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DESIGN, INNOVATION AND COMPETITIVENESS IN THE TEXTILE INDUSTRY

UPSTREAM DESIGN DRIVEN INNOVATION

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Figure 1 'Emotional-Craft', Mianmian Zheng, Master of Art in Future Textile, CSM, 2010

Caminante no hay camino.

Se hace camino al andar.

Antonio Machado, Proverbios y cantares, Campos de Castilla, 1912

ABSTRACT

The Italian textile industry is facing increasingly more difficulties, as a result of the growing competition in the global market. Industrial enterprises which produce textiles for the apparel sector are by tradition labour intensive, but, but also deeply rooted into Italian production environment, renowned for the top-end intrinsic quality, but now obliged to adjust to the influx of imported textile products from the newly-developed countries, particularly those in South-East Asia, mainly from recent-developed countries in South-Eastern Asia. During the last ten years, the Italian textile industry has suffered a strong downturn in terms of the number of companies, employees and revenues; simultaneously the supply of places in higher education institutes for studies in textile majors has been drastically reduced in Italy.

This doctoral research was undertaken in order to study the dynamics of textiles invention processes, in order to outline promising trajectories of relevance to the creation of new textile products. The first assumption was that customers have always paid significant attention to the aesthetic, symbolic, and emotional value of 'Made in Italy' hard break - apparel and design above all. The thesis proposed to move selected practices and theories, which were validated into these traditional design-led consumers' markets such as furniture and electronics, upstream to related B2B market, such as the textile materials' one.

The literature review focused on two major fields of study: the first was the world of textiles, involving the definition of 'textile', 'textile design' and the role of 'textile designer', and specifically the field of research and product development in the industrial context, followed by a wider analysis of recent changes in the global textiles scenario. The second was the theories connecting Innovation, competitiveness and design - specifically, design thinking, open innovation concept design, strategic design and design-driven innovation. The Design-Driven Innovation model and tools, firstly theorized starting from 'Made in Italy' furniture best-practices (Verganti 2009), seemed the most challenging for inventing new textiles, due to the innovation of technology, meaning and language of products.

The lack of references on textile innovation, textile product-development, textile design and textile design education was the cue to develop two empirical activities. The first was the exploration of the field through 20 preliminary interviews with key professionals from the textile academic world and the industrial one, and through the case study on the innovation processes in three Italian leading textile companies. Among these three firms, the second activity was based on the practice-centred approach of research through design.

Starting from the Design-Driven Innovation agenda, an action-research method was specifically drawn up with one textile company, in order to test a design-driven research paradigm and to develop new concepts for a new textile material.

The first phase included direct participative observation of the ordinary activity of research and product development of the company, in order to gain the trust of both the executives

and the other team members, to deepen the knowledge of the company and gain insights into the competences within the textiles chain.

A second phase consisted of the formalization of the Design-Discourse network of the company into a Design-Driven Laboratory, involving 5 players external to the company: 3 artists, a new-technology advisor for a Venture Capital new-tech exploration and a textile material Engineer working as technology-transfer manager.

Only the third phase was a faithful reinterpretation of a Design-Driven Innovation model for the development of new concepts for textile materials. In this case, the researcher played the brokering role of the Designer. This step involved the launch and management of the research activity with the artists and the international exploration of new technologies and studies for textiles. At the end of the third phase a presentation of all the outcomes, both from the artistic and technological research, was made to the company staff, and the two shared concepts were elaborated upon.

The main results of the research are the novel model of textile design, specifically for the Italian industry, and the adoption of an explicit Design-led Practice by a B2B textile company. The original contribution of knowledge of this research is the refined definition of textile design practice and a proposal for the role and competencies for textile designers. Thus, a partial validation that a design-driven approach is desirable for the invention of textile concepts and innovation of textile products was achieved. Although one fully developed project may not be sufficient to confirm the reliability of the Design-driven Innovation model within the textile industry, the elaboration of the theories also derived from this case opens new trajectories for future development in textile design and research in textiles.

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1 INTRODUCTION

1.1 TEXTILE: FROM THE INDISTINCT MATTER TO THE STRUCTURED MATERIAL

The first issue concerning textile materials is the definition of the 'textile' framework.

Inspired by the etymology of the word 'textile', it could be valuable to draw an analogy with the concept of 'text'. Both the words come from the Latin verb *texere*[1], which basically means 'to weave'. Similarly, also the history of the development of the verbal language may be affiliated to the process going from the raw material to the garment, passing through the textiles.

The development of human language consists in the shift from the phonemes, the 'indistinct matter', to the words, the 'determined matter', and eventually to the text, the 'articulated matter' (Russo, 1996).

Following the model of verbal language, an articulated code has a 'vocabulary' of basic units together with syntactical rules, which can be used to generate larger meaningful combinations (Innis, 1986). A semiotic code, like the verbal language, has 'double articulation' and can be analysed according to two abstract structural levels: a higher level, called 'the level of first articulation', and a lower level, 'the level of second articulation' (Eco, 1976). At the level of *first articulation* the system consists of the *smallest meaningful units* available (e.g., morphemes or words in a language). In language this level of articulation is called the *grammatical level*. The meaningful units at this level are complete signs, each consisting of a signifier and a signified. Where codes have recurrent meaningful units, they have first articulation. In systems with double articulation, these signs are made up of elements from the lower (*second*) level of articulation. At the level of *second articulation*, a semiotic code is divisible into *minimal functional units,* which lack meaning in themselves (e.g., phonemes in speech). These purely differential structural units, called *figurae* by Hjelmslev[2], are recurrent features in the code. They are *not signs in themselves* (the code must have a first level of articulation for these lower units to be combined into meaningful signs).

According to these premises, the phonemes are regarded as sounds. Phonemes themselves have no meaning, but only some primitive quality (vowels versus consonants…). Definite sequences of speech sounds constitute the material forms of morphemes, words and utterances. The meaning is given by the distribution of the phonemes. The first design process comes with the invention of the words. Thus it is the sequence of words that provides the full meaning of a thought. The initial awareness is related to the possibility of distinguish, from the

[1] Geijer, A., *A History of Textile Art*, Pasold Research Fund Ltd., London, 1979
[2] Eco, U., *A Theory of Semiotics*, Bloomington, Indiana University Press, 1976

amorphous noise, a sound from another. But an authentic human intention occurs when sounds are linked together in a word to univocally describe something.

In the same way, raw materials, specifically of animal and plant origin, are provided by nature, and they represent the second level of articulation. The fibre may be seen as the minimal functional unit, and it has no signifying role in itself, even if it holds some primitive quality. The first level is embodied by the intentional action of choosing, mixing and treating the materials in order to develop a full meaning, an advanced system of functions. Threads can be compared to morphemes, while woven and knitted textiles can be considered as words. This is the first process of significance. As the full meaning of a message lays in a sentence made by a selection of words, the full meaning in the textile chain is obtained through the garment design.

1.2 PARADIGM OF RESEARCH

The purpose of this research is to examine how Italian companies involved in the manufacture of textile products for apparel obtain ideas for innovations. The trend towards the production of textiles in low wage cost countries has resulted in the closure of many Italian textile companies. A number of these Italian companies have moved away from the production of textiles for apparel, and now specialise in niche markets with highly technical products, which are based on high performance synthetic fibres, or they aim at the higher-price merchandise category with top quality ones, which are mainly based on the finest natural fibres. The ability to develop innovative new products can be a source of competitive advantage for these companies and the generation of ideas for new products or 'creativity' is the first step in this innovation process. In view of the subject matter, a mixed-methods type of methodology was used to examine the different sources and practices to develop new product ideas that are currently used by companies that consume top quality fibres. Based on the key literature themes, and the case-study findings, an action research approach was adopted involving one textile company, which is leader in cashmere products for the apparel industry, to explore a design-driven strategy. The project findings revealed many discrepancies between actual practices and recommended strategy in supporting creativity, showing specific opportunities to implement textile design activity.

1.3 AIM OF THE RESEARCH

The research was undertaken with the aim to study the determinants dynamics of creative processes for the innovation and the competitiveness of Italian companies working into the textile industry.

This research was prompted by the need to understand if industrial design (both through its main theories and practices) could contribute:

- to bridge the gap between engineering design and traditional textile design

- to discover new connections of meaning between textile products and apparel products for end users

- to develop external interferences which promote a different system of analysis and generation of ideas to textile industry, more typical for the discipline of industrial design.

Once, an interpretive approach seemed more suitable to deal with a situation of great uncertainty, where it appeared more useful to identify the possibilities of intervention, through a critical – and subjective – observation of the complex network of interactions, rather than to define in advance a precise path.

The beginning of the research was indeed characterized by clarity regarding the scope of work, but considerable uncertainty about the path of knowledge to achieve it. It was decided therefore to adopt a heuristic method to drive the path of knowledge and evaluate the strategy. The research route took the direction of the Action Research as a technique to *understand by doing*, to clearly plan the closest steps and gradually move to the more distant ones. This choice facilitated the determination of the sequence and the content of single actions, and the processes and tools to apply case by case.

1.4 SCIENTIFIC BACKGROUND

Publishing research outputs, regarding textile (raw materials) design, are unsatisfactorily detectable. The leading international journal, 'Textile: The Journal of Cloth and Culture', deal with the wider meaning of textiles. The issues discussed by the published papers range 'between art and craft; gender and identity; cloth, body and architecture; labour and technology; techno-design and practice, within the broader contexts of material and visual culture'[3]. The discourse on textile raw materials as a design discipline environment and practice is not assumed as fundamental. The shortage of academic literature probably concerns with the attitude of the textile design research to operate in taciturn way, in comparison to traditional design environments that were the core interest of those research fields described through the 'design studies'.

The first scholar who handled the question of textile design was Archer in the first issue of 'Design Studies' (1979), with an attempt of investigation amongst the discipline of textile

[3] Textile: the Journal of Cloth and Textiles, see the website: http://www.bergpublishers.com/?tabid=518

design, meant as sub-discipline of design, outlining particular methodologies and the attitude towards tacit knowledge.

The textile design definition regards a wide range of disciplines. It has always been focused more on the output, the textile, rather than on the objectives and practices. It covers methods and methods from the broader disciplines of design, to technology, art and craft, blending the skills, the knowledge and the profiles. The term 'textile designer' could refer either to artists, craftsmen, hobbyists and professional designers of various levels of education, technical approaches and field experience. With reference to the word 'designerly', Igoe (2010) introduced the word 'Textiley', to describe specific common behaviours, features in the projects, and people, which operate within the discipline.

The issue means to understand which are these common traits. This may be possible whether considering the textile design discipline as an entity, which embraces textile designers, designed textile artefacts and the textile design process.

Graves (2002) studied the linkage between the concept of 'pattern' and the world of textile design. Pattern is a recurrent word within textile design. It refers either to the weave structure of the woven fabrics, to the basic scheme in knitwear and to printing design. This effort to untangle textiles aimed to conceptualize in the same time the artefacts of textile design, the intentions, attitudes and methods of textile designers, giving a deeper dignity to the practice of textile design, overcoming the only activity of printed textile designers. The assumption was that a well-aware design activity could add value to textiles, which were not meant only as decorative surfaces.

The crucial issue is that the knowledge of the process is often exclusively expressed through the outcomes of textile design and that there were not debates discussing whether a textile-oriented approach to design could be associated with a more consistent methodology within the field of design studies.

The greater interest towards innovative textile design arose the debate around textile design, with reference to the complex issues concerned with sensory perception, aesthetic value and social function; a growing attention was gained by the shift of knowledge from textiles to healthcare, automotive and architectural design. Thanks to the closer collaborations with material engineers, chemists and industrial designers, there were valuable cases of this hybridation of competences and roles. These trials at the cutting edge of textiles attested how this interdisciplinary work was fundamental to underline the designerly way within textile design (Kavanagh 2004).

The scientific literature suggested that within the academic environment, textile design was looking towards innovation and interdisciplinarity, while an immediate effect on the mainstream textile designs for consumers' market was modest. Both activities should involve a more conscious utilisation of the tacit competences and knowledge, typical of textiles, to create aesthetic innovations.

Elaine Igoe, discussing her Ph.D. thesis (2010)[4], focused on the textile design education. She explained how undergraduate and postgraduate textile design students are supposed 'to work, manipulate and 'play' with wood, metal, sound, graphic animation, plastics, glass as well as fabrics, threads and yarns within their textile design process'. During the education stage, upcoming textile designers can physically experience the extensiveness of the methodology of textile design, and discover the functions and meta-functions of textiles.

The problematic issue usually occurs when students come into contact with industry or other fields of design; they tacitly understand the distinction with the textile discipline. It's only when they put their designs industrialized in a real context that they can recognize the relational, sensitive and communicative qualities of the designed textiles. This kind of acknowledgement is implicitly transferred from designer to designer, from manufacturers to designers, tutors to practitioners, but rarely explicitly articulated towards other fields of design. The development of textile design thinking remains poorly evaluated in a critical way effectively available for design researchers. This gap between industry and academia creates a dangerous break between a textile designer's tacit concept of the discipline and its understanding outside the university. Moreover, what is accepted and encouraged within the educational environment can be misunderstood, or even appointed as inappropriate, by industrial executives (Moxey 2000, Studd 2002).

The study of Rachel Studd (2002) offered an exhaustive overview of the textile design process in different industrial contexts, in order to outline specific models that could help the understanding of the tacit knowledge and thinking within textile practices.

Recently, relevant attempts to establish a serious discourse about textile design discipline (and sub-disciplines) can be discovered in a number of research organization, which share the common interest in making 'explicit' the huge tacit knowledge accumulated in different industrial areas. In particular, some scholars try to figure out how the textile design practice can enrich the wider design discourse.

There are some relevant universities, which are experiencing the opportunity of assigning an entire school or department to textile-design, teaching and researching in the same place majors as management, engineering and design. The international Association of Universities for Textile 'AUTEX', gather those Institutes that are devoted to textile science and technology. The following ones moved from 'technology-only' approach, to one more holistic.

At the Swedish School of Textiles of Borås, the academic program declares "the creativity of art is combined with the ingenuity of technology"[5]. This combination is the common thread for textile research conducted in a variety of themes within four main research areas: Design,

[4] The paper is available on the website:
(http://www.lboro.ac.uk/departments/sota/research/Duck_NEW_2010/1.%20The%20Tacit-Turn%20-%20Elaine%20Igoe.pdf

[5] Swedish School of Textiles web-site: www.hb.se

Technology, Management and Craft. In this framework, the research activity of professor Anna Vallgårda concerns the development of smart materials; materials that enable an expanding range of aesthetic expressions and user experiences. These materials come to be, or become, only over time and in context—they are becoming materials. Thus, in the development and application of such materials, the researcher assumes that it is fundamental to engage more extensively with the experience of materials in practices of design and of use. She introduces and discusses the concept of becoming materials — as well as the implications for practice - through a series of case studies from the university practice-led research within art, design and architecture. Coming to terms with the implications for material practices of design and of use, Vallgårda suggests the development of new concepts and methods for doing and studying the design of becoming materials.

The School of Textiles & Design, which was founded in 1883 at Heriot-Watt University in Scotland, under the direction of Alison Harley, it is involved in internationally leading research projects connecting fashion, textiles, design, clothing and colour science. Its research activities ensure to lead in fashion, textile and design industry developments. A number of projects integrate textile design with technology. A current example includes a study of the aesthetic concepts associated with the incorporation of shape memory materials into textiles to produce fabrics with 'intelligent' properties. There is also an extensive research in the design of multi-sensory textile products utilising the light-emitting properties of optical fibres, combined with novel applications of electronic sound technology.

Sonja Andrew has been driving a research connecting both the School of Materials at University of Manchester and the Future Textile department of Central Saint Martins University of the Arts in London, on the theme of textile semantics, investigating the communicative capacity of printed textiles in public spaces. The researcher discusses the meaning of the textile medium from the perspectives of both maker and viewer. She considers the integration of hand and digital processes in the construction of textiles with specific communication content by the maker, and how these processes contribute to viewers' understanding of textiles in comparison to other media. She discusses the process-based development of the textiles produced for selected case studies, considering the necessary interaction of hand skills and new technology to create final artefacts appropriate for the research investigation. The focus is also on viewer perceptions of the textiles, explaining how responses to the medium necessitated an increase in the hand-developed elements of the textiles produced for the second stage of the research (Andrew 2005).

SYSTEX[6] is a European coordination action, directed by Lieva Van Langenhove from the Department of Textiles of Ghent University, in Belgium, which is focused on the breakthrough of intelligent textile systems. The main effort is to collect on a public web platform information on on-going research, products, markets, roadmaps, training and education etc. about smart textiles, coming both from educational and industrial partners. Specifically, the SYSTEX initiative aims at developing a framework for current and future actions in research, education

[6] SYSTEX initiative is extensively presented on the website: www.systex.org

and technology transfer in the field of smart textiles and wearable micro systems and electronics in Europe to support the textile industry to transform into a dynamic, innovative, knowledge-driven competitive and sustainable sector.

The College of Textiles at North Carolina State University states that, in today's global competitive marketplace, new textile product development requires a design, marketing, materials and technology interface. The textile department settled an extensive research program to examine the common practices to develop new textile products used by global textile companies with a variety of textile product end-uses: apparel, home textiles, transportation, industrial, nonwovens, carpets, and medical textiles. This study involved two dozens of global companies, even if only based in the United States. The primary interest of the research group has been to examine each company's new textile product development processes, practices, and new products, in order to highlight key new product development concepts being utilized. This academic group is not specifically focusing on textile design activities, but more generally on new product development processes (and a combination of new product development strategies), with the common aim of individuating competitive models and tools, in order to develop and launch products in the global marketplace (Powell & Cassil 2006).

Thus, there are other Universities, which promoted centres and departments, teaching and researching about textile design, starting from a design and creative perspective. They also combine design issues with technology and science, but are more concerned with the aesthetic and semantic value of the textiles.

The Master of Art in Textile Future at Central Saint Martins[7], coordinated by Carol Collet, claims in its manifesto that “the course ethos is to approach textile design as a form of industrial design but with a focus on the language and codes inherent to textiles. By exploring key contextual questions to interrogate, critique and propose new design concepts, we invite our designers to engage fully with the challenges of designing for the 21st century.” The faculty of the college is the main educational proponent of the theory by which smart textiles, invisible performance, sustainable and ethical issues as much as poetics and aesthetics call for new design perspectives. Crossovers with other design disciplines as well as with science and socio-economics are strongly pertinent. The core assumption is that rapid changes in culture, economics and technology need dynamic designers who can propose and realise intelligent, responsible innovations with strategic thought, leadership and personal vision. They also recognize that textile designers must be equipped with multidisciplinary skills to design for the future, through a 'think-tank' in which to cultivate ideas, reflect on individual practice, and challenge the boundaries of textile design.

[7] Research and educational mission is shown both on the official website: www.csm.arts.ac.uk/ma-textile-futures, and on a semi-official blog: http://blogs.csm.arts.ac.uk/snapshot/category/textiles

The Centre for Research in Advanced Textiles at Nottingham Trent University[8], coordinated by Tina Downes, brings together research relating to the entire range of fibres and materials, from the development of electro-active fabrics with advanced functionality to work relating to the history of Nottingham's textile heritage. Drawing on the whole range of skills, knowledge and expertise available in the School of Art & Design, its cross-disciplinary capability means it can research problems that would otherwise be intractable, and understand complex phenomena that are fundamental to textiles and their applications in fashion, art, craft, medicine and smart materials. The staff of the Centre, which includes textile technologists, art textile and textile heritage specialists and fashion and textile practitioners, values these relationships between skill sets and disciplines. The statement is that a cross-disciplinary mix can put to work technical expertise alongside inventive craft skill - aesthetic exploration supported by commercial development of innovative materials - art and science working in effective synthesis that makes possible the intended cross-disciplinary working. The Centre has a wide range of activities concerning textile materials, from the analysis of modern textile production and testing technology supported by cutting-edge science to developing insights into material performances that derive from design and craft skill, eventually to the understanding of commercial structures and distribution processes of textile materials.

One of the research themes investigates the integration of fashion and textiles practice, focusing on the contemporary relation between 2D surfaces and their evolution into 3D garments, but moreover on the relationship occurring between textile and fashion designers, to soften the hierarchies of fashion production. But once again, Townsend (2008) states that although collaborative processes performing within the academia are frequent and effective, in the industrial environment the approach to fashion and textiles remains mainly static, with a persistent separation of the projects between the two creative activities. Even if the two creative roles are usually connected through their educational proximity in art schools, they inherit different competences and practices, with a range of different craft skills design methods, processes, traditions and tacit knowledge, and it is difficult to erode the boundaries (Briggs-Goode 2007).

HUG and Aeolia are the two names for the applications explored to integrate smart materials, smart sensors, advanced miniature lighting technology and feedback devices. The research aimed to investigate whether the development of these 'kinetic' fabrics might have design applications. The outputs resulted were fascinating, but also the design process deserves some attention. In stead a classic user-centred methodology, it was preferred a design-led (or 'material-led') approach, producing samples referencing only the broadest context of apparel, unlike any context of use (Breedon, Briggs-Goode, et al. 2008)

[8] An extensive manifesto of the targets of the research department is presented on the website of the university: www.ntu.ac.uk

In Italy it is difficult to find researches, which aim to investigate textile design and to integrate its knowledge, competences, practices and methods within the framework of design studies.

In general, Italian design lacks of a structured support by the government. There aren't any organization to promote and implement design activities such as the VIA (Valorisation de Innovations dans l'Ameublement) in France and the British Council in UK.

'The effective use of design is fundamental to the creation of innovative products and processes' (UK Government, White Paper on Competitiveness, 1995).

Many countries have followed the example of UK (South Africa, Korea, India, Canada, Denmark and Singapore), setting governmental organizations or independent agencies to support design practice mainly into SMEs. Two classes of services are usually offered: to promote a general comprehension of design benefits and to give a practical support through the implementation of a design activity (Cawood, Lewis & Raulik 2004).

Thus, the importance of design to generate innovation and its role to relaunch the competitiveness of the country is well- established since many years. Design is not considered a growth factor itself, it needs to be sustained by a proper business policy: design is an opportunity only for those companies that are able to build their success around it.

Within this global scenario, Italy drops behind, despite of some openness cases. Antonio Colombo, general director of Assolombarda (a regional Italian Entrepreneurial Association collecting around 6000 firms) stated:

'Design can and must achieve a greater importance in production, communication and distribution strategies of all the firms. Design can't be an exclusive concern of large-size enterprises or a domain of those companies working in traditionally 'design oriented' sectors. Design should be a key leverage for the competitiveness and the internationalization, available to every entrepreneur. The design, if conceived as exploration of meanings and languages, covers a wide range of areas, from the most classic focused on product, up to the study of materials, the reconfiguration of processes, and the planning of services'.

This is the introduction to the book 'Design and Corporate Strategy' edited in 2007, with the results of the Research PRIN 2005 developed by Politecnico di Milano and Bocconi University, regarding new conceptual models and new tools for design-driven innovation in the global economy.

As the matter of fact, only 6-7% of Italian companies can be defined as 'design-based', considering design practice as their competitive advantage (Sarfatti in Galloni & Mangiarotti 2005).

The assumption of the research was that manufacturers of 'technical artefacts', which rarely recognize the value of design and designers as means of innovation, could largely profit by a structured design activity as well as the manufacturers of 'decorative artefacts'.

The research project consisted exactly in the investigation of the opportunity of shifting the design-driven methods from 'design-based' companies to 'design-related', such as materials manufacturers, and 'non design-related', energy providers, industrial sectors (Ferraris 2007).

2 METHODOLOGICAL APPROACH

2.1 SPECIFIC OBJECTIVES OF THE RESEARCH

This research is a contribution to the international discourse about the meaning and the role of design in textiles. Four objectives were formulated:

1. To achieve a definition of textile materials, within the macro-area of materials.
2. To conduct an analysis of the textile industry in Italy, as an element of the 'Made in Italy' initiative, but placed in the global context.
3. To discover if it is possible, necessary and relevant for the textile innovation and industrial competitiveness to be driven by a design practice, distinct from the ones conventionally practiced by textile designers, engineers and product developers
4. To derive a characterization of which and how a new design-driven approach to textiles invention could be articulated.

2.1.1 OVERVIEW OF THE RESEARCH

The research was developed through a composite methodology.

First of all, the research was based on the quantitative analysis of existing data regarding the textile industry and foreign trade of products made in Italy, according to a wider study made by 'Federazione Sistema Moda Italia' (literally the Federation of Italian Fashion System) and funded by the Italian Ministry of Labour and Public Policies.
Secondly, the literature review focused on 3 main areas:

- Textiles as a technical, technological, semantic, but also commercial, product
- Made in Italy: industrial districts and the global competitive landscape
- Design and Innovation: concepts, theories and strategies

This research is embedded in the international debate on the gap between the sciences' and arts' contributions to textiles innovation (Gale and Kaur, 2002). This fissure concerns both the industry and education. Textile design is still essentially viewed as an artistic activity, linked to the traditional craft origin and practices. As a direct consequence, textile science and textile design are treated as quite separate subjects.

“Science is an important creative resource in the development of textiles. Science can span and influence the artistic, engineering and manufacturing aspects of textiles; but how can designers participate in the creative science efforts?”

The science-design gap may provoke a radical rethink of textiles; as the science of textiles grows more complex there will undoubtedly arise different perceptions and definitions of what a textile designer is.

There are various potential solutions for the future, such an increasing teamwork approaches to design and manufacture or perhaps the emergence of intermediaries whose role is to ‘translate’ and communicate between the different professional communities involved.

And again:

“Some textile designers may ultimately prefer to abandon the term ‘designer’ altogether, seeing it as a misrepresentation of their work or having the wrong connotations.” (Gale & Kaur 2002)

The research mainly concentrated on two design-oriented approaches: concept design (Keinonen et al., 2006) and design-driven innovation (Verganti, 2009); neither of these strategies has already been explicitly linked to textile industry in order to develop new textiles.

For both of them three key capabilities are always required:

* Internal resources: the business knowledge, a seductive and powerful brand and the charisma of the entrepreneur / executive management;
* The relational asset: a network of relationships - and potential ones - with key stakeholders, the so called 'Design Discourse', in order to share the same ‘research activity on the meaning of the things'[9];
* The interpretation capability: to integrate ideas from external and internal resources, thus to convert visions into products and services.

The research inquires the possibility, the relevancy and the feasibility of experimenting this type of concept-development process into a company different from the mentioned best-practices, such as a textiles one (see the section 'Theoretical Background' contained in this report). To validate this thesis, it was decided to verify the co-existence of at least two of the key capabilities identified above:

1. the company has an established brand with a strong and seductive power;

2. the company is a leader in its sector: turnover, number of employees, exports etc.;

[9] Verganti keeps collecting ongoing projects recognized as validation of the Design Discourse practice on the website: www.designdriveninnovation.com

3. the company constantly funds on-going research, even if tacit, of new technologies and new product meanings;

4. the company regularly introduces radically innovative products in its portfolio;

5. the company uses or is willing to involve external players for the development of new products.

