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De Toni A. F. (University of Udine)

Nassimbeni G. (University of Udine)

Maierotti M. (University of Udine)

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# PRODUCT DEVELOPMENT IN THE ITALIAN EYEWEAR DISTRICT: OPPORTUNITIES AND THREATS FOR SMEs

Alberto De Toni \*, Guido Nassimbeni ° and Marco Maierotti ^

Dipartimento di Ingegneria Elettrica, Gestionale e Meccanica  
Università di Udine, Via delle Scienze 208, 33100 Udine, Italia  
\* tel: ++39-432-558330, e-mail: detoni@uniud.it  
° tel++39432558330, e-mail: nassimbeni@uniud.it  
^ tel. ++39 435 71074 e-mail: maierotti\_perarolo@libero.it

## Abstract

The eyewear district is one of the Italy's most important local manufacturing systems. As with other districts, it is going through a phase of profound transformation: various producers are rationalising the local supply base or internalising some activities. One of the main elements of weakness of the local system concerns the New Product Development activities (NPD), where nowadays technological and managerial innovations adapted to the new challenges are required. This paper presents the initial results of a research project whose objective is to identify possible instruments and practices for NPD improvement within the SMEs of the eyewear district. On the bases of empirical evidence collected from of a sample of local enterprises, the main problems were detected and a methodology targeted at the restructuring and innovation of NPD activities is proposed.

**Key words:** product development, industrial districts, eyewear industry

## Introduction

The eyewear district is one of the Italy's most important local manufacturing systems. The district is characterised by the presence of some large-sized companies (the top four world-wide leaders are located here) and by a network of medium and smaller-sized enterprises, usually subcontractors of the larger ones. As in other districts, it is going through a phase of profound transformation. In the past, the district formula enabled the Italian producers to achieve cost advantages and mix and volume flexibility. Today this formula is showing difficulties in facing the global market which requires the producers to shorten product development time, produce new models faster and more frequently, and differentiate the product (especially the quality and design) from that of international competitors, who are stronger in terms of innovation (Japan) and costs (south-east Asia). In these aspects the local system is often inadequate, to such an extent that various producers are rationalising the local supply base (often extending their sourcing area to abroad) or even internalising parts in order to achieve a greater control over quality, times and costs of the process. One of the main elements of weakness of the local system, and in particular of the SMEs, concerns the New Product Development activities (NPD), where technological and managerial innovations adapted to the new challenges are required.

While the larger units are generally able to innovate their NPD activities, the small ones denounce inertia and delays imputable mainly to deficiency in managerial resources. In this paper we present the first results of a research project whose objective is to identify possible instruments and practices for NPD improvement within the SMEs of the eyewear district. The study is not only addressed to units that produce or assemble the finished product, but also to the greater portion that operates as subcontractors. The main-contractors in fact require suppliers that have the ability to develop the product jointly with them, and therefore possess adequate technological and managerial NPD resources: subcontractors are carefully selected on the bases of their Co-design capability, as well as their capability to rapidly and effectively respond to customer's orders.

## Literature

The theoretical references that have guided the formulation of this research come from two distinct literature streams: one related to "industrial districts" and the other to best practices in product development. In the following section we summarise some points in the scientific debate that were drawn from these two branches of studies and are connected to the phenomenon here analysed.

*Industrial Districts.* As is well known, the first and most important conceptualisation in this field belongs to the work of Marshall (1920) on English industrial districts at the end of nineteenth century. This seminal work sparked a series of studies on districts: "local clusters of numerous, and mostly small enterprises which alternatively compete and co-operate with one another and specialise in particular aspects and phases of production" are recognised and analysed in various contexts (Brusco, 1982; Beccatini, 1987; Pyke et al., 1990; Harrison, 1994; Dei Ottati, 1994; to mention just a few). Among these studies, the influential contribution of Piore and Sabel (1984) must be cited. These authors argue that the history of industrialisation has kept open one major alternative to the system of mass production, namely clusters of small firms, connected by horizontal and vertical competitive and cooperative relationships, able to achieve, through a strong inter-firm division of labour, a collective efficiency even higher than those of the larger-scaled fordist enterprises.

Local systems have therefore played a fundamental role in the industrial development of Italy as well as in other countries, however for some time scholars have been debating their future: in the era of globalisation is the district formula maintaining its vitality, or is it beginning to decline, or is it just changing shape? No unequivocal answer to this question can be found in the literature. On one hand there are scholars who think that globality is showing up all the limits of local industrial systems. These limits can be imputable to the *district enterprise*, such as the difficulty in gaining adequate technology and financial resources induced by its general under-sizing, the consequent delay in the introduction of new technologies and other radical innovations, the weakness of marketing sales systems (Ferrucci and Varaldo, 1996). Other limits are, vice versa, imputable to the network, the agglomeration of these units, whose external economies seem to be progressively weakened. For example many local systems denounce an excessive dispersion of added value and the difficulty in developing combined and coherent strategic moves.

