New Product Development Process in Fashion Industry: Empirical Investigation within Italian Companies

Elisa Soldani, Monica Rossi, Romeo Bandinelli, Sergio Terzi

New Product Development Process in Fashion Industry: Empirical Investigation within Italian Companies

Elisa Soldani[(1)], Monica Rossi[(2)], Romeo Bandinelli[(1)], Sergio Terzi[(3)]

[(1)] University of Florence, Department of Industrial Engineering, Florence, Italy
[(2)] Politecnico di Milano, Department of Economics, Management and Industrial Engineering, Milano, Italy
[(3)] University of Bergamo, Department of Industrial Engineering, Dalmine (BG), Italy

romeo.bandinelli@unifi.it

Abstract. This paper deals with the investigation and identification of the industrial best practices in the areas of knowledge and process management and business organization applied to design process. The results have been achieved through an empirical research carried out by the authors with the support of the Ge.Co. Observatory of Politecnico di Milano, which focus deals with the evaluation of the Product Lifecycle Management (PLM) approach within manufacturing companies. The research has been conducted with the use of a structured questionnaire distributed on a sample of Italian companies belonging to the fashion (apparel, leather and footwear) industry, carried out through face to face inter-views, according to a survey guide. The results of this study have been classified using a maturity model developed inside the Observatory, which aims to categorize these industries according to nine dimensions, grouped into three main areas: Organization, Process and Knowledge Management.

Keywords: Product Lifecycle Management, PLM, Fashion Industry, Maturity Levels

1 Introduction

The term “fashion” is used both by practitioners and academics to generally indicate an industry which includes several sectors, from textile to clothing, from leather to knitwear, accessories, sunglasses, cosmetics and jewelry. Each of these sectors shows different characteristics and can be further divided into different competitive segments, characterized by company’s dimensions, served customers and markets and applied technologies. A widely accepted classification of the fashion market has been proposed by Saviolo and Testa [1]. In their book, they classify the fashion markets using the price and the number of sold unites as variables that differentiate the type of the product, defining five main market segments: *Couture*, *Prêt-à-porter*, *Diffusion*, *Bridge* and *Mass*.

The paper will focus on companies belonging to the *semi-programmed* and *programmed* fashion (apparel/leather/footwear) group, belonging to the first two sectors identified above, the *Couture* and *Prêt-à-porter*, characterized by the existence of a long period (from 12 to 18 months) between the product design and the delivery of the product itself to the stores. The ability to create successful products calls for an high creativity design phase and high standards in the manufacturing process. Companies belonging to this market, in order to reduce the time to market and to increase products' variety, have to improve their flexibility, without reducing the performances in terms of delivery and quality.

The fashion value chain is a process that starts from the design phase [2][3] and ends with the products delivery process, crossing the textile/leather system, developing a culture based on integration of the supply chain through the use of Information and Communication Technology (ICT).

Considering a PLM approach, in such a system the design tools are integrated on one side with CAM tools, in order to realize prototypes, and on the other hand with CPDM (Collaborative Product Development and Management) systems, sharing drawings and technical specification of the product. 2D and 3D CAD systems are used in order to support the products engineering and the modeling. CAD systems are able to specify products' models, colors, shapes, material and many other information.

The evolution of ICTs in this area can cope with these complexities by offering software applications, including PLM. It is important to remark that markets in general, and the fashion industry in the specific, are increasingly characterized by external factors that impact directly on business. Among the most important it is possible to find quality, product complexity, the reduction of the Time to Market (TTM), etc.. As a consequence, companies know that the main critical success factors are the improvement of product quality, decreasing costs and reducing time to market. It is for this reason that the benefits of an investment, to be useful and possibly generate a profit should belong to at least one of the critical success factors. As well known, a PLM initiative has the potential to impact on all three factors required by the market.