These concepts remain meaningless without addressing the question:

Is there a 'design discourse' in the field of textiles?

The research moved to the validation phase of the hypothesis, related to the third aim of the research. In order to explore and implement a design-driven innovation in a textile company, it was necessary to develop specific case studies. The structure of this phase was based on 'theory testing' methodology, through a judgemental sampling, using the 'constant comparison' of preliminary discursive interviews (Glaser and Strauss 1967).
In the first stage the industrial options for the case studies were identified through an initial selection based on quantitative cross-analysis of the following data: turnover, number of employees, exports, etc. (cf. 2008 data from Istat – National Institute for Statistics in Italy) and the positioning of the brand amongst the leaders in its market sector (cf. Pambianco Report of 2010).
A second step consisted in a preliminary discursive interview within the context of the interviewees.

As a result of the outputs of these preliminary interviews, the possibility and the relevancy of a design-oriented approach were head lighted, and also the interest for the company to work proactively with external players. The other crucial element for the final choice of the case studies was the effective chance to interact directly with the top executives. Based on the cross-matching of these factors three companies were selected[10]: the company 'Alfa' is specifically a textile manufacturer, the company 'Beta' is both a textile manufacturer and an apparel retailer, the company 'Gamma' is exclusively an apparel retailer.

The following interviews were designed on a semi-structured form, following the rule of sending a draft track to the interviewees previously. The relationship already built thus facilitated the management of the interview. As the three selected companies had different corporate structures and market sectors, the interviews followed different tracks.

The common focus of the interviews concerned: organization of new textiles development (structures and relational dynamics, roles and skills), trend analysis and identification of scenarios and visions, role of designers (textile and fashion), investments in R&D, relationships

[10] The companies and the interpreters involved in the research are kept anonymous, while consistently described in Appendix A

with suppliers and customers and other external stakeholders (research centres, universities, arts foundations, etc.).

The outputs were the descriptions of the internal processes of the companies, also through summary diagrams, in order to illustrate the organizational structure, the trade relations and the dynamics of invention.

The action-research phase was mainly based on the organization of a 'Design Driven Laboratory' (Dell'Era and Verganti 2009) and grounded on the methodological tool of the 'participant observation' (Collins 1992), in order to observe and analyse in a real-world context and time the development of new textile concepts and products, interacting with the interpreters of the design-driven laboratory. The most difficult part was to assume a direct role in this process, with the researcher emphasising her competences as a designer in both the 'creative' and the 'strategic' senses.

This phase already started during the former stage, in parallel with the preliminary interviews with those players previously identified as 'key interpreters' within the 'design discourse' in the textile and clothing area. The interviews represented the earliest way to facilitate interaction, involvement and deep immersion in the design discourse.

Within the sphere of cultural production the following professionals were involved:

- a professor of Computer Science also topic expert for 'Made in Italy' innovation,

- a philosopher involved in textile higher education and permanent training for textile industry,

- a cultural anthropologist devoted to fashion studies,

- a new-trends researcher,

- a journalist of contemporary arts

- 3 emerging high-rated artists, selected for their attribute of 'symbolic creators' (Hesmondhalgh 2002)

- a Contemporary Arts Foundation with the greatest textile sample archive in Italy.

Within the world of technology the following professionals were involved:

- a textiles research centre, the national association of technical textiles,

- a materials engineer expert in nanotechnology applications in textiles,

- a manager of technology transfer,

- a senior consultant working for a consulting firm focused on the textile and clothing industry,

- the R&D department of a multinational electronics group now dedicated to the development of new technologies for the textile industry,

- an experienced engineer in the field of environmental certifications for textiles,

- a topic advisor on new technologies for a 'Business Angels' Club.

Starting from the flexible schemes theorized by Verganti, together with the mentioned company, a proper design-driven innovation strategy was created and further refined in a way that was respectful both of the theoretical framework and of the specific case study needs.

Two fronts were simultaneously faced:

1. The direct involvement of the researcher - the undersigned in this case - as a 'complete participant' (Jorgensen 1989). This choice was realized through a part-time internship in the company 'Beta', in collaboration with its R&D office, manufacturing and sales department. The internship lasted for a period of 6 months, between April and December 2011. This kind of immersive and participatory method could usually occur in the risk of defiling the validity of the process (Atkinson and Hammersley, 1995). For this reason, this process didn't assume to wholly validate the elaborated design-driven approach, but tended to explore a way to fill the gap between textiles engineering and traditional textile design.

This partnership had three main objectives:

* To foster the trust with the primary stakeholders of the process, the internal resources; in this case the internal stakeholders were the general director of the yarns and jersey division, the manager of the R&D department, and the sales manager;

* To get in contact with the closer external stakeholders of the company, such as spinning companies, dyeing and finishing, etc.;

* To look at the explicit and tacit internal knowledge and to develop specific competences and skills: relational dynamics, suppliers' references, product development and manufacturing skills, etc.

2. At the same time the structure and the names of the design-driven laboratory, were defined, which included:

* The general manager of the yarns and jersey division of the company 'Beta' and the manager of the Research & Development belonging to the same unit,

* The materials engineer expert in nanotechnology applications in textiles,

* The topic advisor on new technologies for a 'Business Angels' Club,

* 3 artists (selected amongst the ones proposed by the arts journalist),

* A textile design researcher, the undersigned.

2.1.2 ORIGINAL CONTRIBUTION TO KNOWLEDGE

The contribution of this research is to suggest a new definition of textile design and a new profile for the textile designer, which could embrace the traditional 'artistic' skills and the necessary 'strategic' ones, bringing some theories from the international debate on design and design practice, through the elaboration of a new approach to textile product development.

2.2 ACTION RESEARCH

2.2.1 RESEARCH THROUGH DESIGN AND ACTION RESEARCH

Research through design is research 'carried out with the tools of design, and mainly with its most original and specific feature: the project.' (Findeli 1999). The main objective of research through design is not to carry out a design project, but to use it as a ground of research. The main idea is to set design research into practice, where practice is considered as an intermediary of study informed by and informing appropriate theory (Van Schaik & Glanville, 2003). They disccussed that the practice was connected with theory and existed within a developing theoretical framework based in the practice of design re-enforced by an awareness of current developments and the context; and also the theoretical exploration of circular causality, (second order) cybernetics.

Franz (2000) also considered the nature of design in recommending an 'interpretive-contextual framework' for design research. He argued for approaches and methods for design research theoretically and methodologically compatible with an interactive notion of design. Furthermore, Hummels and Overbeeke (2000) proposed a 'context-dependent' research through design, passing from creating products to developing frameworks for experience, with a major focus on the form of interaction.

With reference to Saikaly (2005), Findeli (2001) discussed for the consideration of the complexity of the design process in the improvement of a framework for both design education and design research: 'The fact that the ordinary, linear, causal model is not adequate enough to portray the complex system of relation within the design process, means that a new model is needed, inspired by systems science, complexity theory, and practical philosophy'.

Thus, he made a distinction between methodological complexity, product complexity, problematic complexity and impact complexity. This is way he assumed the need of specific training to manage this complexity.

Research through design remains a relatively new approach; the methodological framework is still emerging and consolidating. Seago and Dunne (1999), debated around the issue of action research by project, meant as a methodological approach for the 'Ph.D. by project'. The crucial challenge of this methodology concerned the consistent linkage of the studio activity and the written development of the project within the research context. Creating and developing prototypes were considered as a process of invention, as a practice of discourse. The methodological perspective of research was understood as 'conceptual modelling', concerning an assessment of existing approaches to production/consumption communicated through designed artefacts. The researcher within this physical context was realized as a critical translator of design processes and their relationship both to the natural and artificial human environments.

The methodology of this research was based on the study concerning how the critique of practice could develop theory that informed practice the same way practice informs theory.

2.2.2 PROBLEMATIC ISSUES OF ACTION RESEARCH

Modern engineering developed in a world where reason was considered unique, the information available was considered complete, and the absolute optimum to be a result that could be virtually attained. Design practice, given those premises, corresponds to the functional strategy and calls for the designer to be omniscient, endowed – when work starts – with all the information potentially available.

In practice, at the outset, the designer possesses partial information, which is drawn from his cultural foundation and from the accumulation of his previous experiences. Upon this information, he forms an idea, he sketches an initial conceptual structure of the topic, and he performs reconnaissance that will allow him progressively to gather new information. The final design is not a product of the search for the optimum, it is rather a product of search for the satisfactory, which will be attained once the designer has accumulated a quantity of information that can be considered sufficient according to his cost/benefit balance sheet.

As Manzini (1989) underlines, this solution will depend upon factors that are quite difficult to formalize and foresee, such as the quality of the initial idea on the cognitive process employed, which in turn will depend on the initial approach, on intuition, and also happenstance, which determines the designer's encounters as he searches for information. This entire process, which is defined as a heuristic strategy represents a description of the design process. The design process always involves chance, subjective intuition, and the variability of the system of relationships. Rarely does the strategy that allows one to pick up the stimuli for creativity, or

to gather and organize information for the development of a design, correspond to a clearly planned program, in which each phase can be clearly laid to entirely explicit reasoning which could be otherwise described as demonstrative reasoning. “The chief guide along this path is an interweaving of intuition, good sense, and happenstance which I shall now dub astute reasoning, the METIS if the ancient Greeks” (Manzini 1989).

That more than one rationality exists, that design is a game played with less than complete information, and that the outcome is one among many possible outcomes, may be looked upon as a loss of certainty, clarity, force of reason. Based on the same awareness, it is possible to construct a more open approach to one’s own relationship with technology and with the other actors in the design process. The component of astute reasoning in the practice of researcher/designer is no longer necessarily rejected and hidden behind a flawless façade of demonstrative reason, but can be made use of and defended explicitly as useful, if not fundamental, criterion with which to face the complexity of the systems with which the designer is working.

This research was substantially based on the collection and the analysis of information gathered from close relations and collaboration with various players in the delineated field of investigation and work.

These relations were characterized as being informal and non-structured for the main part. In the research pathway more than 50 professionals and researchers were altogether involved. With at least 20 of them the discussion and the dialogue were developed far beyond the strict coverage of the textile design topic. The methodology was undoubtedly deeply influenced by this kind of relationships.

The ‘proximity’ or the ‘distance’ drove some of the key strategic choices with the professionals, companies and institutions involved. There was never the assumption to fully unbias criteria and parameters to select the cases and the interpreters, mainly because the primary statement was that ‘proximity’, not only in the literal sense, was the most unbiased criteria of choice.

The participation of the researcher was like an immersion into the textile industry, completely playing the role of the ‘designer’ as intermediary, and hence building contacts and close relations with the full commitment more similar to the enthusiasm of an internal player than an external researcher.
And as often could happen in networking dynamics amongst different companies and professional (Manzini 1989) some relations were preferred according also to empathy and similarity of views; both of them are obviously not standardized and quantifiable factors. Another candidate could follow a very different pathway, and create a completely different net of relationships.
This process was very intense from a personal and intimate perspective, because it involved also a semi-private sphere. Thus this research proved to be even more exciting and enriching.

In the last phase of the research it was necessary to carry on with a precise analysis of these relationships and how they grew up, and hence a serious attempt to formalize the informality and to explain the tacit.

3 FIELD OF INVESTIGATION: TEXTILE INDUSTRY IN ITALY

3.1 TEXTILE MADE IN ITALY

Textile and clothing are commonly considered one of the key industries of the so-called 'Made in Italy', a worldwide renowned label, which started from a specific geographical manufacturing location attribute. This label became a more complex definition, which now also entails an entire system of critical issues.

- 'Made in Italy' refers to locally concentrated systems of small and medium enterprises within 'traditional' sectors; these industries were strictly associated to a bound territory and linked to the concept of regional industrial 'clusters' (Becattini 1979). Recently the boundaries of the original clusters were broken and the name has changed in 'meta-clusters'[11], because no more limited to the territorial division.

- Because of the small size of the enterprises there has always been a shortage of economies of scale and the lack of vertical agglomeration (Bellandi 1982).

- The historical "4 A's" first description of the wording 'Made in Italy' includes four industrial categories: clothing and textiles, furniture-households, food processing and industrial machineries.

- It is commonly accepted that there is a further cross-breakdown of 'Made in Italy' products into two branches: 'direct products' and 'indirect products'. Direct products are for the consumer market, while indirect products are designed for the industrial market, whose production has grown up thanks to an 'induction process' of the consumer oriented goods (Fortis 1998, Becattini 2000).

- Compared to the high value of tacit knowledge, it occurs an extremely low rate of technological innovation (with reference to the presence of R&D laboratories within industries and to the number of filed patents) and the aptitude to 'soft and incremental' innovations regarding both products and processes (Micelli 2010).

- Practice-led knowledge is occasionally integrated in a structured framework; it is described as tacit and lied to the specific context and market of the cluster, thanks to strict engagement of the entrepreneurs of these clusters' firms and their employees (Beccattini 2000).

[11] For the official definition of 'meta-clusters', litterally in Italian 'meta-distretti', see the Lombardy Region statement in the 'Bollettino Ufficiale della Regione Lombardia, II Supplemento Straordinario al n°50 del 12 Dicembre 2002', with reference to 'Criteri per l'organizzazione e lo sviluppo dei distretti industriali, in attuazione della legge regionale del 5 Gennaio 2000'.

- Italian exports have a steady average share holding the 6% of the total world trade. In some sectors, in specific industrial and hand-craft sectors this share is in first position in world rankings (ISTAT 2008).

- The quality of the products is considered from medium to high quality products, thanks to skilled labour-intensive manufacture, partially still maintained in Italy. Complex functions, are retained in Italy, such as: organization and management of distribution networks, customer service, design and finance (Azzolini 2003).

To paraphrase Trabucco, in the presentation of the results of the research PRIN 2005, about design-driven innovation, one of the strongest points of the 'Made in Italy', together with the aesthetic excellence and the hand making capacity, is the quality of the relations along the supply chain. Nevertheless, the competitiveness of 'Made in Italy' was challenged by competitors from East Europe first, then from Eastern Asia, where wage and raw material costs are lower, and both technology and production quality are undergoing a strong growth phase.

In light of the challenges of the global hyper-competitive landscape, that sees a growing aggressiveness of newly industrialized countries, two main trajectories are recognizable to exploit the characteristics of Italian supply chains:

° On the one hand the emergence of 'leader' firms, with a workforce of more than 500 employees and a turnover of between 290 and 3,000 million Euros, and 'column' enterprises, with workforce between 50 and 250 employees and steady-growing revenues between 13 and 290 million Euros (Micelli 2007), both with a strong potential for internationalization, defined by different possibilities of reorganization of the supply chain on an international scale (see 'global value chain', Gereffi 2004, and 'global business district' Camuffo and Grandinetti 2006).

° On the other hand, there is a trend to formalize the interconnections among the networks of local enterprises, innovation led design, and the involvement of researchers from the area of Design (see Bertola 2009, Simonelli, Zurlo et al. 2002) and from the area of Business Design (see Benghozi, De Michelis, Santagata, Verganti et al.).

If the transfer of low-level production to other countries is unavoidable, then the result is uncertain, but potentially it will be the decrease in the number of employees and revenues in Italian industrial clusters. The contraction of that traditional part of the business can be covered or even outstripped by the development of new niche markets, new needs, and new product and process models (Gallico D., 2007). The risk that should be avoided is to trivialize the product. New meanings via invention, customization and differentiation will strengthen Italy's industries and help to ensure a relevant level of production processes.

Within the manufacturing and service sectors related to 'Made in Italy', it is possible to highlight research projects and experiments which tend to show if and how design-oriented approaches and strategies, with different levels of codification, could drive innovation and competitiveness for traditionally low-tech companies placed in mature markets.

3.2 TEXTILE AND CLOTHING INDUSTRY

As already recognized in the description of 'Made in Italy', one of the most famous and relevant industrial sectors is that which is related to apparel manufacture and branding, which developed on a global scale in the late 70's, supported by the local textile manufacturing enterprises.

3.2.1 ECONOMIC BACKGROUND

In the last 10 years, the global market has seen the growth of exports from the newly industrialized countries, accompanied by a widespread decline in demand and the consequent crisis of the traditional domestic manufacturing industry.

Textile Industry in Italy	**2001**	**2005**	**2008**
Enterprises (Number)	19.215	16.869	14.719
Workforce (Number)	227.000	183.900	168.004
Export Trade (Mil. €)	18.359	13.942	10.184

Figure 2 Elaboration of the data from 'TAC Ricerca per il settore Tessile e Abbigliamento', published by the Italian Ministry of the Labour in 2009, which includes the evolution of the Italian textile sector

The textile industry is characterized by a "derivative" demand: the demand amount and trends are not autonomous, but are derived and dependent on the downstream markets: the apparel industry, home furniture and other consumer products. A traditional textile company, that could be a manufacturer of yarns, fabrics or a finishing business, does not work in direct contact with end-consumers. Other companies, which are closer to the market, are able to exert more control over final consumption trends.
As a consequence even 'indirect' businesses, such as textiles, must design their goods in accordance with the needs and desires of the ultimate consumers. The upstream enterprises also have to plan strategies to coming closer to them, through communication policies (around

the brand, the research, the products etc.) and distribution programs (evaluation of vertical integration or partnerships with the sales channel).

There is another fundamental consideration regarding the quality of the product. Medium-low quality textiles are already cheaply manufactured and globally distributed, with the maximum efficiency, by the newly industrialized countries, which have lower labour costs and profits (see Pacific Asia).
Italian textile companies therefore concentrate on top quality, higher price point products in terms of quality and innovation, function and above all meaning/concept.

With reference to the academic programme of the Master of Art in 'Textiles Future' at Central Saint Martins College, the key questions of relevance to designing textiles for the 21st century may be summarised as follows: "How do we reconcile ecology and smart technology? With the current progress in nanotechnologies, how do we engineer invisible functions with new aesthetics? How can bio mimicry principles inform the design of resilient textiles? Will scientists become designers? With digital fabrications becoming mainstream, what future is there for craft? How can textiles lead to the development of smart interactive interfaces? Can textiles inform a new way to imagine architecture?"

The investigation of these issues is considered urgent and fundamental wherever research in textiles is driven, deepening the relations between innovation, function and meaning.
The first research questions are:

- What is the framework of the textiles, so what do we mean by 'textiles'?

- What does it mean to 'design a textile product'?

- What do we know about the design of the function and the meaning of textiles?

3.2.2 TEXTILES: A GENERAL AND PARTICULAR INTRODUCTION

The word 'textile', which originally referred only to woven fabrics, now commonly covers the broad field of products made from fibres. The term 'textile industries' thus could also "include: fibre, yarn and fabric manufacturing, dyeing and finishing, production of knitwear and making-up of clothing, footwear production, manufacture of carpets, soft furnishings and other household textiles, manufacture of 'technical textile' products used in engineering, agriculture, medicine and other fields, and the distribution and retailing of textile products to personal and commercial market"[12].

[12] This definition comes from 'The Textile Institute' website: www.texi.org

The starting point of this research was the attempt to delimitate the definition of textile, focusing on the apparel industrial chain, but excluding clothing and footwear. Textile design refers to the "fibres, yarns and fabric constructions and finishes" (Fiore et al. 2005). Then, the focus shifted to textiles for the apparel industry (fashion, sportswear, work wear, etc.). From this moment on, the wording 'textile design' exclusively inherits the activity of concept, invention and creation of textile raw materials: fibres, yarns, and knitted, woven and non-woven fabrics.

There are two ways of approaching the subject of textiles; one concerns the description of an existent textile material, and the other the design of a new textile material. In this research, the focus was the dynamics of inventing a new textile material and a new textile product, and specifically that part of the process, which can be called 'textile design'.

Within a common industrial textile design practice, two variables seem to be considered valuable: the timing and the collection issues.

Usually, textile materials for apparel follow the double-seasonal timing of apparel and clothing industry, which traditionally splits the year in two periods, defined as 'Spring/Summer' and 'Autumn/Winter', historically based on the organization of retailers around consumer demand, and influenced by weather patterns. "The term 'season' refers to a period of time during which fashion products are sold. The specific period of the selling time associated with a season will vary according to the nature of the fashion business. For example, a fabric manufacturer will sell fabric for production of Spring/Summer merchandise many months before the Spring/Summer retail selling season begins" (Gale and Kaur 2004).

And even if the contemporary fashion system is not strictly following this calendar anymore (see for example 'cruise' and 'capsule' collections or ready-to-market retailers), these seasonal terms are still used because they are firmly ingrained in the Western countries' fashion culture. According to this agenda, textile manufacturers also present their collections of textile products twice a year, just six months before the clothing tradeshows. In fact, every textiles tradeshow institute still organizes two events each year to introduce the new textiles to fashion designers and clothing manufacturers (in Europe see: 'Pitti Filati' for yarns and knitting and 'Premiere Vision' for knitted and woven fabrics, embroideries, and also accessories).

Textile manufacturers develop new textiles for at least two seasons each year, in addition to which some products are retained with minimum variations. A textile company has to intentionally develop new products with the awareness of this seasonal or non-seasonal target.

The second consideration is the 'collection', described by Renata Pompas (Pompas, 1994) as an assortment of sample products, which are presented together depending on a formal consistency, a shared aesthetic footprint. The word 'collection' refers to a whole series of products, which have similarities in terms of number, mood, functional and aesthetic features,

etc. A textile company presents its new collection of textiles to fashion designers for spring/summer, then once again in autumn/winter, every year. Therefore, to design a new textile material means not only to develop it as a single valuable product, but also to consider that this product will belong to a collection of textiles and it will be shown with several other textiles.

Considering the textile material as an independent product, this research explored the processes regarding the invention of a single new textile material and product. It included the whole invention activity, starting from the concept of the intrinsic meaning, and including both the technological development and the aesthetic concept.

3.2.3 TEXTILES CLASSIFICATION

With reference to the scheme assumed by the knowledge bank of materials 'Materia'[13], the description of a material, also a textile one, may be defined as the designation of specific features that could be divided into four main categories:

- Chemical/Physical Characteristics;

- Technical Characteristics;

- Technological Characteristics;

- Sensorial Characteristics.

The classes of materials presented by Ashby (1999) and reinterpreted in the maps by Ashby and Johnson (Ashby & Johnson 2009: 4.2 - 4.13 and 4.21 – 4.26) are the headings for lists of specific qualities, as the following chart shows.

Chemical/Physical Characteristics	**Technical Characteristics**	**Technological Characteristics**	**Sensorial Characteristics**
Composition	Weight	Weave	Colour
Origin	Elasticity	Dye ability	Texture
Fibre treatments	Washing features	Thermoformability	Pattern
Yarn treatments	Waterproofing	Printability	Glossiness

[13] Materia is a free-access material library, with an affordable website: www.material.nl

Surface treatments	Breathability	Coating	Translucence
	Fire resistance	Lamination	Hand
	Wear Resistance	Sewing Resistance	Temperature
	Chemical resistance	Washing and ironing features	Odour
	UVA/B Resistance	Grinding	
	Wind proofing	Sustainability / Certification	

Figure 3 Adaptation of the database system of Materia to Textile Materials

Every existing textile material can be described according to these parameters. They must be the same parameters that a textile manufacturer considers when develop a new product. Physical, technical, aesthetic and perceived qualities express the functionality of the materials. The behaviour of textiles' consumers (both professional designers and apparel end-users) could be predicted or even drove by an appropriate matching of the qualities.

3.2.4 TEXTILES INVENTION PROCESS

As Renata Pompas indicated in the introduction of her textbook (1994), textile material invention requires consideration of the characterization of the material structure, the market destination and the aesthetic specification. A primary design is the combination of three different levels:

1. Materials, including the characterization of fibre type;

2. Surfaces, created as a consequence of technological development from the fibres;

3. Finishings, with reference to the surface treatment methods.

According to this definition, textile design could be also defined as the intentional movement into the chart already shown above, gradually outlining or excluding all the properties listed. A choice in one parameter immediately influences some of the others.

With particular reference to the working experience gained in the research and development unit belonging to the company 'Beta', it was possible to recognize and synthetize certain roots, aims and strategies in developing a new textile that may be summarised as follows:

- The design of a new textile product is based on the direct market demand, inclusive of data about the sale of the previous collections, and requests from business customers;

- The design of a new textile product is based on indirect market demand: analysis of competitors' products and non-customers' final products (garments in the same apparel sector);

- The design of a new textile product is based on the exploration of the needs and the behaviour of clothing customers and end-users;

- The invention of a new textile is driven by the elaboration of functions that the novel product must achieve;

- The invention of a new textile concerns the exploitation either of a completely new technology or of a technology imported from another field;

- The invention of a new textile concerns the elaboration of a new concept based on forecasting research regarding forthcoming trends and imaginary needs.

In accordance with the results obtained in the interviews, three slightly different approaches could be outlined for the development of new textile materials.

3.2.5 COMPANY 'ALFA'

Sell-in Sell-out

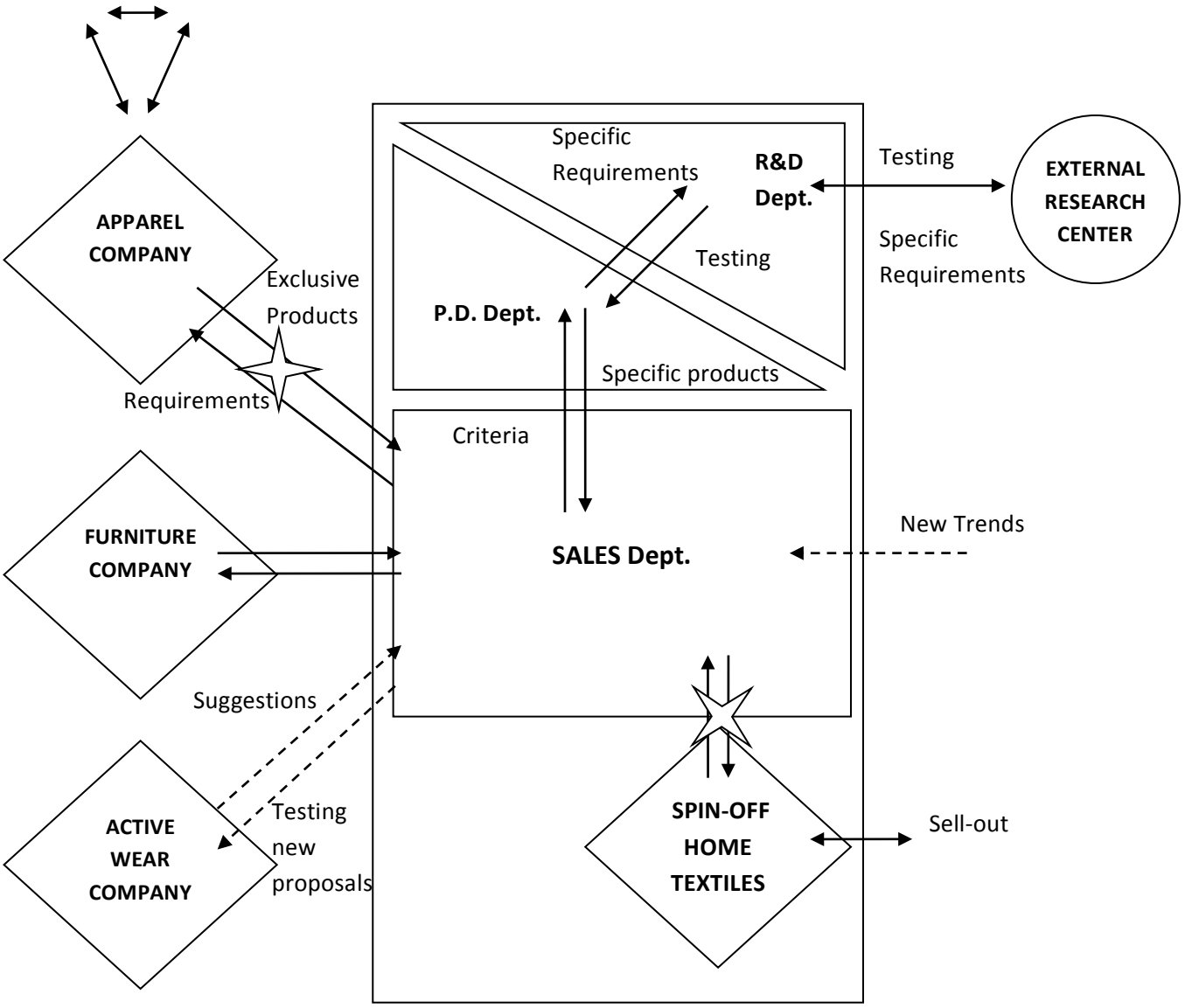

Figure 4 Product Development – Approach: Company 'Alfa'

3.2.6 COMPANY 'BETA'

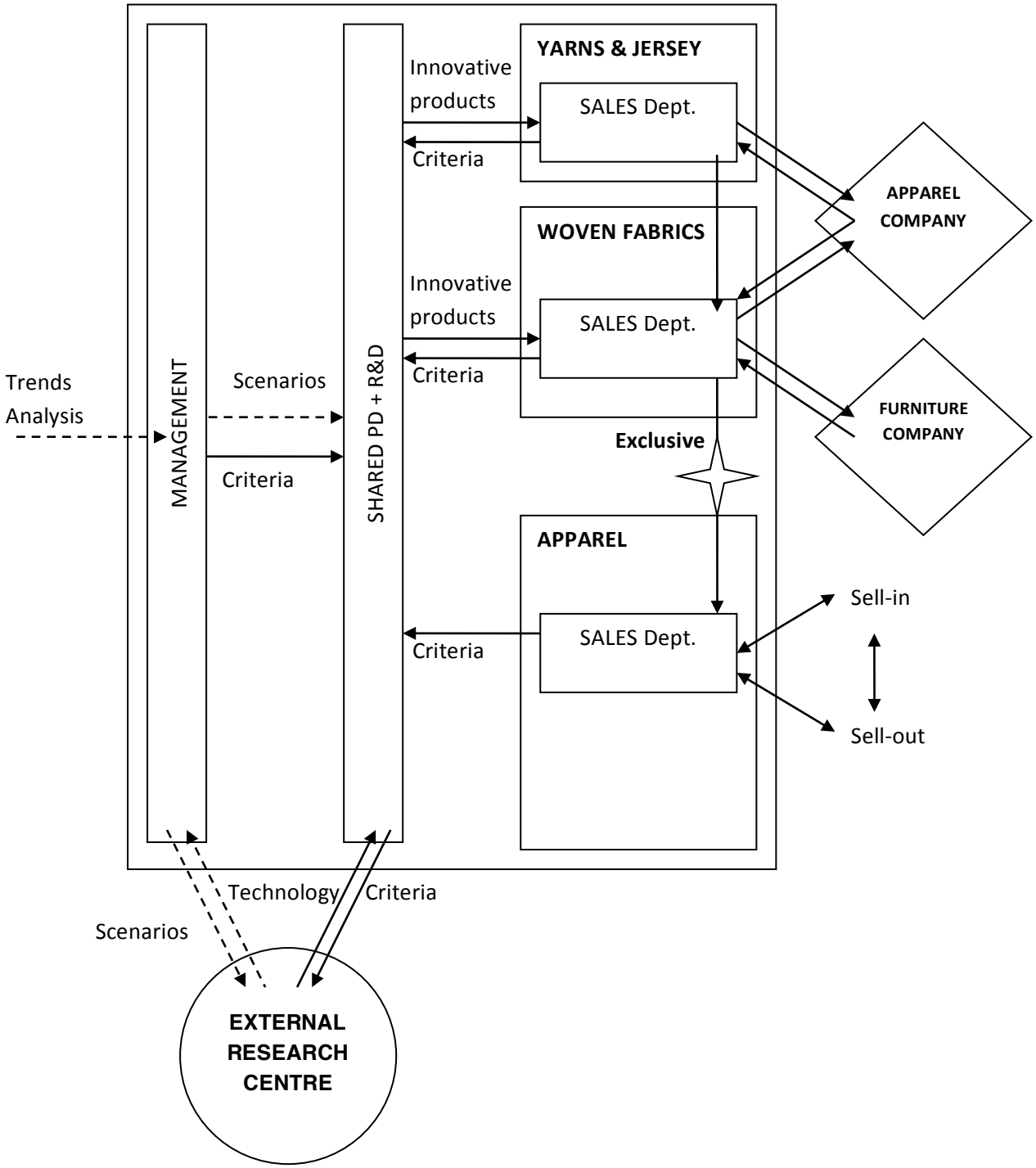

Figure 5 Product Development – Approach: Company 'Beta'

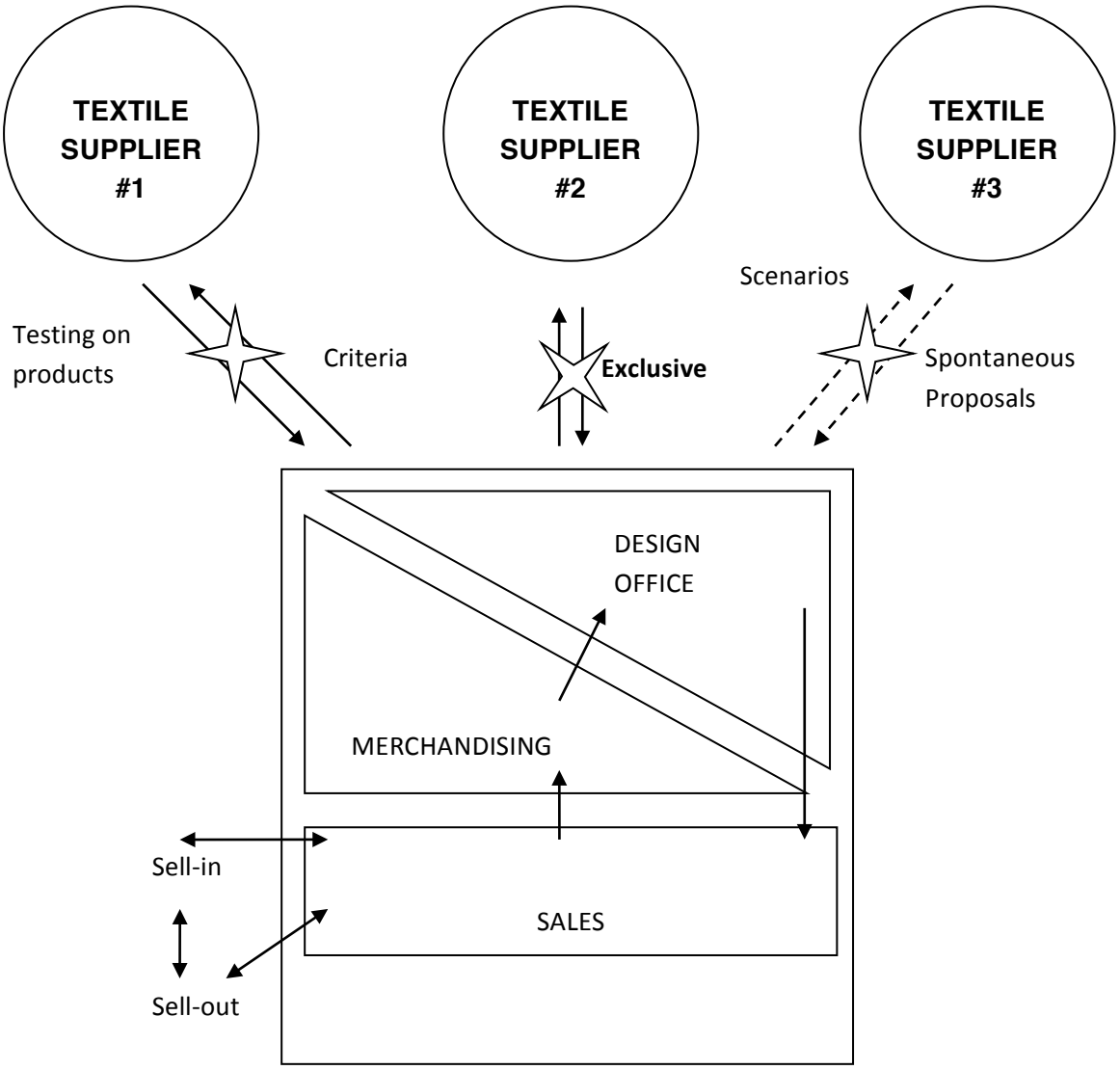

Figure 6 Product Development – Approach: Company 'Gamma'

3.2.7 ROLES AND COMPETENCIES

The following description is a reinterpretation of the general framework of Goworek (Goworek 2006), based on direct observation of the different players in the product development process and on the results of the interviews with the different stakeholders working in the textile field. None of the individuals were referred to as 'textile designers'. The objective was thus to define the present roles and competences along the textiles chain.

Trend Forecaster

This job is the very first in the development of new products, It begins more than one year ahead of the fashion season, thanks to the inspirations coming from fashion forecasting packages, travelling around the world, shopping for vintage clothes. The outputs are generally mood-boards, colour palettes, predictions on apparel trends.

Marketing / Sales Manager

The primary responsibility of a Sales manager is due to the supervision of all the sales representatives. It means also to collect and analyse sales data (both wholesale and retail), and to headlight sales trends: strengths and weaknesses.

The secondary concern is to develop proper strategies to increase both the profitability and the recognition of the textile products. It needs constant benchmark analysis of the market (b2B and apparel) and the competitors, in order to outline new opportunities and new costumers.

Thanks to the strong connection with the market and the costumers'' needs, sales officers have also to collaborate with the R&D and Product development division for the concept of new products

Technical Researcher

This profile is in charge of testing first and secondly experimenting the ideas proposed by designers. In base on the specific merchandising of the manufacturer, this job refers to the technical competence to exploit the machineries capability, evaluating the reliability of the designs

Woven Textile Designer:

This category of textile designers generally works only for fabric mills. The main responsibilities of a woven textiles' designer can concern:

- Visiting trade fairs, such as yarns and textiles;

- Selecting yarns for fabrics: fibre content and colours;

- Designing the construction of the weave's modules (CAD - Computer-aided design systems are nowadays used for the weave's designs; colours and yarns' changes can be applied quickly, and looms can directly work on the elaborated designs);

- Suggesting finishing effects

- If employed by the fabric mill company, liaising with business customers such as fashion designers and apparel purchasers and developing specific designs on demand of these business customers.

Knitted Textile Designer:

First, there are two kind of knitted textiles: knitted fabrics as jersey (single jersey, interlock, rib, pointelle, fleece, etc.) and knitted shapes, which become finished garments directly from the yarns. In the last case, they have knitwear competences but play the role of fashion designers, while knitted fabrics are designed similarly to the woven textiles. The concerns are also similar:

- Visiting trade fairs: yarns and knitwear apparel;

- Selecting yarns and blends: fibre content and colours;

- Designing twisting and stitching proposals, utilization of fancy yarns, knitting constructions, graphic patterns

- If employed by the fabric mill company, liaising with business customers such as fashion designers and apparel purchasers and testing specific techniques on demand of these business customers.

- Suggesting finishing effects

Colour Technician

This role depends on the deying and printing department. The job doesn't match with any design practice. This profile is in charge of creating the colour on demand of textile and fashion designers. A sort of alchemist 'reads' the requested colour and tries to reproduce it with the different categories of deying pigments.

Printed Textile Designer

The main concern of this category is to develop drawings and images for printing onto woven or knitted fabrics. It is related to the decoration of the textile surface, thus it is a visual and graphic role. The starting point is always a trends-forecasting activity. The objective is to propose motifs and printing patterns, on the ground of a specific technique or suggesting the most suitable technique: direct printing (rotary screen-printing or digital ink-jet), mordant printing, resist printing, discharge printing etc. The output of this work is a motif module with a scheme of repetition and recommended colour variations.

Print designs are usually exclusive for one designer or brand. They can be proposed and developed either by the fabrics manufacturer or by the brand design office.

3.2.8 THE RELATIONSHIP BETWEEN TEXTILE AND CLOTHING

Colin Gale described in this way the relationship between textiles as raw materials and the apparel industry: "Throughout history there have been associations between clothing and textiles. This relationship is not only simply one of being connected, in many ways they are inseparable. The relationship between fashion and textiles involves associations between fashion designer, textile designer, textile industries comprising fibre and fabric producers of both natural and artificial materials and including the research, development and finishing industries. The textile industries collaborate with a whole host of professionals, all experts within their own fields, from fashion to colour and fibres. These experts play a pivotal role in the textile and fashion interrelationship: they guide the textile companies, designers and technologists, advising them about future ranges and predicting why or how their ranges will appeal to the consumer" (Gale 2004).

Part of the dynamic of the relationship between fashion and textiles is rooted in trends, which influence also the preliminary stages of fibre production (which generally take place two years ahead of a clothing season). Trends in fibres and fabrics are usually developed from information gathered by different clusters of professionals with expertise in fashion, textiles, and other fields (Rinallo & Golfetto 2006).

Starting from this primary level, colour and fabric trend information is then disseminated throughout the fashion and textile industries. Then initial judgements and choices in textiles focus on colour. At this early stage views and considered opinions are drawn from industry experts. The fibre and fabric industries also resolve issues of texture, production and construction, which are typically informed by demands within fashion. The textile industry is steered by fabrication requirements that the fashion designer stipulates (Stone 2000).

The fashion designer's relationship with fabric can be intensely personal. This intensity is very apparent at haute couture and ready-to-wear level, or at sportswear.

In order to deepen the relationship between fashion designers and textiles, according to the lack of research studies on this topic, it may be interesting to read what academic researchers quote about how contemporary designers communicate their search for the 'right' fabric.

Helmut Lang, for instance: "I have always thought you could use both natural and synthetic, and I have always used both very traditional and very modern fabrics. The way they are put together, the combinations, vary from season to season. It depends on the mood I'm in, on the attitude of the collection. There are still a lot of synthetic fabrics this season, but they have been used in a less apparent way. They were used in a way to highlight the sensitive side of modern fabrics. It all depends on what you want to express" (Lumiere, 1995).

Or Christian Dior: "Fabric not only expresses designer's dream, but also stimulates his own ideas. It can be the beginning of the inspiration. Many a dress of mine is born of the fabric alone" (Dorner, 1975).

When Aillud interviewed Emanuel Ungaro for Architectural Digest, the designer expressed his attachment to fabrics in this way: "I caress it, smell it, listen to it. A piece of clothing should speak in so many ways" (Architectural Digest, 1988).

Also Pamela Golbin, the curator at the Musée de la Mode e du Textile, in Paris, commented in this way about the relationship between fashion and textile: "Everything evolves from the fabric, so your relationship with the fabric will change the outcome. […] Balenciaga and Ungaro let the fabric dictate what will happen, as opposed to using technicians to figure out how to produce a garment from a sketch" (Agins 2000).

Experimentation is seen as a central factor to the fashion design process and fabric can become the stimulus for the fashion designer, suggesting new shapes and design ideas (Sinha and Studd 2005). Apart from being very emotive, the fashion designer's relationship with material can also be influenced by personal poetry and beliefs, which they choose to express through fashion. Alternatively, their design philosophy may simply be avant-garde or culturally alien to the rest of the market. This pattern tends to be either generation led, resulting in the emergence of cutting-edge revolutionary fashion designers, or driven by some cultural ethos. These designers have a kind of 'radical attitude' to cloth in that they challenge preconceived ideas of which materials are 'allowed' to be used in fashion. It seems that if a designer undertakes such an evolution in their creative process, it will, in some ways, affect their material choices or the ways in which they choose to develop a design idea. The fact that a constant stream of young radical designers now explores material innovations raises the question as to whether materials themselves actually assist the fashion designer in becoming more adventurous (Wilcox 2002).

"When a fabric speaks louder than the garment it is transformed into, the scenario begs the question as to which leads which, does fashion lead textiles or do textiles lead fashion?" (Gale & Kaur 2004).

3.3 FUTURE SCENARIOS

The literature review on textile industry and textile-design doesn't outline any relevant scholar project to study dynamics and processes of textile-design in Italy.

At present, the capacity for inventing and innovating in the textile field is reasonably developed in a spontaneous and non-explicit way, within product development units, rather than in dedicated structures only for research and development in order to elaborate new concepts.

Following the analysis of 'Made in Italy', and with reference to the two trajectories highlighted at the beginning of the chapter, in the textile industry it may also be worthwhile to make a concrete effort to encode and formalize the research linking design (studies, methodologies, tools) and product development (Bertola 2009).

The scientific debate on technological innovation and related marketing strategies in textiles has always been focused on technical advances and their possible exploitations.

Therefore there is a huge space for future studies on that part of textile design concerned with the research of new needs, new meanings, new languages for new textile materials, if settled in the same scientific and consistent way of technical innovation. The research on textiles could rethink and propose new models about how a new textile is conceived of and developed.

With reference to the definition of the textile material offered by the fashion anthropologist Eleonora Fiorani: "colourful and variegated second-skin", and as the "interface between body and environment" (Fiorani 2004), the next chapter aims thus to evaluate the semiotic worthiness of textiles, investigating the opportunities given by a design approach based on the exploration of new languages and meanings (Calefato 2001).

Different researches on other surface materials are based on the assumption that materials must be considered as products themselves; they should be 'designed' like every other industrial product. Against this background, a future development for textiles design invites the question:

In which ways can the textile sector be a testing ground for codified design-driven innovation strategies?

4 TEXTILE DESIGN

4.1 TEXTILE MATERIALS

In the previous chapter it was explored the field of textile industry, as it is nowadays: the definition of textiles, the product development processes in textiles, the textile industrial scenario in Italy, the textile industry compared to the macro-scenario of 'Made in Italy'.

Two main trajectories was outlined concerning new opportunities for the Italian textile industry, probably also interesting for the same industrial sector in other Western countries, with the same historical textile manufacture and now suffering from the same shortage, acting on a revision of the approach to textile innovation and product-development.

The suggested approach proposed to consider every textile material as an independent and meaningful product, before cut and sewed in a garment. The critical issue was: can a surface, without a shape, be considered as a meaningful product?

In order to refer to a textile material ad a meaningful product, the first attempt was to study the meaning with reference to the perception of the same object in relation with the recipients (Peirce, 1958), in this case both business users, as the fashion designers, and the final users as apparel consumers.

4.1.1 PERCEPTION OF MATERIALS

The perception of materials happens thanks to the interaction with them. This interaction involves technical attributes and those attributes, which are usually related to the senses: sight, touch, sound, smell and taste. Speaking about materials for industrial design, no matter if furniture, house-holds or apparel, the focus is on the first three, even if it could be also inspiring but less necessary to consider the last two (Ashby & Johnson 2009). The touch sense is linked with tactile attributes, while sight refers to the visual attributes and sound to the acoustic attributes. While technical attributes can always be quantified or measured, only some of the sensory attributes can be approximately be quantified (see the Cambridge Engineering Selector[14]); some other are basically qualitative and critically subjective, as they depend also on the context (the product and the environment) and the culture in which the materials are presented and used.

The sensory attributes alone are not enough to univocally influence the perception of an object. Perception is influenced by qualities and 'associations', which contributes to create the

[14] CES Edu on www.granta.co.uk

personality of the object. They are ambiguous and their meaning can move with time. Some examples of behavioural qualities are: humour, sympathy, surprise, provocation, and even shock.

There was a specific research activity that explored the perceived attributes of materials, exploring the sensory experiences with standardized styles, such as "folklore, deluxe, kitsch, porno, toy, sport, pseudo-eco etc.", coming to the conclusion that a sort of agreement can be reached also in detailing perceptions (Harni 1996).

Ashby states that "There is a character hidden in a material even before it has been made into a recognizable form – a sort of embedded personality, a shy one, not always visible, easily concealed or disguised, but one that, when appropriately manipulated, can contribute to a good design" (Ashby & Johnson 2009).

The expressiveness of materials is not a frivolous topic, and the final personality and meaning are the result of several steps of signification.

4.1.2 PERCEPTION OF TEXTILE

Following the framework of the meaning of materials, the meaning of a textile material can also be related to the perception and the comprehension of the same textile by different kind of users. The comprehension thus refers to the interpretative process between the textile material itself and its users. There are two categories of recipients, as users and interpreters of the textile products: first, the fashion designers, who choose and manipulate textiles in order to make them completed garments, second, the final users of the designed garments.

With reference to the structuralist view from Peirce (Peirce 1958), the interpretative process of a textile - as an object, then as an artefact, and eventually as an independent product – is provided by a sequence of steps from the purely material perception to the logic interpretation.

An intentional design process for the invention a new textile product has its reason in the assumption that every textile material is firstly an artefact. In the following decalogue, textile-design is a process involving a complex environment and it is characterized by the 'invention awareness', which occurs from the forth point (Zingale, 2009):

1. The object presents itself as a quality of matter, colour, morphology, etc..

2. The object appears as a singularity in the situation, both spatially and temporally determined.

3. The object appears as a specific occurrence of a more general type, or as an object that depends on some regularity.

4. The object has properties that are re-known, because of similarity in other cultural objects previously known.

5. The object is observed and understood in a potentially significant relationship and connection with other objects in the same situation (or semiotic field).

6. The object is inscribed in a relationship generally significant, systemic, replicable, or as a type of occurrence.

7. The object is fixed in an 'interpretant' sign through the assignment of a name.

8. The object is defined in a case in which they are interpreting the properties is predicated is the spatial-temporal position.

9. The object becomes the subject of reasoning and inference as to its nature, its origin, its reason.

According to this structuralist view, textile materials are products of sense if and when they are used and act as elements of social mediation, purchased and exhibited, more or less ostentatiously.
Each textile product is an element of a system where human being is an integral and active player. The user, as interpretant, is the only one who gives the meaning to the textile. Only the use makes the project of the textile complete and fully updated.

Given this premise, it may be useful to explore the theme of the textile artefact as a meaningful object, considering three different possibilities, describing the significant quality of the textile object.

A. Object - Object = Icon

Beauty → Preciousness

Object as image and quality.

'Object – Object' refers to that object which is not meant to be used: an object designed to be watched and not to be handled, but to fill and decorate the artificial setting of our environment. This kind of object makes sense because of its ability to be a source of contemplation, sensations, aesthetic stimuli or information. The relation between the object and the human being is fundamentally perceptive.

Figure 7 Silk taffeta hand-painted by Brian Froud for Prada - SS 2008

Many fabrics can be counted in this class, just think of the tapestries, damasks, jacquards for upholstery and furniture, or over-decorated fabrics - made with exclusive fibres, hand-woven, treated with un-washable solvents, hand-painted and dyed for haute-couture.

The main goal of these objects is the look and the opinion of who watch them. In Jacobson's model of functions, the expressive function and the poetic one would dominate.

B. Constrictive and seductive Object = Index

Beauty → Pleasantness and constraint

Object drives and forces the user's actions.

The constrictive or seductive object may impose an answer without demanding an active interaction of the user. The artefact, in this case, requires a mode of dialogue through determined staging posts. The object acts as a cause, the user response as the effect. Only one answer is advantageous, however, all the others have an element of disadvantage and/or risk. There is a main objective of meaning and purpose, which includes a reflected action from the object itself. This reflected action is deeply rooted into the material configuration of the object. Consider for example the waxed fabric used for work uniforms. It is immediately the plain fabric to convey the meaning and use of the garment. Phatic and conative functions

prevail, meant as well as physical pressure on the receiver, who mainly plays a passive role.
In addition to the constriction, there is also the seduction.

Figure 8 'Pleats Please', Special Project from Issey Miyake – 1989 to Present

In this case the object constructs a 'blackmailing' mechanism. The dialogical interaction aims to a sort of exchange. The subject draws on some properties of the object-object, showing what it is suitable and hiding the disadvantages. The purpose is to tempt the user's response, by acting on his weaknesses, his desires and interests. Seductive and bargaining objects are the status symbols, which are effective whether attracting consensus and admiration.
With regard to the world of textiles I think primarily to those designer-stamped textiles: jacquard or printed fabrics that reproduce the logo or renown patterns of the firm, stating explicitly the membership of object to a particular brand.

C. Object - Instrument = Symbol

Beauty → Satisfaction

The object interacts with the user

Objects of this category provide that the receiver (user and maker at the same time) has a role, which becomes aware and active: the dialogical game of these objects is entirely in the hands of the interpretant user. This interaction makes the object turn to be a sort of instrument.

The object-tool involves certain competences, specific conventions and traditions, usually handed down through a transfer of knowledge that can be explicit or even tacit. It is always convenient, or even necessary, to learn the rules and the instructions concerning the use of the instrument. Pierre Rabardel defines the instrument as a hybrid entity composed of the component 'artefact', with its formal, aesthetic and technical description, and the component 'scheme of utilization', including the actions that the use of the instrument makes possible (Rabardel 1995). These two components are slightly independent to each other; the same pattern may refer to different types of objects. The use of these objects can be primarily meant as the application of the declared pattern of behaviour. This pattern, however, is not static: the user himself can define it by drawing on patterns coming from other instruments, adding, replacing or shifting practices and conventions from other objects. The meanings of these objects concern the meta-semiotic function and the referential function.

Figure 9 'Bio-Couture' research project by Suzanne Lee, Central Saint Martins College - 2007 [15]

[15] More information on the official website: http://biocouture.co.uk/

In conclusion of this analysis, several questions emerged:

Is that important for a textile designer to knowingly manage the functions that textiles work?

Which functions does a textile material work?

How is important for a textile designer to knowingly manage these functions?

What is the meaning of a knowingly textile-design?

4.1.3 MATERIALS AS TOOLS FOR DESIGNERS

The last category of interaction, between user and object, assumed that every artefact plays the instrumental role, whenever it allows a threefold process (Zingale 2009):

- the transformation of the existent context;

- the acquisition of a new context;

- the exploration of a new context.

The consequent hypothesis was that also materials could be considered as instruments.

It was clear that the turning point stays in the intervention of the subject's activity, against a simpler perceptive passivity. The material, in the meaning of instrument, thus acts as a mediator between the designer and the final object.