At the same time, the companies themselves should be aware however that the PLM is an investment, that implies immediate costs and benefits which would be developed in the future. As an investment, it is necessary to justify costs that have to be supported in order to achieve the desired results. For this reason is very important to better manage the organization's PLM implementation by identifying in advance the costs and benefits. It is also important to carefully assess the scope of the project, the impact of the solution as well as about the usability of PLM itself. The results of the project derive from the definition of clear and incremental deliveries, but also realistic expectations, and involvement from the early stages, all the actors who participate in the processes involved in the PLM, and last, but not least, the identification of possible resistance to change trying to understand the reasons behind them [2].

2 Methodology and Research Question

The research question behind of this paper deals with the investigation and the identification of industrial best practices in the areas of knowledge management, process management and business organization applied to design process in the fashion Industry.
In order to achieve this result, the research has been conducted using the case studies analysis within a sample of Italian manufacturing companies belonging to the fashion Industry. Case studies have been carried out through face to face interviews, supported by a survey guide. Hereafter the questionnaire is described together with the CLIMB maturity model adopted and the variables used to describe and evaluate companies. A more comprehensive description of the CLIMB model and the methodological approach is reported in Rossi et al. [4].

2.1 The Questionnaire

As previously anticipated, the data has been collected using the case studies methodology, according to a reference framework structured in nine areas, grouped into three parts: *Organization*, *Process* and *Knowledge Management*.

The first area (*Organization*) concerns with the analysis of the behavior of people involved in daily company's activities, the second one (the *Process* perspective) investigates how NPD is performed and the third one focus on the dynamics related to the creation, sharing, representation and re-use of tacit and explicit knowledge.

These three macro-areas have been further divided into sub-areas (respectively 3, 4, and 2), defining a total of nine areas of interest, as reported in Table 1.

Macro Area	Area	Questions
Organization	Work Organization	1-5
	Roles and Coordination	6-9
	Skills and Competence	10-12
Process	Process Management	13-16
	Activities and Value	17-20
	Decision Making Factors	21-24
	Methods	25
Knowledge Management	Formalization	26-30
	Computerization	31-33

Table 1. Questionnaire structure

2.2 Analyzed Variables

In order to define the maturity of the NPD process, nine variables have been analyzed, each one corresponding to a specific section of the questionnaire:

- *Work Organization* refers to the distribution of the work between the various designers and to the task structure (innovative or routinely);
- *Roles and Coordination* analyzes the cooperation between designers, the definition of their task, the relationship with the project manager and the ability to interact with each other;
- *Skills and Competence* is the ability of company to support training and building capacity;
- *Process Management* represents the capability to lead the NPD process to the planned objectives andto evaluate possible deviations (using KPIs);
- *Activities and Value* aims to define the customer product value, how and by whom it is defined and how it is integrated into the NPD process;
- *Decision Making Factors* evaluates which elements can be considered the most important for the firm's competitiveness. They also deals with the relationship between the decision taken at the design stage and the entire product lifecycle;
- *Methods* analyzes methods, procedures and production techniques adopted by designers and project managers;
- *Formalization* analyzes how the company manages, shares and preserves the knowledge created in the design process;
- *Computerization* examines the use of software tools and their functionalities;

2.3 CLIMB maturity levels

The CLIMB model adopted in this paper originates from the Capability Maturity Model Integration (CMMI) [5] developed by SEI (Software Engineering Institute) in the 1990s for the software industry.

The model presents a set of recommended practices described in a set of key processes, classified in order to enhance the software development and maintenance capability. The model classifies these areas using a five levels scale:

- Initial: chaotic, ad hoc, individual heroics);
- Repeatable: the process is at least documented sufficiently;
- Defined: the process is defined/confirmed as a standard business process;
- Managed: the process is quantitatively managed;
- Optimizing: process management includes process optimization.

In this paper, in order to evaluate all the nine areas described in the previous section, they have been numerically evaluated through a % score given to the related questions. Starting from the CMMI model, five possible *Maturity Levels* have been identified (Figure 1), based on the reached % value, named CLIMB (*Chaos*, *Low*, *Intermediate*, *Mature*, *Best Practice*):

- *Chaos*: the area is usually chaotic and slightly structured;
- *Low*: the area has a simple formalization and it is barely planned and controlled;
- *Intermediate*: the area is structured and planned. Standard solutions are normally applied;

- *Mature*: the area is structured, planned, controlled and measured at its different layers, often through specific quantitative techniques;
- *Best Practice*: the organization reached all the previous stages and the area continuously improves thanks to the analysis of variance of its results. The improvement of NPD performance is reached through incremental and innovative actions.