Following the classical Vygotski's point of view (1930) on the basic elements of instruments, every tool can be described in its psychological structures, the so-called 'instrumented design scheme' for which the activity is ordered in one way with exceptional variability and artefact structures, with a code made by explicit signs and symbols. These two kind of structures represent the resources that the designer implements to develop a proper object-oriented activity.

With reference to Beguin and Rabardel (2000), a mediating instrument is recognizable for two components: the material artefact component and one or more associated utilization schemes, which can be the result of a specific elaboration of the designer, or through the adoption of established and common schemes. Utilization schemes have two dimensions: private and a social. The social dimension is the one shared by many users, who belong to the same social or scientific community. The elaboration of the scheme is not only due to the decision of the instrument's designer. Schemes are spread both informally from user to user, and formally through organized training means such as instructional manuals, assistance

systems etc. The material component joint with the scheme works as the mediator between the designer and the activity of design an object.

To follow the first argument, also materials have a physical component and a scheme of utilization, which is composed of the traditional way of utilization of the material, of a specific way proposed by the material's manufacturer or of a new way developed personally by the designer who gets in contact with the material during his design activity.

The development of an instrument occurs through an 'instrumental genesis', which involves both the design of the artefacts, and the creation/evolution of utilization schemes. Instrumental genesis unfolds in two dimensions: 'instrumentalization', which is artefact-oriented, and 'instrumentation', which is subject-oriented (Beguin & Rabardel 2000). During the instrumentation process, the subject evolves. During the instrumentalization process, the artefact develops. These two practices collaborate to the effective implementation of the instrument. The two researchers quoted the wording 'catachresis' from Faverge (1970), to refer to these shifting processes. Traditionally in a rhetoric context it means the substitution of a word with a different one, or the exaggeration of the common meaning. In the field of instrumentation catachresis concerned the adoption of one tool in place of another, or to stressing instruments to accomplish unusual targets. This process can be considered also a deviation from the honest use of the tools. Or an innovative intervention of the user to fulfil his activity (Ashby & Johnson 2009).

Coming back to the world of materials, the designer, who acts as the user of materials, can interpret or even twist the original material or the primal scheme of utilization, activating a sort of catachresis. The designer can choose a material never used for the same category of object, associating the scheme of utilization of one material to another one. Otherwise the designer can enable a radical transformation of the functions, or even the structure of the material. In this case this process can be called 'instrumental genesis'.

The material, as an instrument, has always been designed with its physical and technical component and its utilization target. But through the exchange with the materials' user, as the designer can be, the original structure and application inevitably evolve.

This deepening was useful to understand the importance of studies on cooperative prototyping of materials between materials inventors and materials users, who can validate or reject the instrumental activity of the new materials. This process is referred as the design of materials.

4.1.4 TEXTILE MATERIALS AS TOOLS FOR FASHION DESIGNERS

In order to understand the relation between the textile materials and those specific users represented by fashion designers, it was valuable to keep this wider point of view of the broader materials' world. The idea was to deepen the sense of considering textiles as

instruments for fashion designers. As already assumed in the previous paragraph, materials can be adopted as tools whether they contribute to the transformation, acquisition and exploration of the context, so do textiles. Moreover textiles as instruments have a double content: the artefact component and the scheme of utilization. The issue was the analysis of the instrumental genesis of a textile material.

To deepen the how this relation bears on the surrounding context, it was useful to go back to the Jacobson model of the communication functions, associating each factor involved in the general framework to communication functions (Zingale 2009). The exemplified model can be described as: a sender sends a message to a recipient, referring to a specific context, thanks to a psychological or physical contact, using a code common both to the sender and to the recipient.

Thanks to the analogy between textile and text (as already mentioned in the introduction, the etymological root of both the words and concepts is the same), every fabric can be analysed in the form of text functions, from time to time considering the predominance of one or the other. Here is a description of this linguistic model, with reference to the textile artefact.

Until now the focus was on the description of the textile artefact. Now the aim is to widen the field of investigation to the generative and the utilization practice of this artefact.

Following the most general structure of the linguistic model, the senders of the textile artefact are the ones who order, invent, design and manufacture the fabric. There are two levels of recipients. Upstream the recipients are the fashion designers, who adopt textile materials as instruments of their creative activity. Fashion designers send again the textile to another category of end users, who accept them in the form of the garments, which assume the shop as the first context, secondly the wardrobe, and eventually specific occasions of use of the garment. The channel is always defined by the users' physical contact with the textiles, in the upper level alone, in the lower one through the garment. The code is stated by the sensory perception (mainly sight, hearing, touch).

The themes of perception an interaction have already been covered, while the issue of textile artefact ‘senders’ and ‘recipients’ is still to be discussed.

Whether the first recipients of materials have already been recognized in industrial designers and engineers, this can’t be considered as a homogenous category. There could be identified technical designers or engineers and industrial designers, more dedicated to meaning, language and, eventually, shape.

Technical designers and engineers have ready access to a great quantity of information – handbooks, selection softwares, advisory services connecting with material suppliers[16] – and to

[16] Innovatheque, Presentation ‘Who are we’, last viewed 14 February 2012, http://www.innovathequectba.com/present_whorwe.php?rub=1andsrub=1andPHPSESSID=f22211dd6d5aca0d22105c481fd7467b.

analysis and optimization codes for effective and efficient design. Industrial designers express frustration that they don't have equivalent support. In higher education the same discrepancy appears: the teaching of the science and technical application of materials is highly developed and systematized, supported by numerous texts, software, journals and conferences; there Is no similar abundance of support for the teaching of materials in industrial design (Ashby & Johnson 2009).

Bridging this gap in information and methods is never simple. The technical terms used by engineers are not the normal language of industrial designers – indeed they may find them meaningless. Industrial designers, on the other hand, express their ideas and describe materials in ways that, to engineers, sometimes seem confusingly vague and qualitative.

The same argument is recognized valid also in the relation between technicians and designers involved in the creation of new textiles (Gail & Kaur 2004).

The first opportunity in bridging the gap is to explore how each group of professionals expects from materials and the nature of the information about materials that each requires. A second chance concerns the exploration of methods, design tools, and ultimately vocabulary that weave the two strands of thinking into a single integrated 'fabric'.

4.2 Material Design: from the material of invention to the invention of the material

With reference to Italy, the dawn of the design phase saw a generation of designers who put materials in the foreground and use them as a crucial element of their philosophy and language manifesto (starting from Ettore Sottsass with Archizoom). There was no preventive ideological constraint in the use of materials and decoration. The history of Italian design seems to indicate that the opposition between form and decoration, texture and colour, technique and invention, depth and surface, shape and material, structure / decoration, hard / soft, aesthetics / characterization technology, skin / bones, structure / superstructure, can be reassembled and surpassed only by taking it simultaneously. The role of designer lies in the ability to develop the relationship between what is inherent in the material and what you can overlay it (Raimondo 2004).

Material Connexion Presentation 'Who are we', last viewed 14 February 2012, http://www.materialconnexion.com/Home/AboutUs/tabid/57/Default.aspx

Materio, *Material World 2: Innovative Materials for Architecture and Design*, Birkhauser, Boston, 2006
Materia, Presentation 'About us', last viewed 14 February 2012, http://www.materia.nl/538.0.html

Many designers came to the creation of new languages through the experimentation of new materials. Witness to this change, Manzini (1989) described the character of a designer who is constantly in search of introducing innovative materials that can reinterpret the environment. Manzini identified three clusters of materials' designers. The first involves those who believe that all the materials have inherently something to say. A second category includes the designers who don't accept that materials have an intrinsic meaning; it is the aim of the designers to create their identity through a shape. The third category engages the designers for whom 'the theme of the materials is not only important but becomes the core ground of the project' (Manzini 1989); amongst this group, according to Manzini, the conceptual and operative methods emerged to manage the so-called soft qualities of materials and to design their meaningful identity.

4.2.1 DESIGN WITH MATERIALS

There are millions of different materials and new ones are born constantly, 'the proliferation of new materials and the huge technical and expressive possibilities offered by them require to designers a continuous update on their properties and possible applications (Langella 2003). A growing field of possibilities are offered to designers and manufacturers. The selection of materials and technological processes of transformation can be recombined, generating what Manzini called 'hyper-choice': there isn't in fact a specific material which pushes itself almost as the inescapable choice for one type of product, while there are different materials in competition with each other. As already underlined previously, the pressing issue regards the way to find a rewarding solution (Lerma et al. 2011).

Ferrara (Ferrara 2004) stated that the paradigm of designed materials begun to emerge around 1970 starting from the wave of innovations originated in the United States in the '40s thanks to the invention the transistors. If materials science and technological innovations brought down many limits to the possibilities of production, the project started to involve a greater responsibility. The designer has to seriously wonder about the meaning of his choices: the new technologies do not serve to stimulate surplus of frivolity into saturated markets, but they are valuable instruments to be used for more sustainable solutions. Based on such a consideration, since the 80s, a renewed vision of design research has moved towards a deeper understanding and exploitation of the meaning of technological and materials' innovation (See: J.F. Lyotard and the issue of new materials, called 'Les Immatériaux', following the name of the exhibition, curated by the same philosopher, which was held at the Centre Pompidou in Paris in 1985. Materials were assumed as promoters of a radical change in the relationships with and between subjects and the artificial environment by introducing new utilization forms and new behaviours. Thus, Lyotard was the first to lead the argument from a technical point of view to a philosophical one).

According to the new perspective, to manage the increasing complexity, it would be desirable that the designer looks at the technical engineering of the product, beyond the conceptual component, because it would indicate to develop a greater attention to the value of 'circularity', which lays between doing and thinking (in this economic and industrial context that mainly encourages cost reduction, the transformation of materials and production technologies took place in the hands of scientists and technicians, in an almost unnoticed and unconscious way. The ancient separation defined by Maldonado as 'the distance between the mediated technology and the immediate one' has grown up. A shortening movement is called to review the way of thinking to technique and technology (Nacci 1998).

In the approach of Italian design, the search for technical and aesthetic alternatives to traditional materials has always been driven by the search for new lifestyles and languages of the project: a kind of intuitive and often irreverent approach that, beyond an engineering vision, has been able to grasp the symbolic identity of materials. This is the case of the furniture sector, which is witness to a displacement of the utilization of materials. To be aware of this situation, it is sufficient to look at the designs by Ron Arad for a chair made from sheets of harmonic steel, or at piece of furniture design by Campana's brothers with corrugated cardboard or scraps of textiles. They both wanted to experience shifts in perceptions, which also have an aesthetic value due to the boundary condition. A new dimension of experience and practice was accomplished.

Furthermore, the more the technology is complex, the more it is invisible; thus, the design has the potential to produce objects with an image that seems more real than reality, in accordance with a more balanced relationship between the physical and aesthetic characteristics of the material and the ones of the product.

Industrial design has always been based on materials and technologies, in the last two decades more than ever, showing a strong expression, which is integrated into the wider identity of product as a whole. Those kind of developed innovative materials no longer need to proclaim their own language, or whatever it could be defined as the character of the material, but is inscribed in the identity of the product, converging integrally in it. In this way, the material is not eclipsed, but moves its innovative properties to the artefact, enriching its own nature; the material becomes explicit through the shape of the product, giving it a certain performance, a possibility of use, a functional and aesthetic validity.

Technique and technology have expanded 'what material does', its way of being and the possibilities to use it. The technical evolution shows an extraordinary increase in material and performance variations. In particular, the scenario of miniaturization and nanotechnology has improved the growth of a new class of materials, entitled as 'new generation functional'. This category includes a number of materials, whose characterization it is not directly recognizable during the use. This essential feature is hidden inside the artefacts. The invisible technology, to be used by man, requires some sort of physicality that adequately relates with the human dimension of the user and satisfies the natural need for corporeality, which has often been denied by the interaction with an intangible technological system (Fiorani 2004).

The recovery of a richer sensory relationship is more evident in the success of certain categories of products: from sunglasses to shoes, from technical fabrics to toothbrushes, and now the touch screens of I-phone and I-pad: they propose and asks for a series of sensory stimuli that speak to users about of a 'psycho-active' matter, which qualifies the experience; these are the products where the design uses materials on the ground of their seductive effectiveness for the recipient, in the attempt of satisfying his own need of physicality and self-representation. With the newest objects the quality of the sensory interaction changes because users bodily needs has been changing. Thus, it is difficult to believe to the so-announced de-materialization of objects, it would be more appropriate to speak of a tendency to 'de-corporealization', or about a discrete use of an expressively 'augmented' matter.

4.2.2 DESIGN THE MATERIALS

With reference with Manzini (1989), Petrillo[17] suggests to think the material as an independent territory, with its own language, such as 'hypertexts', which are able to develop multiple dimensions and a complex identity. From this point of view, the material must provide, with its extrinsic values, the contribution that its properties can lead to the enrichment of artefacts.

Materials can be considered the primary land of the project of artefacts. They represent leverage for the project, but also a point of view, a perspective on the reality of products; no matter whether the target of the design activity is a halfway product, the skin or the surface of a product or the decorative pattern. It concerns a game of multiple relations with the technical and aesthetic characteristics of the material, but also with the shape, the evolution of language, the user and eventually the environment.

According with Argan (1982), the tactile and visual appeal of a product is linked to the notion of a relational environment, to the creation of a context of artefacts, which includes designers and users, where everything moves, and where there are unlimited possibilities for meetings and combinations.

It could be argued that all designers characterize their work in terms of research on surfaces and materials. Anticipating the renown wording from McLuhan[18], Eco (1964)[19] states that the medium is the message, thus the material is no longer only the body of the work, but also its end, the object of an aesthetic discourse.

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[17] Petrillo A., Il Lingotto primario (literally 'The primary ingot'), Arcadia Edizioni, Milano, 1985
[18] McLuhan M. and Fiore Q., *The Medium is the Message*, Middlesex Penguin Books, Harmondsworth, 1969

[19] Eco U., *Apocalittici e integrati*, Bompiani, Milano, 1964. Then published as *Apocalypse Postponed*, Robert Lumley, Bloomington, 1994

In the field of materials, preserving and innovating are not antagonistic concepts, but the two faces of the same learning process. In fact, it's needed a fundamental background of knowledge and pre-existing conditions (the history, the forms of tradition, local resources, etc.); the same background that has to be elaborated; the elaboration of new (the design activity) changes the existing cognitive structures and prepares the new structures (Bateson 1979).

Furthermore, in a situation of turbulence, uncertainty and high-pitched competition, such as the present one, it becomes much more desirable that design practice clearly discloses the value of knowledge through research and experimentation of materials and processes, as a practice that must necessarily involve manufacturing companies. The time of research has to be released from the time of production, so that innovation can be realize itself throughout appropriate time and form, enriched with cultural and social values as well as technical ones. This kind of research requires at least a partial transformation of the 'factory' in a sort of scientific laboratory, a creative workshop, where it is possible to invent, capture, and then collect and transmit knowledge through an experimental approach. It is suggested a kind of 'pure research', a type of research that is required to be immediately productive. It can for longer just explore with the appropriate tools, to become a permanent learning process. This kind of research makes design and knowledge the key factors of later production.

At the same time it suit important, as well as the traditional design analysis, the phase of technical and social negotiation between the potentialities of innovative techniques and the social willingness to accept them or to change them. The context in which lies the innovative act is no longer the uncritical acceptance of the contents of technology, nor that of reckoning, but lies in the complexity, in the initiative, in the ability to create networks of communication and sharing, in order to facilitate the dissemination of knowledge and the development of deeper quality of materials and products (Manzini, 1989).

Traditionally, for craftsmen and artists, material – observed and known through direct experience – has represented not only a concrete limitation to work against, but also an enormous source of creative stimuli. Today, matter tends to be increasingly artificial and decreasingly material, thus changing the quality of this framework of references and the way in which one approaches it. The new matter from which stimuli are now drawn no longer provides the physicality of a given material as much as it provides a set of possibilities and performances, 'possible' that emerges from what can be manufactured through an engineering system capable of performing ever more subtle manipulations.

"The matter of design and invention can therefore take the form of a process which allows one to produce, variously, a given composite, a computing method leading to a new approach to a structural problem, a flexible automated manufacturing process that imposes a new set of limitations while simultaneously creating new possibilities. Another possible result (and this is by far the richest vein of stimuli and references) is that what has already been accomplished in other fields and which can be transferred to a new application – transferring images and ideas

even prior to transferring technology - can become a source of generative metaphors" (Manzini 1989).

The field of the possible thus spreads enormously both vertically – towards in-depth specialization – and horizontally, towards what has been accomplished in other sectors. This sets up not only the problem of quantitative knowledge but also that of qualitative knowledge – conceiving the possible by referring to this new matter that is richer in forms, more abstract, more fluid in some ways and more rigid in others.

From the very origin of human manufacturing onward, the craftsman was a figure which knowledge followed rules dictated by matter – his actions, his thoughts were always linked to the requirements of the material which he worked with, the craftsman's technical knowledge consisted in a profound proximity – in physical terms and in terms of perception – with materials. The observation and practical manipulation of these materials often represented the best technical learning process. And innovation, when it occurred, was the result of a fortuitous piece of happenstance, rather that of a deliberate design choice, in the modern sense of the word. But a certain point in history there emerged a new strategy of thought: modern science, which was bound by matter as results, but its initial hypothesis is based on thought, as imagining a result.

It happened only during Industrial Revolution that science was integrated to manufacturing through the engineering practice. Thus, unlike the craftsmen, engineers started to use a precise and referential language to describe themselves and their procedures. They know what they are doing and why they are doing it. They do not see the new as a leap into the void, because their calculations allow them to foresee the results. Matter is no longer a specific piece of wood or fibre, to which a craftsman must turn his hand, but an abstract model characterized by parameters (Properties) and by relationships between those parameters. The passage to an abstract and codified relationship with matter certainly didn't come about overnight. For about two centuries theoretical knowledge and practical experience coexisted. This hybrid knowledge typifies the image of the modern designer.

"Today the abstract and theoretical knowledge of materials is seen as the only feasible approach. There is still a huge space for knowledge and practices similar to the crafts tradition, thanks to the multiplicity of current manufacturing and marketing options, but design must take into account the dominant trend – the number of materials available prevents a designer from acquiring experience on each of them. The appearance of 'made-.to-order' materials, make that a conceptual impossibility" (Manzini 1989).

It's desirable that a designer who intends to work in the field of possibilities made available by technical innovation not only must find an orientation among numerous options, but must especially adapt his intuitive capacity, creativity, and work method to the general trend toward abstraction, immateriality, and multiplicity of the parameters with which he must deal in order to work with matter. Traditional, non specialized materials set limits that had the repercussions on the final image of the object and that profoundly typified that object. At the same time the oversizing that non-specialized material forced designers to adopt not only

offered freedom to manoeuvre in formal and functional terms, but left a certain margin for excess and even error. The designer, thus, once he had internalized his familiarity of certain properties through practice, could concentrate on a few design parameters, taking the others for granted. Everything changes when one encounters new, or even custom-designed, materials, having a specialized set of properties, which are used ever closer to their limit conditions. Precisely because each feature is optimized, if any parameter is not taken into consideration, or if any variation in the conditions of use is neglected, can the product collapse.

4.3 NEW PARADIGM OF TEXTILE DESIGN

"Traditionally the role of the textile designer has involved the design and production of original woven, knitted or printed fabrics in the form of either flat paper designs or fabric swatches. Typically designers will use suggested colours, sketch initial concepts, formulate designs (perhaps in repeat format) and work with a variety of yarns and fabrics. They develop visual and tactile ideas, referring to a specific 'design-brief' which provides guidelines about what the designs should entail or what they are for. These activities are then combined with their technical and practical knowledge of fabrics and processes in order to produce designs.

Through the process of original invention and renewing and refurbishing patterns and motifs, and moreover materials from the past, a traditional textile designer constantly develops and proposes new textile designs " (Hoggard 2000).

With reference with Hoggard (2000), this description refers to the traditional concept of textile-design in the most widely accepted sense of visual design. It remains still strictly related to the project of patterns, sketches, motifs.

The main function of fashion design is commonly recognized into the invention of colour-swatches, based on a trend forecasting researches, of weaving and knitting patterns, eventually also of proposals for finishing treatments. This was what emerged from the case studies' interviews. Also the language used by the textile designers employed by these companies is described as not specifically technical. These designers usually speak about effects (such as glossiness, vintage-look etc.) rather than of processes to accomplish the effects.

The textile-design industry is shifting incessantly, as design methodologies widen, a setting not exclusive to the world of textiles but consistent to the most contemporary design discipline; current end emerging textile designers are constantly adapting their skills and acquiring knowledge about innovative processes in order to drift away from a pattern designs' portfolio.

As professionals referred, most of the textile-design practice concerns experimentation with the very basic elements of textiles: spinning, twisting, weaving, knitting, knotting, deying and printing, but it started to be a greater focus on an inventive use of surface finishings and

special treatments or completely brand new techniques. The broader range of textile-design includes processes such as stone washing, pleating, joining, coating, bonding, lamination, laser-cutting, burn-out and resist methods for printing.

“The potential diversity in textile design is now immense and consequently many designers seek out interesting or unusual combinations of materials and techniques” (Gale & Kaur 2004).

The subject was once enjoyed as simple exploration of fabric construction and image manipulation within clearly defined constraints; it has now transformed itself to provide immeasurable solutions for a field whose boundaries have become unclear.

A third level of textile design is the one that goes at the very beginning of the creation of textile material. Back to the chemical composition of the fibres, yarns and fabric blend. It enables a possible extension of the meaning of textile-design, beyond the design of material surface. . It concerns the participation to the invention of the textile matter. A valuable example of this evolved meaning was the stunning work of Suzanne Lee with the organic generation of textile products[20].

Figure 10 ‘Bio-Couture’, Suzanne Lee, 2007

[20] A fascinating presentation of the work from Suzanne Lee is presented on TED.com: http://www.ted.com/talks/suzanne_lee_grow_your_own_clothes.html

Also, as a possible result of the worldwide textile community sharing knowledge, process, skills, and traditions, the capacity for invention has multiplied within the subject, making it more wide-ranging, also in fields external to textiles, and sophisticated in the outputs. Textile-design followed the industrial design, accepting a more complex subject of investigation and practice.

4.3.1 COMPETENCES AND PROFILES

The new generation textile designer is closer to the hypothetical role of industrial designer suggested by Manzini (1989). More technical and scientific knowledge can be acquired by designers, in order to delegate the understanding to technical players no longer. The blending of tradition and technology disclosed itself in a diverse assortment of new fabrics and materials, mirroring changes in lifestyle and the way modernity and progress are embraced in this first decade of twenty-first century. The space between the producer of textiles and the consumer of fashion garments is progressively shrinking, enforcing the request for innovation (Gale & Kaur 2004). New textile professionals have foresight and employed intuition, fighting limitations and restrictions.

Advances in textile had a remarkable influence on fashion and apparel. In addition to explore issues of body shape, fashion designers envisaged material innovation as an important motivating factor in their creative process. On the contrary, sometimes textile material itself inspires the silhouette. Today, a number of textile designers is a multi-talented resource, and can work either in a laboratory, breaking new ground through developing high-tech materials, or leading the way by practicing the textiles features within the fashion and apparel arena. Again, this practice is frequently achieved by means of exploring finishing processes and treatments. Innovation in textile materials involves primarily surface exploration, due to aesthetic performance. This one is attained by way of combining various methods of production and finishing. For a more unconventional approach to designing textiles, the development in yarn and fibre technology is preferred. Breakthroughs in these fields enhance the creativity of the designers of fabrics (Mahoney 2000). Innovation in yarns drove to avant-garde blends of fibres. Besides developed for aesthetic reason in order to achieve specific visual or textural effects, these mixtures possess performance-enhancing properties.

Traditionally, textile designers had a strong grounding in one or perhaps two of the traditional specializations of woven, printed, knitted and embroidered textiles, and these are still considered fundamental skills in the textile industry. However, now the right time came to wonder and discuss these traditional categorizations of textiles. Current material research within the discipline takes the subject beyond the realm of the yarn and the cloth. Gale and Kaur (2004) stated that: “Technological advances, sophisticated consumerism, changes in society and lifestyles, diverse innovative thinking and media and communication touch not only textiles practice and philosophy but also the wider sphere of design disciplines in general”.

Textiles, breaking the boundaries of apparel, are closely implicated in multiple disciplines beyond fashion, such as visual communication, product design and interior design. Basic skills in textile practice remain the fundamental background: they provide the textile professionals with a preliminary general framework. The acquisition of those first skills has to be followed by a training period outside the main textile environment. Crossovers always occurred. Now it is time to push them, visiting different research and manufacturing areas, to enrich the curriculum with different technical competences.

The language of textiles has already expanded through the absorption of technical knowledge or artistic ambition drawn from other subjects. The aim is to foster inventiveness and vision. New perspectives have enriched the time-honoured skills and materials, so designer should do.

4.3.2 PROBLEMATIC ISSUES

This combinational process of traditional competences and innovative technologies question whether textile-design practice keeps sitting in a hand-craft context or lies comfortably also in the scientific and industrial arena. The hybridation with technology nurtures the question whether the practice could be recognized as scientific or, more conventionally, as the customary aptitude with material.

The new concerns about textile design stimulated a renewed approach to a hyper-traditional discipline; a field that is now in evolution and requests for re-evaluation. Currently there are few research projects taking place in the British textile world, exploring technologies related to textile production, and design issues involving the relationship between surface and structure, such as “Fabric of Life” of Carole Collet for the Textile Futures of Central Saint Martins. There also a number of professionals involved in material development and research who could challenge any predetermined views of what textiles constitutes, as Sarah Taylor collaborating with the University of Brighton, Janet Stoyel with the Royal College of Art and again Suzanne Lee with Central Saint Martins.

Science and engineering have been playing a fundamental role in textile industries; even if the majority textile engineering is mainly intended for manufacturing sector, it started also to influence textile-design. The scientists and engineers are able to enhance, improve on and surpass the previous advances, already forecasting the results. And results came. Issues like textile functions and performance were encouraged firstly by specialist apparel sectors such as active-wear and sportswear; in order to answer with the growing sophisticated requirements from consumers, sportswear companies were stimulated to continue in performance implementation. The mere possibility and opportunity of developing a new fabric, primarily to substitute the previous one, justified the effort to work on the related experimentation (Quinn 2011).

Often nowadays it is the fabric that makes the trend. “Garment physiology and environmental behaviour, comfort and lifestyle have become the components of modern fabric creations and turned them into high-fashion, high-tech products... Words such as intelligent or electro-textiles, antibacterial or biomimetic could well come from computer dictionary. Today’s fabrics are programmable” (Gale & Kaur 2004).

Definitions within contemporary textile practice are now debating: conventional boundaries between sub-disciplines (spinning, knitting, weaving, finishing, etc.) have become blurred. Today also technicians are asked to be involved in the creative process, thanks to their material skills, and now they work with computer and digital technology, or in scientific laboratories, engineering departments. And always in connection with professionals and from other disciplines. The fusion among design, craft and technical disciplines is no more just an abstract theoretical hypothesis; it is coming to be a challenging reality, populated by real textile people (Jones 2000). What is not enough clear is who is asked to do what. How technical designers should become? How creative and networking technicians are supposed to be?

It is clear that the changes in textile-design and in textile designers’ competences need a radical change also in the methods and practices of material suppliers. As the characterisations within textile practice start to overflow into the worlds of science, engineering and technology, the fashion designer and apparel purchaser, who search for the brand new and original materials and treatments, would demand for a more adequate source, rather than the conventional fabric fairs. The definition of this occurrence, place and situation is all to be outlined. This issue is certainly critical for a consolidated traditional system of supply.

Starting with the digital revolution, textiles industry slowly reformulated itself. The awareness behind this process is not evident. This evolution is the result of the cutting-edge activity of a new generation of inventive designers, who started to seriously play with the versatile and fascinating properties of innovative raw materials. It’s obvious that, at least within textile design research academia, terms like spin, weave, knit, print, dye and embroidery became reasonably archaic, or even obsolete.

This was the up-to-date conclusion of Gale and Kaur (2004): “We are truly at a point in time where re-evaluation is needed; this is even reflected in the nature of the student experience within the subject, many no longer desiring pure and simple textile design. There is a craving for something altogether more definitive of the twenty-first century, textiles of the future. As a result of the perpetual changes in textiles technology and culture the impetus to redefine textiles will undoubtedly grow”.

5 DESIGN DRIVES INNOVATION

5.1 THEORETICAL FRAMEWORK OF DESIGN-ORIENTED STRATEGIES

The need of a design approach within textile s innovation and industry was related to a wider, but extremely contemporary, investigation within the design methods and practices.

A systematic analysis of design methods and design methodology started with reference to the first generation of researchers, such as Archer[21] with and Simon[22]. From the time of the first conference held in London in 1962[23], many achievements during the following decades contributed to a new development of design studies and design research. With reference to the assumptions of few contemporary design researchers, such as Buchanan (2001), Friedman (2000), and Margolin (1999), although a common definition of design and design research has not been revealed, the focus of the issue has gone to the relation between design practice and innovation.

Hon David Willetts MP, the Minister for Universities and Science in UK, speaking about the 'Government's plans for innovation' and the 'Innovation and Research Strategy for Growth'[24], stated that: "Design can help organisations transform their performance, from business product innovation, to the commercialisation of science and the delivery of public services. That is why design forms an integral part of the." Design Council in UK reflects this intention.

Worldwide design methods and practices are raising profile. The EU launched a design innovation policy in 2010 with funding for projects that raise the performance of SMEs. The Danish Department of Construction and Enterprise itself has published 'Design Vision 2020' with a strong challenge-led innovation and public services. Different countries in Eastern Asia are pushing policies to foster the implementation of design-driven activities to promote innovation. China started up a strategy to shift from 'Made in China', to 'Designed in China' as a part of a major plan to reduce dependency on low-value manufacturing and develop original products and brands, investing on the setting of 27 creative districts devoted to design, provided with incubators, prototyping facilities and research supports. Singapore also replied the model of Design Council, in order to put in contact designers and design practice also with consolidated industries, such as the financial one.

The idea of adopting design principles at the heart of business culture and management is surely linked to global business success stories such as Apple, Dyson, North Face, Nespresso. A number of theories was developed on the ground of such case studies, in order to interpret

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[21] Archer B., *Systematic Methods for Designers*, Council of Industrial Design, 1965
[22] Simon H., *The Science of the Artificial*, MIT Press, 1969
[23] The 'Conference on Design Methods' was organized by J.C. Jones and D.G. Thornley in London in 1962
[24] http://www.designcouncil.org.uk/publications/Design-for-Innovation/, last visit on 23 February 2012

design methods and tools within strategic business management. Design research processes behind key breakthroughs, often tacit and not precisely defined, were broken down, analysed and rebuilt into systematic models.

The models typically reprocessed to facilitate innovation also into traditional manufacturing and were followed by consistent strategic models were inscribed in the following theoretical frameworks: 'Design Thinking', 'Open Innovation', 'Concept Design', 'Strategic Design' and 'Design Driven Innovation'.

5.1.1 DESIGN THINKING

'Design Thinking' has become a recurrent expression, often used with a broader sense in describing how creative thinking-in-action can influence the problem solving of wicked problems within a management paradigm. The idea of design as a 'way of thinking' can be found in the mentioned book of Herbert Simon (1969), who called for the organization of a rigorous body of knowledge about the design process as resource and method to approach managerial problems.

Richard J. Boland and Fred Collopy in 'Managing as Designing' (2004) explored the theme of 'Design Thinking', involving distinguished scholars, artists and managers. It was focused on management education, public policy, and management practice, in order to make managers better designers, primarily thanks to the adoption of the 'vocabulary of design'.

This design attitude was also pushed also by widespread management-related publications, such as Fortune and BusinessWeek, which regularly introduced design successes, stressing the relevance of design for managers.

One of the supporters of 'Design Thinking' has been Roger Martin who attempted to distinguish 'Design Thinking' from the general framework of design (Martin, 2005). He explained 'Design Thinking' as the way designers think: the mental processes they use to design objects, services or systems, with no regards to the end result of appealing and useful products. The concern related to the nature of design activity: a work based on projects, which face 'wicked' problems.[25]

[25] The concept, and expression, of 'wicked' problems was theorized by Horst Rittell, as described by Richard Buchanam into the paper 'Wicked Problems in Design Thinking' (Design Issues, 8, 1998): a category of social system problems which are ill-formulated, characterized by confusing information, conflicting values between clients and decision makers, and blurred ramifications throughout the whole system.

Designers were supposed to work on a 'project' basis, where the project has a certain deadline, and, once accomplished, is considered over; unlike managers, whose work-flow concerns everlasting assignments. The consequence has been that designers have been familiarized to build ad-hoc teams, and are comfortable in cooperating for one single common and definite purpose. Also the career of a designer was meant as a growing portfolio of singular projects, rather than a progressive advancement within the hierarchical pyramid. The assumption was that designers embrace wicked problems as a challenge to strengthen their 'status'.

Thus, designers have elaborated a specific way of thinking, dissimilar to the established management thinking, just in order to successfully face these wicked problems (Dunne 2006). Three qualities of design thinking were summarized: cognitive, affective, and interpersonal.

Cognitive properties

With reference to David Dunne, who quoted the inferences' model from Pierce, 'Design Thinking' was described as cyclical process, embraces either inductive and deductive reasoning, as well as abductive logic[26], which has always been evaluated as the most suitable reasoning in order to generate innovative ideas (Dunne 2006).

Design thinking was not depicted only as the generation of new ideas, but also as the extensive analysis and assessment of how they can be widespreadly applied, also in a different context. From this perspective, abductive reasoning is appropriate to spawn a number of new concepts. Furthermore, deduction is needed to forecast the concerning outcomes and their consequences, introducing the concepts into the real world, while and inductive logic serves to develop a generalized framework from the experimented outputs.

In addition to the model of inferences, Design Thinking was associated to the idea of 'Systematic' reasoning; designers, in fact, were appreciated for their attitude in visually mapping a wicked problem as an organism of 'structures, patterns and events'. This method facilitates comprehension and awareness of the relationships of cause and effect among the different elements of the organism (Senge 1994).

Attitudinal properties

With regards to the attitude of Design Thinking towards decision-making and constraints, there were some different arguments.

With reference to Dunne and Martin (2005), one of the leading differences between designer's thinking and manager's thinking regards the sympathetical attitude towards constraints. Designers were meant to consider constraints as a valuable part of the challenging process of

[26] Charles Pierce, with reference to classic Aristotelian philosophy, considered inductive logic as the generalization from specific instances, while deductive reasoning combines inferences starting from logical premises. On the other side, abductive reasoning was meant as the process of formulating an 'explanatory hypothesis'. This logical inference was assumed as the only one that can introduce an innovative concept (1958).

generating innovative solutions, unlike managers, who were supposed to disregard constraints as obstacles to the efficient implementation of new ideas. Constraints bound, but they don't curb the design process. On the contrary, limitations encourage the creativity and the commitment to the assignment. The same assumption was sustained by Norman (2002), who stated that limitation facilitate the design process by reducing the load on memory; and with Vandenbosch and Gallagher (2004), who argue that constraints have the capacity to inspire.

On the other hand, also the attitude to decision-making is interpreted as distinguishing characteristic between a designer's approach and a traditional manager's one (Boland&Collopy 2004). The strict models of decision-making game have too impacted current management practice. The critical perspective was that decision-making strategies usually intend to evaluate solutions for existing, and mainly steady, problems with evident alternatives. The approach is primarily analytical, thanks to the adoption of generalized methods and tools. Designers were meant to face problematic situations as opportunities, and again as a permanent challenge, starting from a proper investigation (doubting the conventional alternatives) and inventing also riskier options, whether they are considered the most suitable ones and they can be exploited thanks to the team competences and capabilities. The established managers' attitude would be based on the conviction that all the sustainable options are available, and the choice has to move to at least to accessible solutions.

Interpersonal properties

The third aspect of Design Thinking revolved around the network of relations among the different players of the design process. Designers were supposed to interact with team members, with the other stakeholders on the ground of two points: by sympathetically comprehending clients and users' viewpoints and needs, and by cooperating with both commissioners and colleagues.

In this case insights are by provided thanks to an exhaustive study on and into user experience. In the former one, priority is given to reciprocal sharing and understanding, rather than negotiating personal positions until a win-lose agreement occurs.

In order to better understand users' needs, Leonard and Rayport (1997) claimed for the adoption of 'observational research' to approach users, in order to emphasize particularly those needs that users are not able to enlighten explicitly. The design consultancy firm IDEO always mentioned both the practice of user observation and understanding and the issue of team playing. Even in the case of solo-designer, the effort to get closer to users and to positively cooperate with peers was pointed as fundamental (Kelley 2001).

User-centred design started to appear in design literature during the 80s. With reference to Donald Norman (2002), a user-centred approach is necessary to designer in order to fight the natural chance of egocentricity, which can arises whenever designers concentrate on the project with no regards to users' necessities and desires. Effectiveness and functionality of the

output could suffer. Consequently, it would be key to develop a preliminary research phase, combining a neat analysis and a constructive interaction.

Within the framework of cooperation with the other players, two issues were outlined: sharing knowledge and 'creative abrasion'. The former one investigated the needs of making all the facts available to all the players, and to discuss explicitly about the possible ways of processing them. The latter one introduced the concept of creative abrasion, in order to have a soft conflict among the players (Leonard & Straus 1997). The conflict has to be driven in a constructive way, to facilitate the dialogue among different perspectives and backgrounds. This controlled divergence can push the permanent growth of those kind of contrasting and enterprising ideas, which can trigger innovation off.

5.1.2 OPEN INNOVATION

The lexicon of 'Open Innovation' was originally described by Henry Chesbrough, who started from outlining the transformations in the management of innovation, which occurred in the end of 20th century (2003). Chesbrough explained how companies were mainly used to invest a huge amount of capital in internal Research and Development, hiring the most talented specialists, who were supposed to generate the most innovative designs. Intellectual property was considered key and patenting strategies were always implemented. Thanks to the resulting profits, new funds were undertaken to R&D, resulting in a virtuous circle of innovation. The chief factors that changed with the rise of new century were the increased mobility of knowledge workers and the emergent convenience of venture capital.

Closed innovation processes inside the firms were brought into a question. Chesbrough recognized specific issues related the unsatisfactory performance of conventional management of innovation. Valuable knowledge became widely disseminated and publically available. Abundance of information was considered time consuming disadvantageous. New ideas and technologies were subdued to the current business model and wasted if not exploited immediately. New patents had to be directly and actively negotiated by the companies.

Moreover, accessibility and availability of resources of venture capital radically transformed the rules of innovation process.

One of the consequences driven by these insights was the legitimization of the so-called 'Open Innovation' model, base on the trading of both external and internal ideas, by implementing both outside and inside marketing strategies. In this way, boundaries between companies and

their surrounding environments became more permeable, in order to facilitate the opportunity for innovation to shift easily between the two spaces.

An important aspect of an open innovation process was that projects and new researches could be indifferently leaped either from internal and external proponents and new technology could occur at various stages. Also the marketing strategies could follow different pathways: either out-licensing, spin-off ventures, or conventional sales channels.

Open innovation, starting as a management model in information technology industry, gained increasing grounds in many other fields. Gruber and Henkel (2006), for instance, stated that those Open Innovation paradigms, which were primarily implemented by Open source software's' houses, could be generalized to those industries where projects and blueprints could be easily shared (see internet means) and related innovation works through incremental stages.

West and Gallagher (2006) investigated three key challenges of Open Innovation, such as motivation, integration and exploitation of innovation, through a qualitative and quantitative analysis of Open Source Softwares' case study. Four Open Innovation strategies were generalized: 'Pooled R&D', 'Spin-outs', 'Selling complements based on commodities', 'Donating complements as toolkits to users'.

Thus the 'Open Innovation' model was structured around a number of values:

- Combination of internal knowledge, represented talented people who work in-house, and external knowledge;

- Full-value and profitability of external and external-internal R&D;

- A solid business model, with no concern to be to market at once, must support External R&D;

- Capitalization of internal IP and negotiation of external IP, when needed.

West, Vanhaverbeke, and Chesbrough described Open innovation both as a model of practices and a cognitive model for 'creating, interpreting and researching those practices' (2006).

Furthermore, Open Innovation model was supposed to react to two problematic questions regarding the previous research settings for innovation. 'Spill-overs' were not depicted as something to avoid, but as one of the direct and ordinary outcomes, according to the business models. On the other side, intellectual property rights evolved from tools for protection to a new category of assets. At the end, both intellectual property management and spin-offs could be the source of additional value and revenue to the existing business model.

In parallel with properties and qualities, there were identified also a number of arguments, which could be more explored: business model (extract a part of the value created within the value chain), external technologies (develop a business model in order to gradually market the

novelty), assessment and integration of external knowledge, start-ups and spin-offs as scouter and medium of new technologies and new markets, IP rights' dynamical management.

According Chiaromonte (2006), the theme of assessment and integration between internal and external knowledge was discussed in terms of co-development partnership. External partners were meant as peers unlike suppliers or purchasers.

Nobelius (2004) spoke about a 'fifth generation of R&D', which proposed business models to manage the innovation process as a network, in which all the partners who could bring useful know-how have to participate: suppliers, clients, distributors and even competitors. The necessity to share the huge technological investments and to separate the research from the development, suggested cross-firms cooperation. In this way, R&D departments became totally devoted to the exploration of new technologies while the exploitation of the accumulated knowledge was in charge of the product development.

In order to share and exchange R&D were required first to define business and research targets for partnering, to evaluate and grade the R&D capabilities of each partner (as core, critical, or contextual), to coordinate the business models of the different players.

Eventually, Dodgson, Gann and Salter (2006) recognized the methods, tools and processes that are recurrent in Open Innovation models:

Aggregation

'Connect and Develop' standard was used to leverage sources internally, and externally to leverage the distributed innovative capacity. This model made use of the broad interface of a multinational organisation towards outside parties all over the world to find ideas for new products, understand customer needs, and find solutions to technical problems or issues. In order to promote a deeper understanding of the specific needs of the organization and extend the company's interface towards the market, the model suggested also to cooperate with external providers, which could explore valuable answers to those needs. Aggregation referred also to the conventional open source methods toolkits, adopted to drive contemporarily innovation and mass-customization (Huston & Sakkab 2007).

Liberation

This concept concerned the opportunity to emphasize users 'sticky knowledge' (Piller&Walcher 2006), which didn't usually emerged in a proper way through average market researches. In order to uncover the hidden knowledge and the hidden inclinations, it emerged the opportunity to propose to customers so-called 'idea competitions', which were supposed to facilitate the expression of the creative thinking of the users.

On another side, the direct participation of customers could occur in a number of risky chances. Piller and Walker (2006) proposed ad-hoc strategies for each problematic issue:

Reliance on customers' sights	- Involve a proper mix of customers
Reliance on customers' claims	- Organize an assigned human resource office to comprehend customers' personalities and culture
Leakage of Knowledge	- Choose trustworthy users and customers. - Develop IP agreements
Incremental innovation (vs. breakthrough innovation)	- Choose carefully leading customers - Schedule and adequate timing

Inclusion

Open Innovation was based on the idea of a proficient exchange of knowledge between external and internal resources. The question, that immediately raised, concerned how to set up the new model into the internal organization, to make it more porous. It was necessary to shift from a model focused on internal sources to generate innovative ideas and knowledge, to an advanced blueprint that targeted the internal attention towards external sources. It was a typical matter of corporate governance. The implementation of a new organization and structure required first the firm intention of the leadership, and secondly an adequate fitting with the internal profiles, responsibilities and existing relations among the people on premise (Huston & Sakkab 2007). Endorsement of a senior executive was considered not sufficient; the directed involvement was outlined as fundamental for a successful realization of such a model.

Thanks to this analysis it was clear that there are a number of common links between open Innovation and Design Thinking. The key aspect was that culture of sharing among interdisciplinary teams.

Roger Martin also (2005) underlined how within the development of the new concepts, the understanding user's needs, the brainstorming sessions, the prototyping phase and generally within the broader framework of Design Thinking, cooperation could be exploited as co-creation. The preliminary remarks concern the hyper-value of the diversity of disciplines that would participate in the interdisciplinary teams.

As Open Innovation started within IT world, web-based tools were also considered the right choice to exchange the experiences and the knowledge in order to make the 'openness' more comfortable. These web-base tools also represented a field of investigation and practice for the design activity. Combine the Design Thinking approach and the complex model of Open Innovation were interpreted as a fascinating challenge by Martin himself.

5.1.3 CONCEPT DESIGN

The lexicon 'Concept Design'[27] usually described the earliest stage of product development. Turkka Keinone (2006) linked this practice to those designing tasks that are achieved with no intention of delivering product specifications for manufacturing, mainly in order to introduce the product into market. He meant to focus on the design processes and outputs that were not expected to be immediately implemented as marketable goods, besides with a major further design effort.

On the other side, Cagan and Vogel (2002) focused on 'Product Concepting' as the function that blends a number of product design perspectives, within the framework of integrated product development. According to product development, Product Concepting indicated the first sketching of a product that should be elaborated during the initial stage of product-invention or just before the design specification phase. Thus, 'Concept approval' was meant as the gate between the preliminary stage and the product development in the strict sense of the wording.

Concept design, instead, was assumed to adopting the practices of product design (such as creativity, user-centred design methodology, extensive investigations, image visualization, prototyping), but often providing a broader coverage of the firm's different functions than product design. In fact, embryonic concepts were supposed to be explored thanks to technical and technological studies or to the ambitious shifts of products from radically different fields. These concepts could be expedient to reveal the opportunities of a new technology to discover a new market or to exploit an existing one. Even abstruse concepts could be used to make a cutting-edge knowledge understandable by non-researchers and non-designers, in order to encourage the company's learning and decision-making processes with regard to potential marketable products.

Concepts were often devoted to support the company's strategic decision-making by and attempt to define insights of the future, beyond the conventional structure of R&D and product development activities. Future scenario exploration and technological anticipation could be situated behind new vision concepting.

For this reason, the purpose of Concept Design could be related to:

- the brainstorming, generation and development of completely new classes of products and services

- the elaboration of distinctive product meaning and features

[27] The expressions 'Concept Design', 'Concepting' or 'Product Concepting' all refer to the design activity which intend to create meaningful 'artefacts', with less concern to their development into 'products' (Kokkonen 2004).

With reference to Keinone (2006) Concept Design, which included also preliminary research activities and prototyping, was described as a long-term process, with single projects lasting months or even years, and a great difficulty in setting deadlines.

In order to distinguish some peculiarities among different meaning and practices under the umbrella of Concept Design, four different elaborations were underlined, mainly on the ground of final target:

Concept design for Innovation

Within the environment of product development, creative ideas, inventions and the subsequent process of refining them into innovative products were stated as appreciated, but the certain uncertainty related to them often facilitated a more conventional approach when determining which solution to concentrate on in a product development task. A major investment was considered fundamental to product design and production start-up and relevant financial implications could occur in the case of an unsuccessful solution. An additional developing and testing could minimize the risks of new solutions, but the fixed schedules of product design would seldom allow the long-term broader study of radically new proposals. Moreover, the cause-effect dynamics could be very tough to predict.

In addition, general conditions for generating new concepts through a design process underlined the need not to exploit the initial ideas, trying to dictate their final evaluation. This requirement could be supplied by launching different concepting projects in the same time, with the unique significance of creating only prerequisites for innovation.

Whether R&D and technical experiments could offer the grounds for product opportunities; both insight and design were fundamental first to identify remarkable fields of opportunities, then to implement them into tangible models. Design activity could suggest linkages between the pushing mechanism of technical development and the pulling mechanism of the market, and was depicted as essential for converting inventions into innovations and for combining implicit desires with emerging possibilities. Design was considered key to move away from the too concrete product development to explore new scenarios, and then to move from a remote technology to concrete proposals to exploit it. Concept design was also recommended to sell the innovation.

Concrete proposals, where opportunities and potentialities are clearly articulated, were required as essential by the decision-making process about adopting new platforms, financing additional technical development or entering new markets with brand- new offering.

Direct product improvements could be only one of the valuable ways of making use of the newly generated technical, commercial, user or scenario's ideas. Other possibilities to award them include: idea banks' improvement, directing technology development, launching of strategic cooperation, and intellectual property patenting.

While the improvement of existing products was rejected as a goal of Concept Design, it could represent a desirable consequence of the process.

Concepts could also elaborate the kind of products that would also need new relations of strategic cooperation between different partners in order to be fulfilled. Within the wider framework of cooperation there could be a shared responsibility for technological development, a mutual specification of industry standards for the entire supply chain or the establishment of a distribution network for up-coming markets.

Concepts could be extremely useful to identify the key technologies, consenting them to be patented for a firm's eventual exploitation, or to avoid that competitors could profit by them.

Time was classified as the key asset, with regards to concepting for innovation, to explore ways to exploit concepts. It is necessary to look much further into the future, rather than product design. Time is needed visualise the framework of future products before it is drove through the tightly scheduled process of product design activity.

Concept design for shared vision

The improvement of interdisciplinary and cross-cultural communication within decision-making processes (with reference to both in the global consumer durables and business-to-business marketplace) required a more extensive and demanding discussions in order to undertake the desirable shared understanding. Concept Design used work with visual supports, such as simulations, sketches, photographs, videos, schemes, stories and prototypes to transform generated potentialities and abstract solutions, into tangible form. This was considered the most suitable way to share foundation for understanding.

These physical tools would be fundamental for concepting to provide a wider overview of the forthcoming future. Images and other visual media could understandable principles, according to the different players involved. The so-created map could be also used to forecast the placement of hypothetical products (which integrate the on-development technologies) in the future, figuring out correspondent hypothetical customers. The concepts act as broker between technologies and potential products and markets, they have to illustrate the upcoming idea and products an the net of relation within the upcoming environment. This kind map would be readable and easy understandable by the different recipients. An additional value consisted in giving each concept a remarkable name strictly linked to its meaning, in order to create a common vocabulary within the network.

On the ground of the physicality of the concepts, potential products could be examined in the same way as the already existing products. It would be intuitive to evaluate their features and their perception.

In a suitable scenario, concepts could perform as closer archetypes for future products.

Concept Design for knowledge

Concept design provided alternative solutions to envision the future. Preliminary researches could be connected to company's internal knowledge, as well as to expertise from outside, and linked to concepting products. The access to external knowledge could be extremely critical.

The acquisition of knowledge could be even considered crucial, and sometimes it could be pointed out as an essential secondary objective. A product design company, which meant to maintain its innovation potential, had to concentrate on learning processes.

There are two level for a company's learning process: the individual and the organizational (Lawson 1990). On of the main creative skills of Concept Design laid in the ability to envision future products in a new environment (organizational level), as well as to visualize the new roles and profiles (Individual level).

This passage between existing products and concepts for the future, and between new system and new roles was realized as a particular asset for an innovative company. This incessant change of perspective could be appreciated as the capability to move from designing features for products to defining new design challenges, adapting to them, developing ideas not supported by market analysis or specific users' needs.

Another specific characteristic of a Concept Design process was identified in the authorization to fail (Moggridge 1999).

No perfection was required in the development of new concepts and new expertise. Daring experiments were particularly welcomed, and it was perceived as acceptable that outcomes could be failures. In this phase, mistakes could represent a great opportunity for the learning process; an internal 'incompetence' could push to search for certain skills outside the company, which helped in the development of new partnerships, either outside the design department, the company or even the industrial sector. Different entities (public and private, research-related or business-related, at every stage of the supply chain) could be interested in studying the same technology or the same emerging scenario. Partnership could even consist only in sharing and matching views. Furthermore it should be easier to arrange contacts and to create connections for Concept Design tasks where the freedom could be relatively higher. Also the time accorded to Concept Design would be consistent to develop this kind of collaboration, in order to set the expectations, to nurture an idea, to listen to mutual opinions, and contemporarily to build a shared vocabulary (necessary to share the opinion pertinent to the project).

Concept design for expectation management

When an innovative product is launched on the market, it could changes users' thinking about what they need. Consumers' new needs often arose when new products, with new meaning and new functionality came to the market. Breakthrough products could obtain two timing of success: one is immediate, when products are quickly understood, unlike the most common one, when consumers familiarize with new products, after they were firstly accepted and adopted by an 'elite circle'. The perception of desire and need of breakthrough products could be influenced both by trendsetters who showed explicitly the use, and by digital or printing media that describe them.

Furthermore, before a definite products had launched on the market, the company could invite consumers to 'taste' the new ideas behind them. Thanks to a strategic communication

plan, innovative companies could drive the expectation of the consumers, also through concept products. They are not still ready products, but they could preview some features or totally a new scenario. This choice could be particularly relevant for radically new products. In this way consumers would be prepare largely in advance compared to the effective marketing.

This kind of conceptual products could impress also brand identity and reputation. Innovative concepts helped the whole company to be recognized as innovative. If the Concept Design project were collective ad adequate presentation of a new Concept could improve the interest in the entire product system. A new concept could suggest all the different technologies, which constitute it, and could attract suppliers for supplemented technologies and other facilities.

Concept Design projects often involve a number of different partners who shared different expertise, such as industries, universities and other research institutions. This concepting work should be visible in order to enlighten the different outputs of each player and to show the business opportunities, those related to the concepts and those related to the competences developed working around them. Concepts could change the expectation of both the consumers and suppliers/partners.

Concept products could be meant as instruments that could transform consumers and peers' behaviour and attitude towards innovation and innovation practice.

5.1.4 STRATEGIC DESIGN

"Strategic Design is a design activity that concerns the product-system - i.e. the integrated body of products, services and communication strategies that either an actor or a network of actors (companies, institutions, non-profit organizations, etc.) generate and develop to achieve a set of specific strategic results - .

It is often claimed that technological innovation, cultural and economical globalization, and the transition to environmental sustainability generate problems and opportunities.

It is also repeatedly stated that the possibility to avoid the former and to exploit the latter requires the development of three core skills by companies and other types of institutions and/or social actors: vision, sensitivity towards signs of innovation, and the ability to create solutions. It calls for the ability to design products and services whose success today anticipates what will be, or may have to be, the norm of tomorrow.