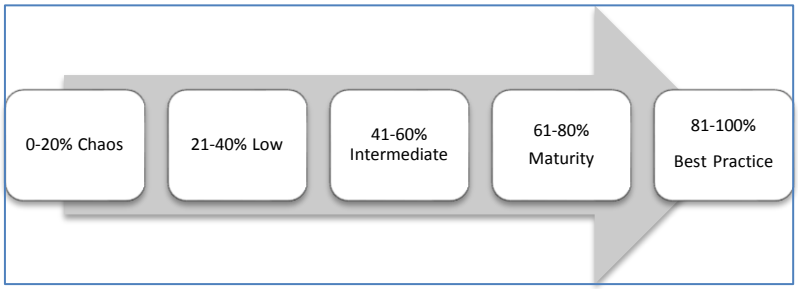

Fig. 1. Maturity level profile

3 The sample

In this study a sample of seven fashion Italian companies have been analyzed.

ID	Main Product	Employees	Turnover (M€)	Market	Man. Env.
A	Apparel	260	45	National	MTO
B	Apparel	5000	1300	International	ETO
C	Accessories	35	12	International	MTS
D	Apparel	900	100	International	MTO
E	Apparel & Footwear	350	286	International	MTO
F	Apparel & Activeware	200	100	International	MTO
G	Accessories & Footwear	250	150	International	MTO

Table 2. The sample

The sample contains both big than small-medium firms as shown in Table 2.

Only one firm produces exclusively for the Italian national market. The rest of the sample produces for both national than international markets.

The design process takes place internally for all the interviewed companies and is localized into a single physical center. A logic of Global Product Development (GPD) has not been found in any of these industries.

The most used manufacturing environment is the Make to Order (MTO): four of the seven companies produce items starting from a catalog, which is developed twice

a year. Taking into consideration the other three companies, one of them produce according to the Make to Stock (MTS) approach while the other one follows the Engineering to Order (ETO) strategy.

Focusing of the NPD process, the results shows that its structure is not uniform within the sample:

- three companies adopt a concurrent engineering process, where a multidisciplinary and multifunctional team is responsible for the product development. People involved in quality, production and service functions collaborate since the first stages of the development process;
- three companies adopt a collaborative process, where both final customers and suppliers are involved in the activities carried out within the NPD process;
- Only one firm have a sequential NPD process: different functions work sequentially, exchanging specifications and review requests.

Finally, all of the companies, except one, have both PDM/PLM and ERP systems.

4 Results

In this section, the results of the investigation on the information collected through the case studies is reported, and a possible answer to the research question is presented. The nine variables were examined and the companies positioned according to the maturity level achieved, derived from the CLIMB model previously defined.

4.1 Maturity level of the NPD process

The adoption of the assessment maturity model developed by the Ge.Co. Observatory permitted the representation of the results through the use of radar charts.

The maturity of NPD process in fashion industry is represented in Fig. 2. An observation of the chart shows that none of the companies belonging to this sample represents a best in class firm considering the all manufacturing industry. A first result of this research shows that fashion industry can be classified as intermediate for five variables (*decision making factors*, *methods*, *formalization*, *computerization* and *skills and competences*), while best practices can be identify in three variables (*process management*, *activities and value* and *roles and coordination*).

Because of the small number of companies interviewed, in order to validate the results presented above, the data dispersion and consequently the standard deviation have been calculated. The results are reported in Fig. 3.

The analysis of the Fig. 3 highlight that the standard deviation can be considered low only for few variables. In particular, the results regarding *Methods* and *Skill and Competence* variables cannot be considered reliable (Fig. 4, 7). On the other hand the behavior of the companies in comparison to *Roles and Coordination* and *Computerization* can be considered comparable (Fig. 4, 6).