The social demand for a new generation of products and services, coherent with current socio-cultural transformations, and their sustainable development becomes an opportunity for

companies able to operate in the context of this new design mentality. This unique meeting of design and company strategy: strategic design." (MDS presentation[28], 2011)

Looking at the Manifesto of the Master in Business Design from Domus Academy[29], the perspective was only slightly different: "In Design driven firms, managers must be able to combine managerial skills, creativity and entrepreneurial spirit, within a perspective able to embrace at the same time design and production, tradition and innovation, reality and vision, everyday life and future. The modern manager is a figure that gets trained and thrives in a border area where designers, managers and entrepreneurs, experts in enterprise and corporate organizations, in information technology, communication, marketing, contribute to the creation of new operative codes and a new strategic language for the companies and the market.

The core idea that the project is the hinge and the guide of the enterprise and it aims at bringing quality within the territories of product, services and social enterprises."

From a historical perspective (Zurlo, 1999), the original emphasis on the company as the main subject of the strategic design culture was over: it has became increasingly evident that the Strategic Design approach was firstly accepted and then needed by a broader range of social organizations and corporations, from companies to consultancy firms, from institutions to governments, from local administrations to cultural associations. In a turbulent and uncertain context, it seemed valuable to deal with design decisions (Meroni 2008).

Basically, strategic design was born to deliver to social and business entities a system of conditions, beliefs, values and methods to face the external environment, in order either to innovate, survive, develop and nurture one's own identity and to influence and transform the environment too (Landry 2000).

Ezio Manzini assumed that Strategic design was all about PSS Product Service Systems (Meroni 2008). A PSS was described as a mix of products, services, communication and people. The strategic design of Product Service Systems shifted the focus of innovation from product or service design to an integrated product-service design strategy, orientated to invent sustainable solutions. Products and services were always linked together, but this connection was mainly transient and casual, leaving many responsibilities to the individual initiative of who sells or purchases the product.

The novelty of PSS approach was that, at certain point, this connection was conceived and designed from the very beginning, according to a strategy of optimisation and integration. To sum up, this change fitted under the general concept of 'complexity', which, for contemporary firms, already meant 'segmentation, just in time, personalisation, unpredictability,

[28] Manifesto and full program of the Master in Strategic Design at Politecnico di Milano are available on the website: http://www.polidesign.net/mds/

[29] Manifesto and full program of the Master in Business Design at Domus Academy of Milano are available on the website: http://www.domusacademy.com/site/home/master-programs/business-design/intro.html

globalization and demand turbulence'. These issues called for strategies every blueprint, which involved the whole organization (Zurlo, 1999).

The service aspect started to overcome the product dimension in the majority of offers (Sangiorgi, 2004) added value was increasingly related and generated by intangible facility elements. This aspect was due to three key points:

- The increase in demand for customised solutions;

- The development of the 'dematerialized' ICT industry;

- Increased specialisation in companies. Manufacturing was outsourced in low-wage countries, while the core business was kept into the original company. The number of new service companies exploded.

The growing need of this service asset certainly required an adequate service-design attitude; moreover, this urgency of service design asked for a strategy, in order to develop a set of services, which is consistent with both the company identity and the whole offer of the company, where the services were coordinated to each other and drove the company towards a change in decision making (Manzini and Meroni, 2007).

The company identity, recognition and reputation were currently considered provided by the product service system. The PSS was seen as the most relevant strategy to differentiate a company's offer to another one. It would work both in the consumers market and in the social environment, thanks to the strong linkages among products, services and interactive communication. In this scenario 'social innovation' was born, starting from the deep observation of emergent consumers' attitudes and behaviours. This meaning of innovation oriented the PSS strategies to evolve towards this social focus.

Green (2008) sustained that the value of company lied in the values coming from a product-service-system strategy, which could impact on its essential dynamics, production processes, history and service dimension. This meant that product service system influenced the process and the brand experience as well as the final result.

A special weight was recognized to the social, ethical and communal questions and needs, unlike to individual perspectives. It was this social perspective that leaded PSS to move in a direction that made these values concrete, and Strategic Design to concentrate on values (Daly & Cobb 1989).

A key issue was to understand if every PSS process could be aligned to a strategic design activity.

A preliminary discussion stated that product-service-system activities should be considered by definition as strategic design practices (Zurlo 2004).

At the end, the debate came to a distinguished description of the two. A strategic design project could always include some PSS activities; on the other side, a PSS project could not

automatically involve a strategic design project. The main element of distinction concerned the innovation content of the project: it could be defined as a strategic design activity whether provided a breakthrough that promoted a relevant evolution into the context and system. Strategic Design was stated to be unequivocally associated to radical innovations.

The strategic design used PSS methods, taking inspiration from strategic management, but without the meaning of schematic program (Purser & Montouri 1999). It was defined as a set of consecutive actions led by the analysis of scenarios, which should be chosen and implemented responding time-by-time to the feedbacks coming from the environment.

Within the Italian scientific community, strategic design was firstly described as the approach which aimed to interpret emerging issues, when situations are open and wicked, uncertain objectives, trial processes, shared knowledge, which gradually occurred, thanks to relations and exchanges with suppliers and partners (Zurlo 1999). The major output of the research was that the behaviour of the stakeholders could be driven by the general understanding that interests of the community could be strategic also to favouring single interests, even if the will just to win overstayed. Thus, every strategic decision would be the effect of a proper interface with the context, its players, constraints and potentialities. This kind of strategy could also bring to win-win resolutions among the individual actors and the collective society:

1. Strategic design regarded primarily problem setting, rather than merely problem solving. The main role was principally to open all the possible issues before attempting to figure out possible solutions. The delineation of the field of investigation was recognized as crucial. This important phase was related to assess the available opportunities, and then to understand how to use them. A fundamental role was the one of strategic designer, who was asked to detect what would be available. It is the strategic designer himself who was in charge of articulating the essential brief; the attempt of the strategic designer was to explore all the data. This stage couldn't be considered as a neutral action: a strategic designer had to go upstream, to develop the so called counter-brief, which represented the method to restructure the mission provided by the company/institution. The leading medium to accomplish this task and arrive to a solution would be mapping scenarios where all the opportunities were envisioned (Zurlo, 1999).

2. Social innovation was stated as the main content of strategic design projects. Starting with the concern about collective values, the principal effects of the innovations resulting from a strategic design approach should work within the socio-cultural sphere; the social innovation should transform either consumers' behaviour in order to achieve individual results and the organisational structures. Innovations led by behavioural changes typically arose from bottom-up processes, more than from top-down practices, represented a crucial focus for the contemporary designers. Furthermore, social innovation could be also be leverage for technological innovation, according with sustainability's issues. The turning point would be the identification of positive situations within common society and a deep investigation of they could work, in order to be inspired by them and develop consistent competences in designing future scenarios. Positive emerging situations and changes would be examples of sustainable future innovations that strategic design can promote and recommend. The first task should be

to analyse them and determine the claim for products, services and solutions that these scenarios made explicit. Thus it would be feasible to outline the research direction that could drive the improvement of efficiency and affordability.

Creating scenarios was considered one of the main concerns of strategic design. Wicked problems were acknowledged as chaotic situations, which were seen as a valuable ground for innovation. In this chaos it would be fundamental to headlight a powerful emerging idea and to assess its potential evolution, no matter how many people were involved. The key capability would be to make it feasible and appealing, in order to shape the future environment in a different way. Even a minor fortuitous phenomenon emerging from chaos within the context of contemporary society could generate a break and become the lead of the system's evolution both in the same or in a different selected environment. Little facts could create successful and growing opportunities, if used to develop a dynamic stability between one class of products and services and its environment (Bateson 1979, Meroni 2004).

According with the thought of a vision, which arose also from minor promising situations, strategic design could be interpreted as a gamble on the future and a hypothetical proposal of reforming the same future. Unlike a simple bet, this vision should be based on reliable competences and experiences and settled into a structured project, describing also constraints and conditions to realize it.

Forecasting the future would be impossible, but it could be possible to outline in the present environment a number of premises, which would found the future. The effort of envisioning the future was seen as the determination of searching and giving consistency to the most favourable signals of the present, and identifying the features of that potential environment.

The instruments provided to strategic designers to make the visions into tangible hypothesis were concerned with the creation of scenarios, which were images, which transform basic data and intuitions into perceivable and sharable knowledge. Scenarios are the essential media for strategic discourses, brokering different players' views, sharing some possible understanding of the present environment and its future evolution, and helping decision-making process.

With reference to Bateson (1979), Ogilvy assumed that it would be valuable to follow the 'scenario framework model', a conceptual medium developed from the mishmash of critical ambiguities, which usually results in a set of scenarios in a 'two-by-two' framework, in order to structure the way of creating and communicating the stories around the future. Scenarios resulting from this design activity should be conceptual but tangible artefacts that were capable, in parallel with adaptive systems to familiarize with the ever-changing environment. Adaptive systems were described as ready accessible and interactive organizations, confident in learning from normal events and finding inner resources to organise or re-organise themselves, thanks to expertise learned before. The adaptation attitude was the condition recognized successful for the evolution.

3. Strategic design was also about co-designing. A strategic design process should be shareable and participative, in order to take advantage from social creativity and to build scenarios that

can change according to fluctuating environments, and be skilfully managed by the different social players, both companies and public entities. It required a methodical participation of the different players in a collaborative way, no matter if they were suppliers, clients, end-users, peers or other professionals. Basically, Strategic Design was conceived as a process to facilitate a wide range of disciplines and players to collaborate with each other: partnership wouldn't be a plus, but a fundamental characteristic, consisting of several different participants integrated thanks to a similar strategy (Manzini et al., 2004).

The foundation of a co-designing methodology would be that a direct participation of those involved onto an issue could generate and implement the solutions. A participative approach would be both a need and a chance for gaining problem solving capability from the others' experience. Designers were not supposed to be the only creative people

Strategic design meant to understand how to take advantage experience and expertise coming from different players, developing a sense of interest, commencement, and social prosperity. Von Hippel (2005) spoke about the concept of 'democratisation of innovation', referring to the growing users' attitude to innovate products and services by themselves. Moreover, involvement in a participative design activity could carry out personal satisfaction and a sense community: the social efficiency of the system spread whether also en-users communicate what they have created to other players. Strategic design could contribute in this economy of reciprocity. Within the present scenario, a new model was growing: products and services lost the highest value, unlike the support provided by a company in order to help users to give the desirable direction to their lives and to surf the current complexity.

4. Strategic design has always been about strategic conversation and training competences. The strategic conversation referred to the psychological technique of stimulating radical changes in the patient during therapy. Strategic conversation was moved to the field of strategic design, keeping the constant factor of pondering the whole project, from problem setting to problem solving.

Counter-briefing, sharing perspectives and visions, and co-designing belonged to the matter of strategic dialogue (Meroni 2007).

5.1.5 DESIGN DRIVEN INNOVATION

'Design driven innovation' management model was theorized by Roberto Verganti (2008, 2009), starting with the etymological essence of the word design, which meant 'making sense of things'. And DDI was stated as a R&D process for inventing meanings. This meta-model was developed ex-ante a series of scholar projects and consulting assignments, focused on understanding the role of design thinking in launching products and services that communicate a radical new reason for consumers to accept them. DDI was presented as a suitable strategy for the companies that want to step back from users existing needs and assume a wider perspective.

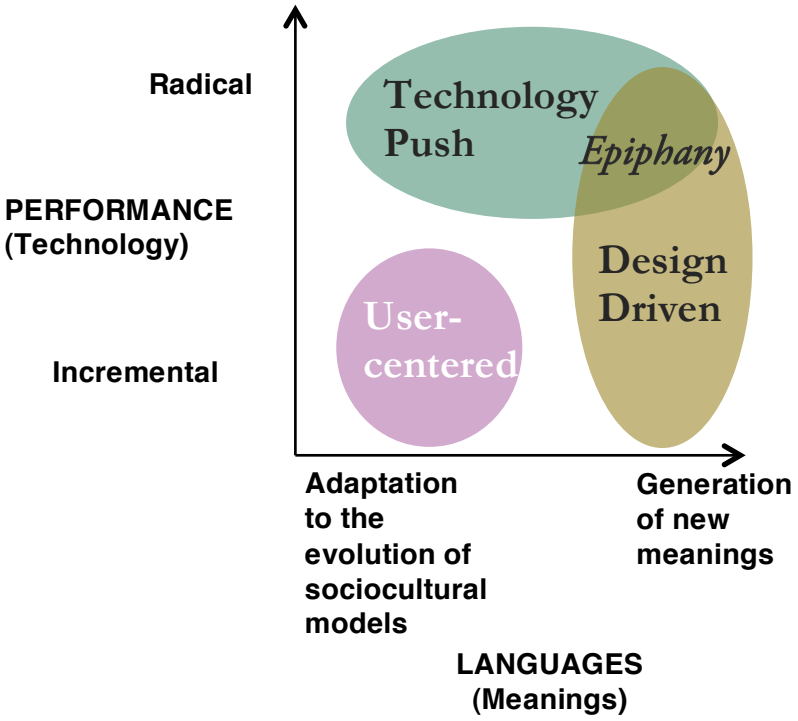

Figure 11 Design Driven Innovation: 'Epiphany'. Adaptation from the scheme proposed by Verganti (2009)

Verganti stated that DDI was almost unexplored because companies, which were successful at DDI, were not accessible to researchers who try to investigate their process. Their innovation models were based on 'elite circles', which accepted new external players only if they brought appealing knowledge and expertise. The innovation processes of these companies were generally tacit and invisible. No methods, tools, or schemes were structured. The main element was represented by networks of uncodified connections among various actors of innovation and directly headed by top executives.

Investigations of users' needs and a user-cantered market-pull strategy could produce only incremental changes, and contemporary also a technology-push approach, through breakthrough technologies, could create only incremental adjustments. On the contrary, radical innovation of meaning, defined as an outcome of DDI, would be generated when technology-push meet with design-driven meaning.

A number of companies developed a different approach from the ones presented above to leverage on design. It was an approach not fitting with the user-cantered model, which could be considered orthogonal to it. Thus, DDI couldn't come from an exploration of user's insights. DDI was stated as led by a company's vision about potential breakthrough meanings and languages that could develop in the future. It rejected formal roles and common user-centred methods such as ethnographic research (Verganti 2008).

With reference to the suggestion coming from Dosi (1982), every innovation implied an integrated understanding of both technologies and markets and, whether changes in technological paradigms, such as radical technological innovations, were mainly technology push, incremental innovations within existing technological paradigms were principally market pull.

The starting point of the DDI theoretical framework laid in the adaptation of theories concerning on technology management.

Verganti firstly took in consideration the 'Made in Italy' manufacturing world, recognizing how the companies belonging to this category were immersed into a network of players who explore emerging and future meanings. The same players, called 'interpreters' could also influence, simply with their actions, the development of new cultural models. All these players shared the same need of understanding the evolution of socio-cultural models, and the same will of providing new visions and meanings. These players used to be interested in exploring and evaluating possible future scenarios.

Different processes, approaches and tools were implemented to research into these scenarios, in order to create a consistent knowledge regarding future socio-cultural models. Their outputs, which embraced products, concepts, reports, artworks, exhibitions, etc., contributed to stimulate what consumers and end-users would think and appreciate in their own lives. These interpreters always tried to envision evolution of present scenarios into future scenarios, in special networks in order to share visions, to exchange information on long-distance trends and eventually to check the strength of their suppositions.

These special networks were comprised in the definition of 'design discourse', with concern to a collective research process on meanings and design languages. The term discourse referred to the continuous dialogue running on socio-cultural models, either foreseen or desirable, and on potential implications on forms of consumption and product languages. This discourse could occur through a number of explicit and tacit connections among several player operating both in the global and local chain. Interpreters, belonging to the design discourse, could include companies in other industries, artists, media, cultural institutions, designers, universities and research centres, and sometimes lead users.

The crucial aptitude in DDI was accessing and sharing knowledge within the design discourse. This process consisted in identifying among the others the key interpreters, in attracting them and building with them a favoured relationship. When the discourse was established, the purpose would be to share and integrate knowledge to invent unique concepts, and also to leverage on the design discourse to communicate the pattern towards innovation with end-users. Design was fully meant in its research expression: a knowledge-based investigation of new languages and meanings. There were not specific tools or methods to push the creativity.

Cohen and Levintal (1990) introduced the concept of 'absorptive capacity', which was meant as the capability of an organization to estimate external knowledge, to make sense of it, to learn about it, and to embrace new approaches coming from it. Integration and exploitation of

external expertise could be valuable and effective whether the organization had already experience in combining internal and external knowledge.

This kind of processes grounded on the interactions with the design discourse was documented by few studies on or from Italian manufacturers, in the field of furniture and households (Zurlo et al. 2002, Mendini 2003). This category of research should start even before the concepting, when companies decided to predict the changing dynamics of socio-cultural models and search for new languages. This process was not far from a typical process of scientific or technological research, untargeted to the assessment of new technical opportunities. This one could be considered similar to a technological knowledge-based process, which look at innovation as a process of invention, integration and preservation of knowledge (Iansiti 1997).

The process could be comparable, and also required the exploration of new technologies and material, but the purpose was different; the exploration concerned mainly the new languages mediated by artefacts.

With reference to Verganti (2008), DDI could be considered as a expression of a 're-constructionist' view of the market (Kim & Mauborgne 2005) or a 'social-constructionist' perspective (Prahalad & Ramaswamy, 2000), where the concept of market was not taken for granted, but was the consequence of a positive interaction between consumers and companies. This interaction could imply the cocreation of the needs either with a utilitarian, symbolic or emotional meaning. DDI should entail a radical modification of the market.

The ability and the competences to leverage on design discourse couldn't be an activity with immediate outcomes. The effectiveness of this process would be extremely time consuming; the long and virtuous circle necessary to invent innovative scenarios, meanings, and languages should require the development of absorptive capacities, the creation of strong connections within the design discourse, and the retention of these relations.

5.2 PROBLEMATIC ISSUES: FROM PRACTICES TO THEORY , TO PRACTICE

Most of the theories correlating innovation and design are based on the idea of theorizing recurrent aspects found in selected case-study investigations. They could be all bring back to the principles related to 'Best-practice theory', firstly formulated in the field of Human Resources, where Pfeffer set the renown '7 practices' model (Pfeffer, 1994).

Best practices were usually excellent behaviours demonstrated into successful processes. Abstractly, best practices were always ethical, fair, sustainable, replicable, and appropriate to be adopted by any other similar organizations. They embraced programs, policies, practices that have worked in the particular, chosen case studies, in according with standards of effectiveness, feasibility, and pertinence to the situation.

The main and simple criticism on this kind of research concerned the replicability of the model theorized from a small number of practices; even if they were consistent and substantial, it wouldn't mean that it will work on others, only because that practice had been successful for the leader organization. Armstrong (2006) challenged the assumption that there could be a recommended practice that would demonstrated to be the best in all cases. Instead, he provided an alternative view, called as 'contextual practice', in which the concept of what were the best would change in relation with the context.

He outlined three key critical issues for shifting a practice from one company to another:

- Disconnection from organization's objectives and environment;

- Unconcern with national cultural differences within management practices;

- Contradiction between inimitability and best-practice universalism.

The biggest problem of all these theories remained the fact that they were developed starting from the exclusive analysis of high-performing cases. Either they were successful or failures, they were the fundaments for rigorous models drawn as a program of consequential steps, tools, competences, roles, but which were unfortunately not repeated and rarely replicated in new successful ones.

Instead of the concept of 'best practice', these strategies were largely interpreted thanks to the assessment of the models conceptualized with the term of 'promising practices' (Leseure et al. 2004), which acknowledged that solutions from one organization might not directly be transferred to another one. Promising practices were those actions, programs, or strategies that had profitably worked within one organization and showed, even during their early stages, the energy for becoming similar to the concept of 'best practice', with long-term consistent and sustainable impact.

A promising practice should certainly have some objective basis for claiming effectiveness and a potential for replication among other organizations.

Nevertheless, all the models presented couldn't be fully and consecutively replied. Not all the steps, tools, competences and roles outlined in these high-performing circumstances could be considered either sufficient or fundamental to generate innovation. The successful cases of breakthrough innovation should always be considered for their exceptional occurrence.

6 DESIGN DRIVEN INNOVATION AND TEXTILE INDUSTRY: A PARADIGM FOR THE ACTION RESEARCH

6.1 PHENOMENOLOGY OF THE RELATION BETWEEN DESIGN DRIVEN INNOVATION AND TEXTILE INDUSTRY

Among the different strategies and practices discussed above, the research was led towards the 'Design driven Innovation' meta-model, as proposed by Verganti (2009). According to the critics regarding the reproduction of a successful from one organization to another one, it was necessary a preliminary understanding whether it would be possible to promote this approach to push inventive Innovation within the textile industrial sector.

The first assumption was related to the impossibility to schedule this kind of inventive process as a production scheme. If scientists typically operate in 'white room' conditions, carefully forming abstract characterizations of the phenomena under consideration, and studying them in a controlled research environment as a sterile laboratory, this is not the situation of designers. Moreover it would be purely haughty to claim to reproduce the dawn of innovation through a scheme.

'When researchers well versed in experimental methods attempt to study practices, they discover that the very nature of a practical discipline throws in so many idiosyncratic variables that rigor is simply not possible' (Norman 2011). The real world is multifaceted and messy, dominated with uncontrolled variables: executives and designers who want to draw complex strategies have to be aware of it.

Furthermore, the main goal of the adoption of a DDI approach never meant to demonstrate that the model could be itself adequate for the textile industry. Even considering that there were no cases of previous implementation of this model into the textile industry.

The objectives of the proposed framework were the following:

- Understand if a structured design practice, and particularly a controlled design-driven research activity, could generate a greater interest in order to develop radical innovation throughout textile materials.

- Highlight some evidence of validity of the strategy in elected case studies.

- Evaluate the potential capabilities of design and designer in bridging management, R&D and external stakeholders.

The first step was the definition of the textile industry, through a proper classification of the textile companies operating in this manufacturing area. The goal concerned the necessity to have a preliminary understanding of the field of investigation.

According to the literature review on the topic (De Michelis, 2006 e 2011; Verganti, 2009) the intention was to draw the key recurrent factors recognized as fundamental to generate breakthrough products thanks to a DDI approach, in order to organize a relevant map. The consequent step concerned in orienteering the map, matching the winning factors with the existing clusters.

This oriented map was necessary to highlight the demands of the DDI paradigm compared to the field of invention and innovation of textile materials.

The third step consisted in the overlapping of this map with the Italian textile scenario, in order to set the criteria to choose potential business partners and recognize those companies, which could be eligible to be involved in the research.

6.1.1 TEXTILE COMPANIES CLUSTERS

The general filter to a first rough classification of the companies was based on the recommendation of the European Commission, according to the number of employees and the annual revenue[30].

These data are extremely general and didn't mean anything themselves, but the dimension of the company and its number of employees was considered crucial for the DDI model. So, even if these parameters were intentionally meant as general, they represented the objective of starting from a sharable assumption. Therefore it was fundamental to explode this rigid categorization in order to draw a map that could give some more information about the different clusters.

Enterprise category	Headcount	Turnover
Large	< 1000	≤ € 250 million
Medium-sized	< 250	≤ € 50 million
Small	< 50	≤ € 10 million
Micro	< 10	≤ € 2 million

[30] Every country has different parameters to classify enterprises. This taxonomy is the one shared within the European Community. See the website: http://ec.europa.eu/enterprise/policies/sme/facts-figures-analysis/sme-definition/index_en.htm

Figure 12 Classification of companies per Revenues and Workforce

6.1.2 *DESIGN DRIVEN INNOVATION FACTORS*

According, with the already mentioned best practices of DDI, it was possible to review some recurrent key capabilities:

- Internal resources. The company is committed to knowledge, technological innovation, R&D, concept design. The brand identity is well recognized as appealing. Top management and executives are provided by and exceptional charisma.

- External resources. The company is the leading interpreter of the Design Discourse in which it is immersed, referring both to the technological world and to socio-cultural sphere. It used to share knowledge and expertise with external partners. Its charisma permits the converging of visionary professionals to new meanings' explorations.

- Interpretation asset. The company works with cultural mediator who acts a broker, integrating the suggestions coming from external resources with the internal knowledge in one accurate scenario, one concept, one product/product family.

6.1.3 *THE MAP*

This map was the output of the analysis of the main requirements of Design Driven Innovation throughout the literature review on the theme, matched with the general classification of the companies into clusters based on the annual revenues and workforce. Thanks to that investigation, it was possible to understand that there was a linkage between the dimension of the companies and their capabilities to combine design driven research and innovation management.

	Micro	Small	Medium	Large
360° production			★	★★
Converter	★★	★★	★	
Niche	★	★★	★★	★
Global		★	★★	★★
Love-mark			★★	★★

Contact with the top management	★★	★★	★	★
Internal R&D			★	★★
Budget			★	★★
Network	★★	★★	★★	★
Various portfolio		★	★★	★★

Figure 13 Necessary requirements for a Design Driven Innovation process matched with companies' dimensions: '★' medium presence of the criterion, '★★' for high presence of the criterion.

6.2 DEVELOPMENT OF THE CASE STUDY

The first selection of eligible companies for the case study was made thanks to the quantitative cross-analysis of the following data: turnover, number of employees, exports, etc. (thanks to the Report of SMI-ATI published in 2009 for the Italian Ministry of Labour) and with the profile of the leading companies per sector (Biella district, Como district, Prato district and the Cotton/Sport cross-regional district), according to the production data in the Pambianco Report of 2008.

12 top-performer companies were outlined. Through the preliminary contacts with them, it was possible to assess the existence of the key factors necessary to develop a design-oriented strategy. The crucial elements were: the chance to interact directly with someone from the top management and the disposition to proactively collaborate with external partners. According to these criteria only three companies were selected, which were referred as company 'Alfa', company 'Beta' and company 'Gamma'[31] (the last one it is not a textile manufacturing company, but an apparel manufacturer, but thanks to its focus on the exploitation of textile materials, it was included in the case study).

The executives from these three firms were interviewed in order to deeply analyse the ordinary inventive process within the company, so how the company used to develop new concepts and create new products. This stage was fundamental to understand:

- which kind of creative process was engaged by the enterprise;

- whether the design was already an explicit tool/strategy;

- which was the hierarchical structure of the product development (PD);

[31] The full profile of the three company is accessible in the Appendix A

- who was in charge of the key choices regarding innovation, concepting and product development.

These interviews, highlighted the following aspects:

	Creative process	Explicit design	PD structure	Decision Making
Company Alfa	New Ideas come from business clients, through the sales department.	No.	Collections with a wide range of products. Energy and time consuming. No innovation strategy	Sales department
Company Beta	New ideas developed with special partners: suppliers, clients and research centres	Design consultant (Surface features and colours)	R&D and PD are joint in one department. Shared strategy.	Management
Company Gamma	New ideas provided to suppliers to test the feasibility and provide efficient materials	Structured Design Office	Tested materials are directly implemented in the apparel collection. No time waste	Chief Designer (also president of the company)

Figure 14 Description of the ordinary inventive processes within the companies involved in the Case Study

Both company 'Alfa' and company 'Beta' (the two textile companies) were recognized as eligible for a further development of the process, but only executives from company 'Beta' demonstrated to be really interested in testing new paradigms to concepting new products for the cashmere yarns and knitted fabrics Division.

According with the internal management, the two most fascinating levers of the company were outlined: the integrated supply chain (from the sheep farming to the retail of the apparel collections) and the love-marked brand.

Before structuring the strategy to implement design along company's procedures, it was recognized as fundamental by the general manager of the yarns & knitted fabrics Division to experience the existing product development process and to set a partnership also with some external partners as the deying & finishing company.

The involvement consisted in a part-time participation in the ordinary life of the company, in the form of internship, with effective collaborations within different departments. It had three main goals and lasted three months:

- Foster the trust with the main potential players of the process: the internal resources of the enterprises, the general manager, the technical manager for research and development, and the sales manager.

- Get in contact with the existing stakeholders of the company: spinning companies, dyeing, printing, finishing and other professional usually involved in the creative stage of product development.

- Acquire specific knowledge and expertise regarding creative and productive processes, technical issues about yarns and jersey, and the existing or emerging products.

The internship was extremely operative. The three targets were fully accomplished. Both the general manager and the executives agreed that a design-driven structured approach could be useful, interesting and therefore effective for the company, in order to explore new meanings, original scenario and innovative concepts (and not only ready-products). Moreover the management was acknowledged for the supportive attitude, experimenting and suggesting new ways to invent and innovate.

The following step concerned the elaboration of an operative program. The company was provided by an exhaustive road-map.

In the Figure below it is shown the scheme of the proposed process, which was elaborated starting from an adaption of the DDI model drawn by Verganti, following the pattern indicated by the company 'Alessi'[32].

[32] Alessi is a kitchen utensil company from Italy. It was founded in 1921 to produce crafted products in metal for eating and drinking, by Giovanni Alessi. By the 1980s, Alberto Alessi took over the management of Alessi (which he still does today) and launched the Alessi company into the design decade through collaborations with designers and architects. Talking about the company's design practice, Alberto Alessi said: 'Our true nature comes closer to a "Research Lab in the Applied Arts" than to an industry in the traditional sense of the term. Research Lab in the Applied Arts, the role of which is to mediate continually between the most advanced and stimulating expressions of international creative culture on the one hand, and the public's requirements and dreams on the other. A lab that should be as open and dedicated to the world of Creation as possible. The right type of contribution that an industry such as Alessi can make to the civilised development of the consumer society is to be an artistic mediator, attempting to create new objects, introducing a touch of transcendency, helping us decipher our own modernity'. Quotation from www.alessi.com

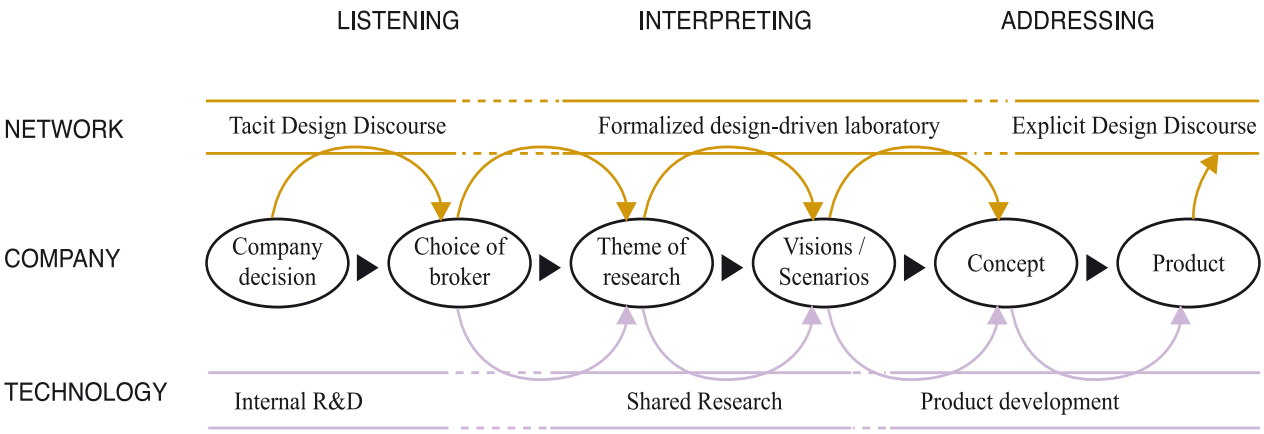

Figure 15 Elaboration of the Scheme of DDI (Verganti 2009)

6.3 Map of the Design Discourse

'Every company is surrounded by several agents who could share its interests. Some of them are looking at the same people in the same life context. And consistent ones are conducting research on how those people could give meaning to things. They all could be the interpreters of the Design Discourse' (Verganti 2009).

The literature review outlined a number of basic characteristics of the system called as Design Discourse, which was firstly described for its relations within 'elite circles' (Kadushin 1976).

- it is a networked research process;

- it spans widely outside the boundaries of the firm, including several interpreters of the same scenario, and, only in few cases and with specific objectives, end-users;

- it is based on a sharing attitude regarding expertise, knowledge and technology (prevailing with concern to socio-cultural models, meanings and product languages);

- it also includes an action of influencing and modifying (through the interpreters themselves as trend maker thanks to their influencing and seductive power) the socio-cultural regime.

Interpreters could be seen as symbolic creators (Hesmondhalgh, 2002), or cultural intermediaries (Hirsch, 1972).

The key issue for firms pursuing DDI is accessing and internalizing knowledge in the design discourse. This is a collective and networked research process on meanings and design languages that takes places outside the boundaries of the firm. How companies may develop strategies and routines to effectively interact with the design discourse?

The so called Interpreters could belong both to the technological world (research centres, technology advisors, manufacturers in other areas, design agencies, retailers, trade-shows etc.) and to socio-cultural sphere (academy, artists, cultural associations, sociologists, anthropologists, marketers, media, etc.).

Quoting Alberto Alessi, 'In the '80s and in the '90s myself, Gandini of Flos, Castelli of Kartell, Zanotta of Zanotta, Longhi of Elam, Astori of Driade, Cappellini of Cappellini, and some other guys used to meet periodically to share possible evolutions of the design world, to organize joint exhibitions, to develop specialized magazines. We were 'the group of nine' (Verganti 2007).

Companies that produce design-driven innovations highly value their interactions with these actors. With them they exchange information on scenarios, test the robustness of their assumptions, and discuss their own visions.

The fact is that once the company has defined the possible products' ranges, general competences and roles, it is fundamental to carefully identify the exact firms, associations, institutions and professionals. It's highly dispersing and quite unreasonable to involve all the possible stakeholders in this kind of research on a specific scenario.

The formalization of the Design Driven Laboratory always consists in cultivating privileged relationships among individuals, even if they represent a big company or a research centre, or just themselves as free-thinkers.

Even before the beginning of the internship, some connections were opened with valuable professionals all around the company: potentially interesting to acquire more technical expertise or wider knowledge, and relevant for the company to be involved into the research.

Amongst the so-called socio-cultural sphere were inquired: an IT professor keen in the interaction between Made in Italy enterprises and innovation, a philosopher working on education along the textile industry, an anthropologist devoted to fashion studies and textile, a professional trends analyst, an Arts journalist, 10 talented artists suggested by the Arts journalist, the person in charge of the most important textile archive in Italy.

For what regards the technological world, a number of professionals were interviewed: two textile research centres, the technical textile Association, a material engineer keen in nanotechnologies for textiles, a technology-transfer manager, a senior consultant of a consultancy firm devoted to textile and apparel market, the R&D manager of a multinational group developing sensors also for the textile industry, the technology advisor for a *business angel* venture capital.

A firm, which intends to promote DDIs, is aware that there is not just one network right for similar textile companies, nor just one network for all its Design Discourses.

Different possibilities of collaboration were explored in order to provide to the company a first sketch of the potential partners and a plain detailed proposal.

6.3.1 *BROKER: PROFILE AND SKILLS*

The top management is always recognized as the first responsible in charge to decide if design practice and design-driven processes are and could be core elements within the innovation-centred strategy of the company.

In the DDI strategy the firm is always the promoter and centre of the design discourse. In the case of a textile company, in particular for what regards Italian traditional manufacturers, there are not the right internal competences and profiles to manage a similar process. R&D units hold highly technological knowledge and competences, while Sales departments manage market ones. Very often the launching of new products is in charge of the management (frequently in Italian SMEs the management is also family run), which collects external inputs and requires to R&D unit specific researches through empirical tests.

Thus, in the case of first settlement of a design-driven approach, or in general for medium enterprises lacking the internal resources, companies need a support in the exploration of the Design Discourse, in detecting the key actors, in interpreting and integrating technological suggestions and socio-cultural scenarios, in the creation of product meanings acting on the semantic dimension of a product.

The interpretation matter as a problematic issue was studied by Hannerz (1992), who assumed that the understanding between different interpreters could be controlled through cultural translators that he called 'cultural brokers'. The incursion of external influences within an organization always existed, even through different means, filters and applications. The global flows offered a wider range of cultural phenomena and technologies that were explored from numerous perspectives, and internal players often performed innovative practices inscribed in the expression of 'cultural brokerage'. Hannerz anticipated that designers, performing this negotiator activity, could be potential 'cultural brokers'.

On another side, focusing on the perspective of designers, Grinyer (2001) delimited two directions for this profile in a networking world: firstly, as 'value exporters' by means of internal values and global virtues, and secondly, as 'value collectors' by challenging internal conditions and market forces. He stated the meaning of the concept of translation values, which involved three approaches: speak an own language, turn internal values into sharable virtues, and speak the organization's language with a 'local accent'. Nevertheless, it was self-evident that this exchange of values through the traditional boundaries of an organization required the construction of networks that provide interaction between information, actors, processes, and institutions.

Furthermore, designers were legitimized to interpret this brokering role: they can capture, recombine and integrate knowledge about different socio-cultural contexts proposing new aesthetical solutions that can become paradigmatic (Verganti 2009).

As brokers, designers need to be entrusted by the organization and the Design Discourse. In some cases they can be employed in the firm activity, in order to share the internal knowledge. In other cases they collaborate as freelancers, to be recognized more autonomous by the other interpreters of the Design Driven Laboratory.

In this research activity, according with the purpose of the investigation and with the approval of the management, the brokering role was played by the researcher herself, who collaborated as intern to entrust both the internal and external resources of the company, with a particular focus on the development of both category relation.

6.3.2 TECHNOLOGY WORLD AND SOCIO-CULTURALE SPHERE

Starting from the scheme developed by Verganti (2009) in the preliminary phase of the research was drawn the map representing the first exploration of the Design Discourse around the investigation of new meanings and languages among textile materials.

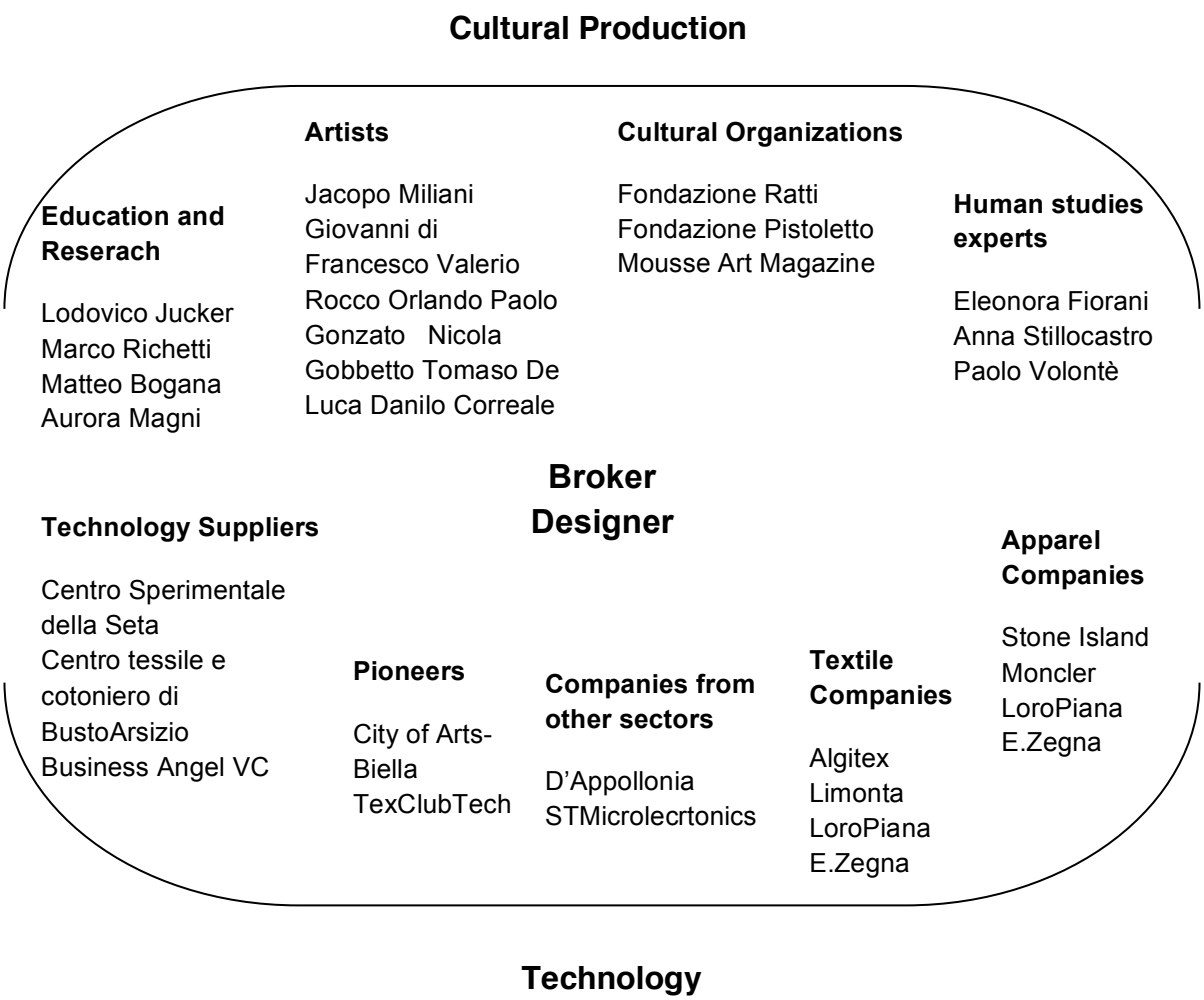

Figure 16 Map of the interpreters within the Italian textile industry

6.3.3 *INVOLVEMENT OF THE KEY INTERPRETERS: THE INTERVIEWS*

The program of preliminary and explorative interviews lasted for more then 6 months, from July 2010 to January 2011. Most of the so-called interviews were wittingly more similar to discussions and long talks, than to formal and structured interviews, widening from the textile manufacturing system to new technologies, current and emerging trends, global market scenarios etc.

At the beginning there was a structured survey, but very soon, following excellent examples in the literature of case studies, it emerged that was preferable to have 5-6 key points, and to leave the interview much looser. The interpreters were not just asked to answer to a sequence questions but to choose which topic could be more relevant for him.

The conversations were not fully recorded. No notes as well. It was more relaxing to take just few annotations, mainly on some languages, or cross references to other professionals or scholars.

The 6 main themes that were faced during the interviews were:

* Organization of the creative process to concepting and developing new textile materials:

Structures, relations, timing competences, profiles, education;

* Trends Analysis and identification of new visions and scenarios;

* Role of design and participation of designers

* R&D Investments

* Relations company – professionals – business partners

* Relations within the Design Discourse:

Research centres, Universities, Arts Associations

This exploratory phase was a demanding hardly time-consuming activity. In order to build real relations that could be exploitable in the future, it was essential to give all the time requested by the interviewee. Sometimes the conversation was very quick (almost one hour), come other times it was necessary to split the appointment in more dates and the total amount of time came to 10 hours.

It was necessary to have a real-time overview on the situation of the textile world, with concern to figure out interesting points of meeting with other industrial or academic fields.

7 THE RESEARCH PROJECT

7.1 PRELIMINARY REMARKS TO THE ACTION RESEARCH ACTIVITY

As already declared in the paragraph regarding the methodology developed for the action-research, the proper implementation of a DDI activity in a textile company mainly followed the road-map summarized and schematized by Roberto Verganti (2007 & 2009). The process was slightly reviewed in order to accomplish the customization requirements of to the selected company.

It is necessary to underline one key point, concerning the style of the narration of the action-research project from this moment on. As the opening of the project was primarily pushed by the researcher, instead of the company, the researcher was accorded the central role of the broker of the entire process, according with the management of the company. For this reason the full responsibility in the ideation, development and management of the process was in charge of the researcher, who concerned all the critical turning points of the activity.

With regards of the direct involvement of the researcher in the creative process within the company, the discussion of the action research shifts to the first-person narrator[33], in order to stress the attention on the human input of the entire work, providing either the detailed description of the progression of the practice and the relational issues occurring time by time. Furthermore, the chronological explanation of the evolvement of the process is also combined with critical comments that can highlight key personal decisions of mine.

The review of the development of this phase started just before the presentation of the new scenarios to the company (July 2011). In that moment I tried to piece together all the parts of the process, in order to provide a full description of the advancement up to that stage. From that time I tried to follow contemporarily the development of practice activity in the field and the expository writing.

From the very beginning it was clear that the implementation of a DDI meta-model into a textile company, which never used to organize explicit design practice, could be far away from

[33] James Dacey studied how the first scientifc paper were written. He noticed how in relevant papers of the past (see for example 'New theory of light and colour' by Newton), the use of the first-person narrator was the most common, and the scienttists used to describe themselves practicing new methods and procedure. 'The style is in stark contrast to modern scientific papers, which are largely written in the third person, where the scientist writes economically about "an experiment that took place", where the results emerge seemingly without human input. One could argue that the modern scientific paper hides the scientific process and the essential toils of the experimentalist, thereby making it difficult for an independent party to come along and repeat the experiments from simply reading the paper'. See http://physicsworld.com/blog/2011/10/should_scientific_papers_be_wr.html

the sequence of a scientific protocol. Of course, it started with an hyper structured plan (see the Figure 14 in the previous chapter), but when the tight scheme faced the uncertainty of the reality, both internal and external to the company, the linear model was converted towards a complex system.

Thus, the following description is an attempt to describe and comprehend what happened, keeping a certain distance from the planned model.

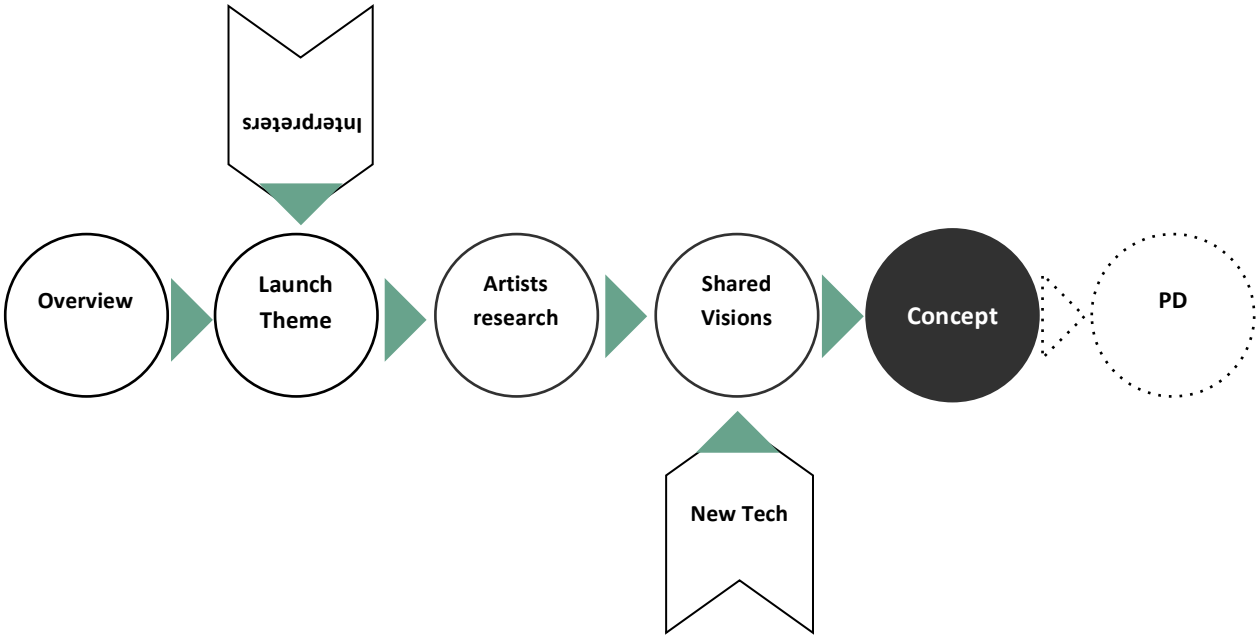

Figure 17 Representation of the DDI within the company 'Beta'

7.2 The Setting of the Action Research

Once that the Company 'Beta' decided to participate to the process, testing within its 'Yarns and Knitted Fabrics Division' the implementation of a DDI, in January 2011, and began to officially collaborate with me, it was fundamental to draw a draft road-map to present the overview of the progression of the process.

During the case study analysis, I had already started to explore the Design Discourse around the company. Thus, when the company demonstrated the intention to experiment a new design approach, I was able to propose them a close number of key interpreters of the enlightened Design Discourse, referring to professionals coming both from the world of technology and the socio-cultural sphere, to be involved in the Design Driven Laboratory.

The company gave me *free rein*. So, a crucial question was: how to choose among 40 relevant professionals the right ones to involve in this demanding project? As I stated in the paragraph

2.2 regarding action-research methodologies and in 6.3.1 regarding the profile of the broker, I played the role of 'values collector' and 'values translator', in an entrepreneur's way, rather than in the typical researcher's one. During the whole action-research, my criteria of selection and interpretation were basically discretionary. In spite of assuming that, I needed to explain some reasoning behind this crucial step.

1. The involved interpreters had to be enthusiastic of the proposal, and available to collaborate on a long-term (one year) project for free.

2. All the designated interpreters had to demonstrate to be absolutely *visionary*. If I didn't know them properly, I dedicated several hours to each interview in order to deepen this not-measurable attitude.

3. I needed interpreters who could *entrust* me and *be entrusted* both by me and by the company. If my trust was undoubtedly fundamental, I found much more delicate to understand who could really trust in me both as researcher and intermediary, and in my research project.

4. I was aware of my shortage of *scientific knowledge* in textile-advanced technologies. I necessitated someone with a broader and boundless expertise and skills, who could be able to easily understand different typologies of innovation, and up-to-date on the most cutting-edge research novelties (both industrial and academic).

Even if I kept on dialoguing with other professionals of the larger Design Discourse, I preferred to settle a very small circle. According to these conditions, as the internal technical and marketing competences of the company were very strong, I proposed to the management to focus on envisioning potential new scenarios and meanings.

So, the design-driven laboratory was defined, involving:

* The general manager of the 'Yarns and Knitted Fabrics Division' of the company 'Beta' and the manager of the Research & Development belonging to the same division,

* The materials engineer expert in nanotechnology applications in textiles,

* The topic advisor on new technologies for a 'Business Angels' Club,

* 3 artists (selected amongst the ones proposed by the arts journalist),

* Me, the textile design researcher, as the intermediary of the laboratory.

This was the birth of the Design Driven Laboratory for the company 'Beta' – 'Yarns and Knitted Fabrics Division'.

7.3 LAUNCH OF THE ACTION-RESEARCH: NEW SCENARIOS

Once the Design Driven Laboratory was definitely shaped, I extensively briefed the artists on the master plan of the research (March 2011). I spoke with each of them in a separate informal face-to-face meeting.

I provided to them key references about company 'Beta', but I preferred not to show them any existing product. I only gave them some raw cashmere flakes. Those were meant to be the inspiration of the research. I asked for a critical research of suggestions about the world of materials. I clearly underlined I was not requiring any kind of concept or product. I invited them to be unbounded, and possibly to share their current explorations about the present and the future, through every kind of artefact: pictures, sketches, references, text descriptions, artworks.

I was not interested in an exclusive performance; I wished their envisioning outputs were intrinsically connected with their present research.

They had four months to develop their scenarios. I constantly called them but I officially met them just one time per each one, in the middle of that period, in order to make them feel cherished and well cared. I also asked them to suggest me some farsighted movies and books, in order to share the directions of their researches.

7.4 TECHNOLOGY EXPLORATION

The technology exploration consisted in detecting interesting and valuable advances in technology, within both the industrial and scientific ground, to be subsequently offered to the materials' interpreter and tested (metaphorically speaking) for the concepting.

It has ben developed in three different phases and responsibilities:

1. General investigation

The assessment of the actual and potential technological opportunities all around the textile world began in the early stage of the action-research. This study meant to be a voluntarily fuzzy investigation amongst the most important research centres related to textile materials in the North of Italy: thus the first screen involved the closest resources (to the company and to the undersigned). Every time I submitted my findings to the 'technological advisor' of the Design Driven Laboratory. It could be considered a relevant part of my permanent training along the process.

2. Company on-going research activity

I studied the technologies that company 'Beta' was already funding (for example the project 'Industria 2015' for the development of stable plasma treatments and adequate machineries to disable the typical 'pilling' effect on cashmere and woollen yarns and fabrics). The company always understood the potentiality offered by the so called 'fifth generation of R&D', managing the innovation process as a network, in which all those people who could bring useful know-how have to participate: suppliers, clients, distributors and even competitors. The necessity to share the huge technological investments and to separate the research from the product development, spontaneously suggested a cross-cooperation with other subjects interested in the same functionality. There was not a research department totally devoted to the exploration of new technological solutions, but the same staff was also in charge to shift the exploitation of this accumulated knowledge into new marketable products.

3. University exchange in China

While the artists were working on their research, I decided to explore the technology world outside the national boundaries. I drawn a three months research-plan in China, to visit some outstanding universities' departments in textile: Jiangnan University in Wuxi, Donghua University in Shanghai, Polytechnic of Tianjin and Polytechnic of Hong Kong and to participate to the International Conference of Textile Materials 2011, held in Tianjin. This trip had a double intention:

- to figure out an overview of the most funded textile topics in the most prominent textile-manufacturing and exporter country[34];

- to establish relevant connections for a potential re-elaboration of the technology.

7.5 COLLECTION OF THE VISIONS

After the investigation experience in China (October 2011), I eventually met the artists to receive the outputs of their research period. I just scanned the proposals they presented, to be sure of the effective accomplishment of their task. It was the time to have a general meeting, introducing the artists to the management of the company. It was less difficult than expected to find a proper occasion.

The participants who attended the meeting were: the general manager of the general manager of the 'Yarns and Knitted Fabrics Division' of the company 'Beta' and a collaborator experienced in trend research, the materials engineer as technological advisor, two artists and me. The meeting lasted almost three hours.