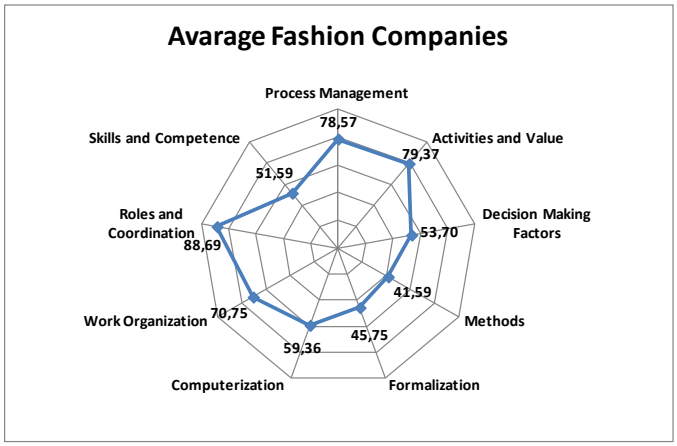

Fig. 2. Representation through a radar chart of the nine variables average score

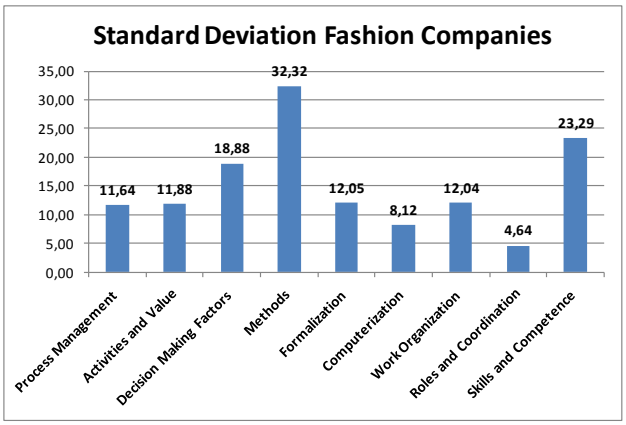

Fig. 3. Representation of the standard deviation of the nine variables

If, on one hand, *roles and coordination* seems to be well organized into fashion companies, on the other hand the research shows that *Methods* and *Formalization* are not evolved.

Focusing of the interpretation of these results, a first understanding shows that within the fashion companies roles and responsibilities are clearly defined. This is probably due the fact that the whole design process is internally performed for the totally of the sample. Moreover the geographical proximity of each actor involved in the design process could lead to the same result.

Considering the macro area Organization, the two variables present different values. The first one (*Work Organization*) (Fig. 4) achieve a *Mature* level (approximately 70%), while the second one (*Skills and Competence*) presents a lower value *(Intermediate*) and a wider data dispersion.

Process Management and *Activities and Value* standard deviation are between

Mature and *Best Practice* (Fig. 5). Customer product value is clearly defined, starting from a market analysis. At the same time, process management is properly controlled, mainly with the use of time and cost performances indicators.

The last macro area of the questionnaire deals with the Knowledge Management topics. Within this macro area are included the variables *Formalization* and *Computerization* (Fig. 6), where fashion companies perform an Intermediate level, although all the companies belonging to the sample, except one, has adopted CAD software, PDM/PLM and ERP systems.

The low score obtained in the Formalization area can be explained by the fact that, even if PDM/PLM solution have been introduced, the exchange of information among these software is still not structured. Knowledge management tools and formal rules have not be implemented within the companies and in some cases the advantages of a full implementation of a PLM approach are not considered both a priority neither a competitive advantage for the management.

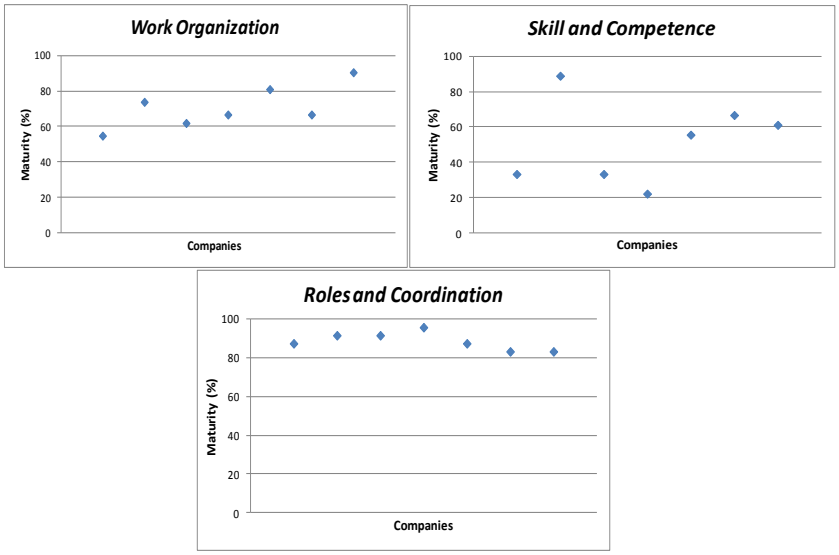

Fig. 4. Standard deviation of Work Organization, Skill and Competence and Roles and Coordination

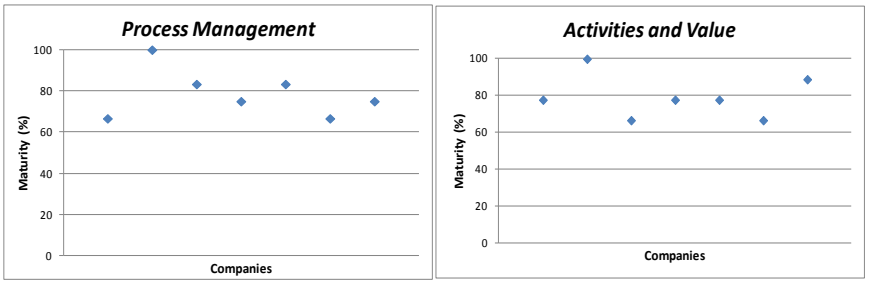

Fig. 5. Standard deviation of Process Management and Activities and Value

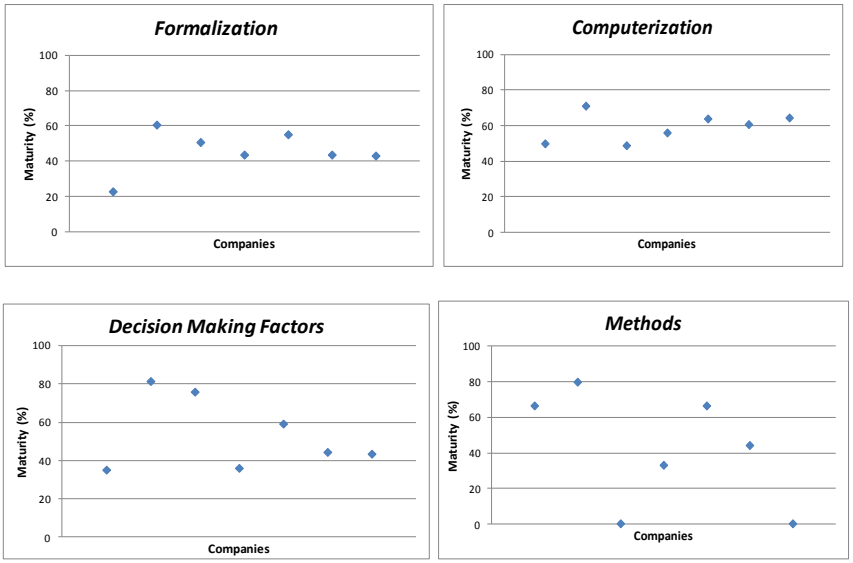

Fig. 6. Standard deviation of Formalization, Computerization, Decision Making Factors and Methods

Finally, referring to the other radar's sections (*Decision Making Factors*, *Methods* and *Skills & Competence) (Fig. 4, 6)*, the high data dispersion highlights different performances among companies.