[34] A wider report of the technology-exploration led in China in the period July 2011 – October 2011 could be found in the Appendix C.

After a short introduction, when the previous stages were summarized, I asked to the artists to show and enlighten their visions.

Every artist took almost one hour to illustrate his research direction, mixing verbal explanations and pictures with original artworks. I provided to all the participants a copy of the materials offered by the artists, including the summary of the technology exploration made by me. I also solicited all the participants to take notes about novel suggestions and ideas coming from the discussion. The management was extremely meticulous in listening the presentations, proposing punctual questions and observations.

After the artists, it was my turn to shortly point out the most innovative and significant fields of textile advances, mainly focusing on the findings gained during the visiting period spent in China.

The next one was the most delicate step: the technological advisor was required to review all the suggestions, visions, ideas in order to link them with possible technologies, among the ones I illustrated but not only. Thanks to his amazing capability in connecting abstract concepts and images with real technical possibilities, he outlined a number of linkages from the textile field, but also from other scientific areas, proposing solutions to bring them in the textile industry. It was substantially an interpreting activity, to concretize visionary hypothesis in the real world, allowing the management to have a complete and complex net-map.

I concluded the meeting asking to the manager and the trend forecaster to separately reflect on the emerged proposals, first, and to analyse them with the necessary time, in order to decide a further development of the process with the elaboration of the concept. The meeting was resolved with the acknowledgements from the management.

The management had three weeks to maturate a decision and to eventually decided for proceeding with the definition of one concept, starting from the artists' visions and imaginary suggestions.

7.6 ELABORATION OF THE CONCEPTS

The company decided to carry on two themes deriving by the suggestions envisioned by the artists. They follow two opposite directions, which could be conceptualized in:

Identity

The identity is recognized as a refuge and rescue from the external world.

It can refer both to the individuality of consumers and to the character of the material.

It reflects a search for steadiness, stability and invariance.

The identity of the garment mirrors the identity of the consumer.

The textile material as a mimetic second skin.

The surface of material acts as a mask covering the body, and not only the face.

It replicates the surface if the body. But in a abstract way. Through the colour.

The colour and the touch are skin alike.

* Studies on changing patterns on textile surfaces through pearl luster and colour travel pigments (Eivazi 2010), new applications for colour-changing materials injecting colour-changing inks into foams, then moulded into 3D shapes (NunoErin thanks to Sommers Plastic Products[35]) chromatic changes of textiles threatened with a number of chemical and biological agents (Bamfield & Hutchings 2010).

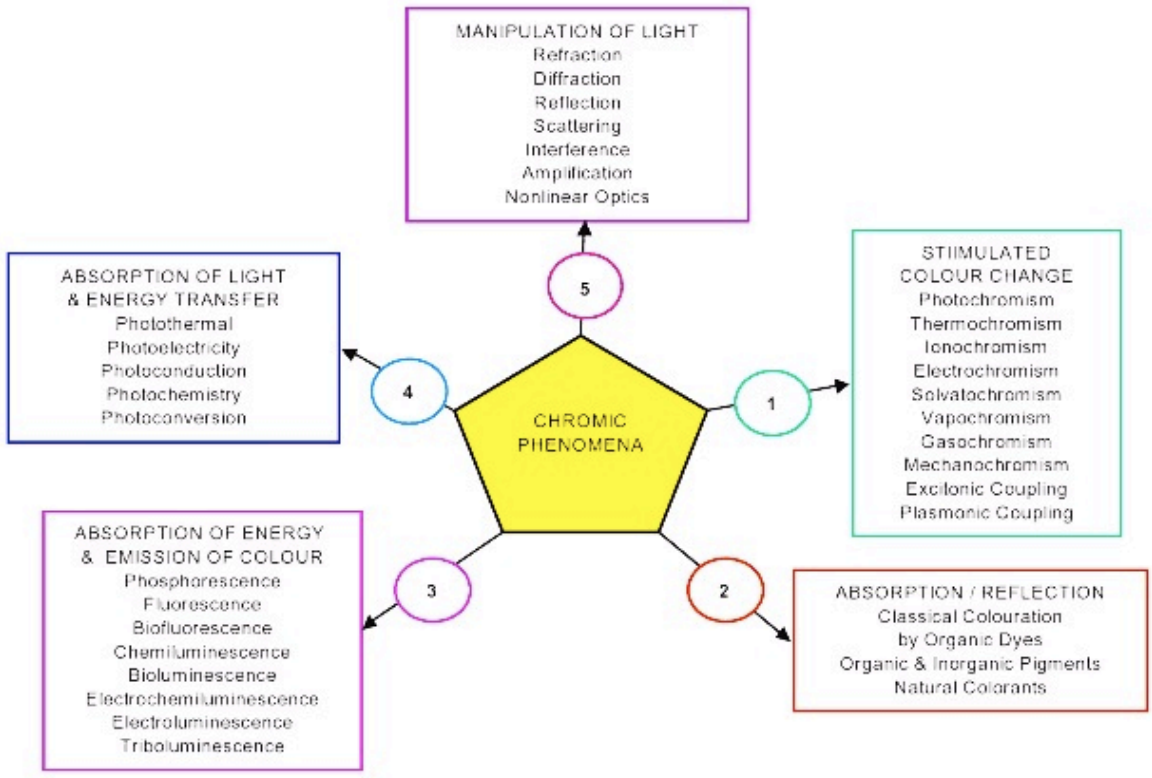

Figure 18 Classification of chromic phenomena (Bamfield & Hutchings 2010 - Figure I.1.)

[35] The history and the research activities of both the companies are presented in 'Textile Futures' by Bradley Quinn (2011)

Growth

The textile surface gradually develops into a solid structure

The growth of the fibres, of the yarns, of the fabric.

Evolution, growth, progression. But controlled.

Natural materials change as nature does.

The material is alive.

During the production the material is nurtured as an organism.

'Rhythm experiments' to design with time-based parameters to create dynamic growing textile structures.

During the consumption the materials follows a pathway of development.

The same textile challenges different sensory perceptions: soft/rigid, rough/smooth, full colour/ rare colour.

* Studies on 3D composites weaving for construction changed with new raw material to innovate weave structure with concern to aesthetic properties (Lanping 2008), hybridation between 3D technical textiles and textiles for apparel (Stylios 2003), 3D woven composites for design to integrate load-bearing properties with aesthetic surfaces and visual appeal (Soden 2007); studies on bio-generation of textiles through the utilization of microbes to simulate the growth of moulds (Lee 2007), and on a biodegradable polymer, coated with 3T3 mouse cells to form connective tissue and topped it up with human bone cells, called Victimless Leather (Tissue Culture and Art Project & University of Western Australia 2004).

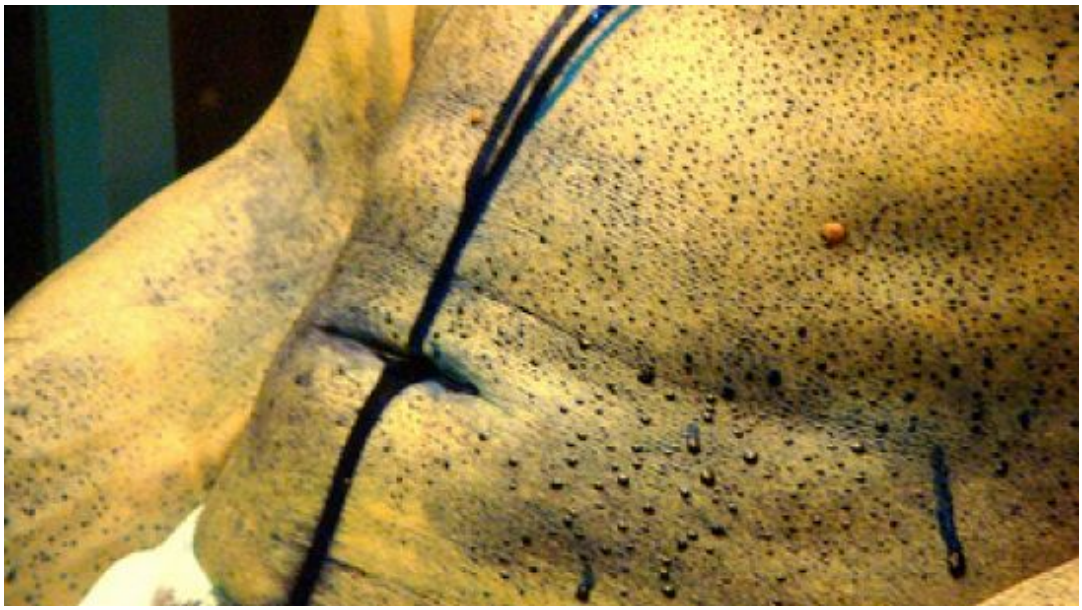

Figure 19 A detail of 'Victimless Leather' byTissue Culture and Art Project, 2004

The two concepts are now in the hands of the company. They are still exploring the scenarios enlightened with the work of the Design Driven Laboratory. The technology exploration offered some suggestions and some references for a further development of the concepts. A concrete product development phase, starting from the two original concepts, seems highly improbable in a short term perspective. Operating within the boundaries of the firm, I have experiences how hard is to implement a breakthrough concept into a marketable product. What is happening now is the investigation of some finishing techniques to customize the colour of the textiles, challenging the concept of the overlapping identity between the end-user's body and the garment.

8 CONCLUSION

Three arguments are articulated in this final chapter: the main contributions of this research, the limitation of the research and the proposal of further work.

8.1 MAIN CONTRIBUTIONS

8.1.1 A PARADIGMA FOR TEXTILE DESIGN

Through the combination of a review of literature and empirical works and the movement back and forth between the theoretical analyses and the empirical ones, it was possible to identify, classify and describe an emerging approach to textile design and research in textiles: an approach modelled on design practice within other fields such as furniture, communication and services.

Textile Matter

Among different meanings attributed to the word 'textile', the primary need was to provide a definition that could be adequately wide to comprehend the different outputs of the emerging textile design practice, and appropriately close not to invade the world of apparel and fashion, which had already other models of design methodology. At the end, 'textile' referred to all the fibre-related matter: fibres, yarns, knitted fabrics, woven fabrics, non-woven fabrics, and eventually the associated process: deying, printing and other finishing treatmens.

The second analysis concerned the nature of the textile matter. From one side, textile materials should be considered as products of sense if and when they are used and act as elements of social mediation, purchased and exhibited, more or less ostentatiously.
Each textile material is an element of a system (the apparel, the wardrobe, etc) where human being is an integral and active player. The user, as interpretant, is the only one who gives the meaning to the textile, through sensory perception and conscious interpretation. Textile artefacts can be described into three categories: Icon (attractiveness provided by the preciousness), Index (attractiveness provided by constrictive and seductive influence) and Symbol (attractiveness provided by the satisfaction of needs).

The third investigation discussed the hypothesis that assumes the textile material as an instrument. Starting the debate on materials, textiles are tools if they contribute to the transformation, acquisition and exploration of the context, and whenever they have a physical component and a scheme of utilization, which can be composed either of the traditional way of utilization of the material, of a specific way proposed by the material's manufacturer or of a new way developed personally by the designer who gets in contact with the material during

his design activity. The 'instrumental genesis' of a textile material occurs both during the concepting of the textile material, and during the creation/evolution of utilization schemes.

Quoting Elaine Igoe (2010), who is working on the same at the Royal College of Art in London, "Textiles is a mother. Textiles is a geisha. Textiles is a spinster."

I agree, suggesting a further meaning: mother for its physicality, geisha for its appealing power, and spinster for its attitude towards consumption.

Textile materials represent an independent territory, with its own language, which are able to develop multiple dimensions and a complex identity. The textile material must provide, with its extrinsic values, the contribution that its properties can lead to the enrichment of artefacts (clothing and apparel). Textile materials can be considered the primary land of the project of artefacts. No matter whether the target of the design activity is a halfway product, the skin or the surface of a product or the decorative pattern. It should always concern a game of multiple relations with the technical and aesthetic characteristics of the material, but also with the shape, the evolution of language, the user and eventually the environment.

Textile Design Practice

Traditionally the role of the textile designer involved the creation and production of original woven, knitted or printed fabrics in the form of either flat paper designs or fabric swatches. Typically designers used suggested colours, sketched initial concepts, formulated designs (perhaps in repeat formats) and worked with a variety of yarns and fabrics, developing visual and tactile ideas, referring to a specific 'brief', which provided guidelines about what the project should entail or what it are for. These activities were combined with their technical and practical knowledge of fabrics and processes in order to produce the final patterns.

During the past decades textiles industry has incessantly shifted towards new technology and a growing hybridation with other disciplines. Textiles disceples started to interact with other players in order to share knowledge and visions. The textile practice lost part of its 'taciturn' attitude and began to conversate with scholars from different disciplines. What was implicit needed to be understandable by others.

Design methodologies and practices became more interested in the field of textile. The recent openness pushed the integration of those approaches towards the ground of textile products. A general growing attention to materials and the design of materials should now come the textile materials to the fore. Textile design has to demonstrate its potential in challaneging design strategies such us Concepting Design, User-centered Design, Open Innovation and Design Driven Innovation. Textiles can be a framework to demonstrate the competitive advantage of design practice.

An output of this research is that textile design can go upstream to the very beginning of the creation of textile material: up to the chemical composition of the fibres, yarns and fabrics' blend. It enables a relevant extension of the meaning of textile design, beyond the concern on material surfaces. It assumes the participation to the invention of the textile original matter.

Towards the designerly approach to a B2B Industry

Whether the action research activity has been focused only on one company, the entire process of investigation of the field, exploration of technologies, and case study spread the new concept of textile design over the boundaries of the firm.

As literature review and the case study investigation revealed, design is rarely meant as a consistent medium of innovation within the textile industry, which is always considered a derivative sector, at most it is included within the category of design-related sector.

The research demonstrated that also a B2B manufacturer can be sensitive to advanges of a design practice and of design-driven approach, understanding the values of new scenarios and new concepts coming from a completely different creative procedure.

8.1.2 TEXTILE DESIGNER AS A BROKER

Within an environment recongnized for its taciturn attitude, such as the textiles context, it was recognized necessary a professional profile who can conversate both with the main resources used to work on textile creation and product development, and with external player, in order to interact with interpreters coming from different sectors.

The textile designer can be employed as a 'broker', whether is able to understand other vocabularies and to translate the typical language of textiles products into an understandable language either for other kind of designers, artists, human studies experts, and professional from other industries (electronics, automotive, architecture…)

The designer can be recognized as a pathfinder. As it became clear that the most talented technology pioneers can't be hired by the company, the designer should act as an ambassador of the company, detecting the best connections with the key interpreters of the same context (universities, research centres, other industries).

Starting from the close range of products of one company, the designer as a broker should push the innovation, conserving the core manufacturing soul of the company, figuring out in which context exploring upcoming visions.

8.2 LIMITATION OF THE RESEARCH

Practice – Theory - Practice

The main issue of the development of this practice-based research was that it started from the theoretical generalization (Design Driven Innovation) made on the ground of high-performing cases. It was necessary to be aware that any replication and repetition of the success would have been utopian rather than impossible. Different categories of critical knowledge were produced in the research settings: the knowledge relative to the design project(s) developed, which is a kind of 'local knowledge;' the knowledge constructed over the course of the research process, which is a kind of meta-knowledge; and the findings relative to the whole research with its theoretical and practical contexts, which is mainly a publishable knowledge.

The constructivist epistemology underlies that these kinds of knowledge haven't a status of truth, but the status of 'plausible hypothesis.'

Complexity Of The Process

The action research was developed through the development of one only case study, structuring one research process, which included the scenarios' investitation of three artists. The study of a single environment in order to develop generalizations presented a clear limitation to the research. The strategy framed revealed what was specific to one individual case. Also the interpreters chosen were strictly linked with the individual case of company 'Beta'. The time required to the development of one single case didn't allow the repetition, even with proper adapations, to other cases.

8.3 FURTHER WORK

The elaboration of the concept meant also the evaluation and improvement of the selected technology. This step saw also the intervention of the internal product development resources, despite thew fact that the concept didn't mean toexploited for the production and the market.

The following questions will be fundamental for a further investigation of the concepts:

- Who is working on the mentioned technology? How to establish the proper collaboration with this laboratory? Is the internal R&D able to work with the other partners? Is still need a technological broker of this stage?

- Are the current suppliers, partners, and costumers eligible for this project? Who else in other supply chains should and could be involved for developing the new product (also from the marketing point of view)?

- Which are all the technical requirements and specification of the products? Which other functions have to be developed?

- Which kind of distribution and communication is more suitable for it? Are the traditional tools and channels adequate enough?

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APPENDIX A: INTERVIEW SURVEY

1. The creative process

1.1 How is organized the creative process for the development of new textile materials (hierarchical and peer relations)?

1.2 Which departments are involved into the creation of new textiles?

1.4 Which department is in charge of the concepting of new textiles?

1.5 Which department is in charge of the R&D regarding new textiles?

1.6 Which department is in charge of the Product Development of new textiles?

1.7 Who / which department launch the research for new scenarios / new concepts?

1.8 Who is in charge of decision making for the creation of new textiles?

1.9 What amount of budget is dedicated to development of new products?

2. Network

2.1 Do external partners/ players participate to the concepting / R&D / PD of new textiles?

2.2 Which kind of partners are usually involved in the process (Suppliers, Users, Opinion makers, etc)? At what stage?

2.3 Who manage the participation of external players?

3. Knowledge, Competences and Profiles

3.1 How is managed the knowledge coming from the concepting / Product Development / R&D for new textile products?

3.2 Which competences are requested to be employed in the R&D department?

3.3 Which education is preferred? Are there graduates?

3.4 Are there designers involved into the creative process?

3.5 Are you satisfied by the outcomes of the existing educational programmes?

4. Innovation and Design

4.1 Is Innovation a key leverage of the company?

4.2 How innovation is promoted (product, process, service)?

4.3 Is design and design practice related to your concept of Innovation?

APPENDIX B: THE CASE STUDIES

COMPANY 'ALFA'

Company 'Alfa' is a group of 8 enterprizes based in the Como textile district. The whole group is devoted to the production of textile materials for clothing, accessories and footwear, home furnishing, automotive and sports facilities.

The company was founded in 1893 by the homonymous family. The production was initially concentrated on tapestries, jacquard fabrics, velvet and quilted textiles. In the '50s the focus turned into textile finishing treatments (coating, flocking, resin, coagulation, etc.), becoming the leading industry of that field.

The Group is now structured into the following divisions: Interior Coverings Division (jaquards home textiles also intended to supply the internal retailers), Fabrics and Coatings Division (special fabrics for clothing, leather goods and accessories, footwear), Wall coverings Division, Sport Division (sports floorings and facilities), Furniture Division (façon service for home textiles and furnishings), Deying Division (deying and printing for Fabrics and Coatings Division), Weaving Division (innovative woven fabrics), IT Division (IT tools for the group), Silk Division (luxury fabrics for apparel and clothing), and Fabric for Automotive Division.

Amongst the most innovative products there are waxed finished fabrics and textiles coming from a manmade procedure from cellulose.

The group is still managed by family through two heirs of the founder. The number of employees is 1360 units. The turnover for 2008 was estimated in 152 mil. €, 53% of which derived from the textiles for apparel and accessories.

COMPANY 'BETA'

Company 'Beta' is a family-run firm based in the Biella textile district. It was established in 1924 as a manufacturer of the highest quality woolen fabrics. After World War II, the company started to export of woolen textiles towards the European, USA and Japan markets. The company has maintained the family ownership and management over the years. In the '80s the 'Apparel Division' was launched. The company was in charge of the entire supply chain: from the sheep farms to worldwide retailing of women and menswear collections.

The group is structured into three main branches: the Luxury Goods Division (creation, development and production of top-end sportswear and leisurewear for men, women and children), the Interiors Division, and the Textiles Division, which is segmented into two business units: Woven fabrics (fine and extra fine woollen fabrics, cashmere and vicuna, wool fabrics 'technical' patented; the manufacture is destined both to the Luxury Goods Division and to selected external clients), and the Yarns and Knitted Fabrics (cashmere and other luxury blended yarns for knit-wear, and fine Jersey fabrics, both of the products can be purchased both by the Luxury Goods Division and by selected external companies and workshops.

The business group is now held by the heirs of the founder entrepeneur. The total amount of employees in the world counts about 2000 units. The turnover for 2008 was calculated in 420 mil. €, as follows: 65% Luxury Goods Division and 35% Textiles Division.

COMPANY 'GAMMA'

Company 'Gamma' is focused on sportswear and leisurewear for men, women and children, based in Veneto district. Core business is the 'dawn jacket'. It was founded as a French company in 1952 in an Alpine village near Grenoble. The first dawn jacket was designed and produced in 1954, intended to workwear. Thanks to some trend-setter mountaineers they became garments of for activewear and specifically skiing. During the '80s the company became a world leader of 'metropolitan' down jacket, concentrating on goose duvet and nylon fabrics.

Among the most innovative textile products: washed nylon and no-season quilting.

Through several transfer property in 2003 the company was acquired by an Italian entrepeneur. Now the business is a company owned partially (38%) by the entrepreneur and creative director and by a Private Equity. The number of employees is about 1100 units worldwide. The turnover for 2008 was estimated in 310 mil. €.

APPENDIX C: THE VISIONS FROM THE ARTISTS

The following presentations have the form of 'stream of consciousness'. They reproduce how the artists shared their visions and scenario first with me, then with the company.

ARTIST #1

Spontaneous growth of materials

Self-generation

Self-expansion

Biological growth of moulds

To block the mould growth keeping the softness

Microscopic structure of mould similar to dandelion flowers

Crystallization of cells

Structure of minerals

Crystallizations similar to rigid hair

3-Dimension Growth

The touch transforms 2D surfaces into 3D structures

The coloured metamorphosis

Natural foam grows like beehives around the plants

Food Freezing process

Numerical Control Machines

Memory Form

Mimosa leaves

Filaments in light bulbs

From micro to macro

Yeasts rising

Solid mould from cereals' husk

Laser-cutted sculptures by Xavier Veilhan

Permanent alteration vs Reversible transformation

Egg gelatine vs Meat gelatine

A determined quantity of material generates determinated shape

Material comes first. Then the shape

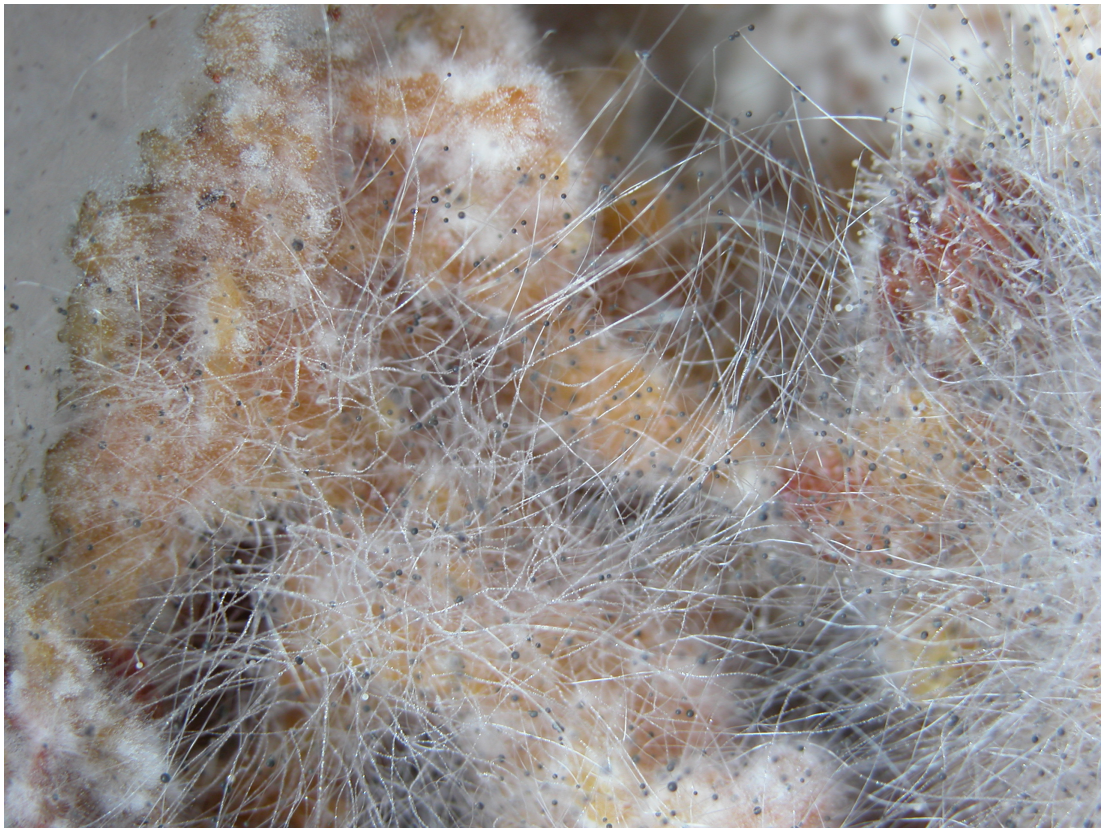

Figure 20 Paolo Gonzato, 'Mould', Selection of Pictures from the Web, 2011

ARTIST #2

Agambem – Contemporary.

Over the thoughts

Animal Intelligence

Ants act through a consistent reasoning

Catch sheeps' soul?

The mating dance

Seduction language

How to identify the natural from the artificial?

Abstraction from the natural world, strating from existing geometrical and symbolic features

Non descriptive elements

Natural elements become solids: earth = cube, fire = pyramid, water = icosahedron

Veneration of icosahedron

Pictures of animals become icosahedrons

Trasnforming skin

Representation skin: the masks from the faces

Skin's Tones

Flat, solid field of colour

Matt luminosity

Human masks as shields

Cuts simulate human expressions

Mimesis of the skin

Skin shade gives the identity

Cancealing the expression

Ambiguity of representation

Colour and matter suspend the understanding of the deep meaning

'Persona' of Igmar Bergman

The search for identity - the lost of identity

Already and 'Not yet'

Figure 21 Francesco De Giovanni, 'PERSONA', Artist's Archive, 2011

ARTIST #3

Performance between Arts and Theatre

Hybridation of categories

What is representation?

Performance of stage vs Reality

Interaction with the audience

Body as instrument

Changing matter

Blending the media

Uninterrupted process

Precise choice (symbolic) of materials

Translating human behaviours and moods into concepts

Audience as master of performance

Audience translation

Open performances

Installations network

'Moby Dick' by Orson Welles:

Mimesis: representation of reproduction

Masks

Textile weave as photographic plot

Frames as theatre curtains

Unrepeatable movement of textile folds

Ephemeral exhibition

Architecture of body

Column as symbol of human body

Dyptich: black vs white

Syneshesia

Watching what preceded the represented instant

Mind sights: the mirage

Light diffraction becomes an illusion, aspiration, dream

Photographies ante and post performance

Recurrent materials: the glass

Recurrent imagines: the parrots

Figure 22 Jacopo Miliani, 'UNTITLED 1967', Museo Madre, Napoli, 2011