5. Conclusions

Fashion industry is one of the most important manufacturing sector for the Italian economy. The goal of this paper was to identify and highlight the strengths and weaknesses of the NPD Process of the companies of this industry, classifying the results according to nine dimensions, grouped into three main areas: *Organization*, *Process* and *Knowledge Management*.

The outcomes of this research show that higher level of maturity is achieved in the *Organization* macro area. The majority of the companies achieve an average score which is more than 80% for *Roles and Coordination* (the standard deviation in this area can be considered low, so the behavior can be assumed the same for all the companies of the sample). Moreover, the NPD in the fashion industry is based mainly on the interaction and the exchange of information among several actors of the whole value chain. This means that the roles and responsibilities assignments across the supply chain is a very crucial aspect. Regarding the *Activities and Value*, the average score can be classified as mature: all the actors of the value chain consider the customer and the product value the focus of their activities.

Another important aspect is related to the *process management* and the flexibility of the supply chain, both in terms of independence of the design and engineering divisions than in terms of industrialization.

Last, Fig. 8 represents the average score of the lifecycle orientation of the companies. It is important to highlight that due to the high standard deviation of the obtained result, the data cannot be considered statistically reliable, and a bigger sample of companies should be analyzed.

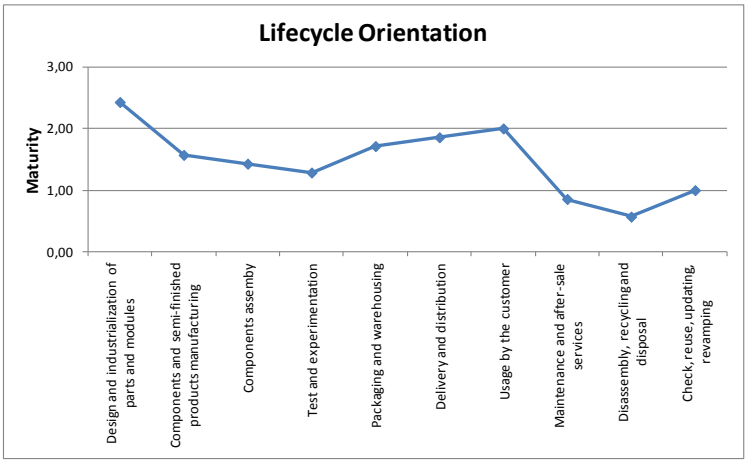

Fig. 8. Lifecycle orientation of the companies of the sample

As a future step of this research, it would be important to understand if these results represent the whole companies belonging to the fashion industry, or if a wider sample of companies could lead to different results. Moreover, a comparison among fashion industry and other manufacturing sectors would be advisable. In this study all the variables have equal weight in the definition of the radar chart. A comparison among different industries could lead to define different weights for different sectors, according to the different markets behavior.

References

1. Saviolo S., Testa S., (2005) "Le imprese del sistema moda - Il management al servizio della creatività", Etas Libri, Bologna, in Italian.
2. Bandinelli R., Terzi S. (2011). An Exploratory Study on Product Lifecycle Management in the fashion chain – Evidences from the Italian leather luxury industry. In: T. J. Choi. Fashion Supply Chain Management: Industry and Business Analysis. p. 270-285, Hong Kong: Tsan-Ming Choi, ISBN: 9781609607562
3. Bruce M., Daly L., Towers N., (2004) "Lean or agile. A solution for supply chain management in the textile and clothing industry", International Journal of Operations and Production Management, 24 (2) 151–170.
4. Rossi, M., Terzi, S., Garetti, M.: Proposal of an Assessment Model for New Product Development. In: APMS2012 – International Conference on Advances in Production Management Systems, Rodos Palace hotel, Rhodes, Greece 24-26 September 2012
5 Mark P., Aulkb P., Curtis R., Chrissis M., (1993) Capability Maturity Model, Version 1.1. Software Engineering 7 institute.