On the other hand we find scholars that consider the contraposition between *global* and *local* only apparent. There could exist instead a clear relation between the firm's competitiveness on the international markets and its territorial roots: the local system constitutes in fact an

irreplaceable sourcing area for new competencies, creativity, and variety. Beccatini (1999) speaks about “re blooming” of industrial districts, whose number continues to grow and whose profit rate has been demonstrated to have grown comparatively higher in the last few decades. A series of studies and empirical evidence supports this perspective (Porter, 1990, 1998; Fabiani et al., 1998; Signorini, 1994).

The literature therefore indicates various positions regarding the perspectives of local systems in the new competitive context. However it is a widely shared opinion that global economy is modifying the traditional territorial forms, changing their inner ties and strengthening their need to open up to the outside (Rullani, 1998).

In conclusion, the local firms, both those that are situated at the end of the production line and those that supply intermediate phases are now urged to make changes on numerous fronts. On one hand, in fact, the local network, that in the past carried out most of the productive work must now be able to make a contribution to a variety of aspects complementary to production. On the other hand, end-producers are ever more aware of the need to rethink the organisation and localisation of the value chain activities. Among these, a place at the forefront must be given to product development.

*Best practices in product development.* A significant number of the studies is concentrated on best practices in product development, that is, practices and methods which make firms good product innovators (see Abdalla (1999) and Griffin (1997)). Analysing these studies we can note that most of these practices are ascribable to Concurrent Engineering tools and techniques. Concurrent engineering (CE) suggests an 'integrated' design approach, that is, a systematic approach to the integrated, concurrent design of products and their related processes, including manufacture and support. This approach is intended to make developers consider all elements of the production cycle right from conception to expedition, including quality, cost, schedule, and user requirements. It requires therefore a co-ordinated effort of the various competencies and organisational functions involved in the development of new products. The main idea of Concurrent Engineering is to integrate all the functions involved in the project, including external ones, that is, suppliers and customers. The most widespread CE tools and techniques - grouped according to their goals - are: 1. reduction of the number of parts, by product Modularization, Standardisation of parts and project Simplification; 2. manufacturability and assemblability, achieved using techniques such as Design for Manufacturing (DFM) and Design for Assembly (DFA); 3. project schedule and development time reduction, where tools such as Work Breakdown Structure (WBS) and Overlapping (OL) can be helpful; 4. product assessment, using Failure Mode Effect Analysis (FMEA) for example; 5. customer satisfaction, evaluated by Value Analysis and Engineering (VA/VE) tools (De Toni et al., 1999). There are many articles listing the advantages of these "concurrent" methods and tools, used in isolation or, preferably, in groups (Maylor, 1997, Ettlé, 1997, Loch et al., 1996). Many of these practices are more effective if the suppliers are involved. Various empirical investigations have shown that supplier involvement in NPD can be beneficial with regard to the quality of new products and the costs and time of their development (see Wynstra et al. (2000) and Dowlatshahi (1998) for a review on this topic). The literature on Concurrent Engineering is abundant, however it appears to us that the potentials and problems of implementation of this approach within small organisations have not been adequately investigated. Some particulars regarding the SMEs should be considered: a) these small firms are not greatly aware of CE principles and their benefits; b) they usually have only limited resources and little technical know-how to re-engineer or continuously improve processes and methods; c) SMEs are often 'forced', indeed usually by their customers, to adopt tools and techniques on an ad-hoc basis; d) SMEs usually lack the

expertise to select appropriate methods and tools from the large amount of CE supporting means.

## **Objectives and methodology**

The eyewear industry is one of the leading sectors in the Italian economy. In 1999 it registered productions valuing around 1.5 billion of € (accounting for more than 70% of all exports). Italy is the leading country for frame production and Italians are among the 4 world-wide leaders. More than 18,000 are employed in more than 1,500 productive units and 80% of this business is concentrated in the area we considered (Anfao, 2000). Indeed the industry has been present in this district for more than a century (the first factory was built in 1878). Traditionally it was characterised by the following aspects: a) high concentration of production units; b) prevalence of small companies; c) intense relations, both competitive and co-operative, between the firms.

The eyewear industry, and obviously also the district we examined, during the last few years have been faced by huge changes. In particular the need has arisen to protect those functions and competencies which have become key in the changed scenario. In the first place, commercial competencies are required since, on the advertising front, the trademark has become the main vehicle for selling. Thus it is essential for the firm to be able to link its name to a well known stylists and designers. Then the need for superior resources and distribution competencies arose. To find a space in the market for its own models it is important for a firm to be able to present itself as having sufficient financial means and adequate volume. Such images are appreciated by the distribution chains and selling points. Significant changes are also taking place in NPD activities, where the ability to develop new products in always shorter times is required, but at the same time guaranteeing the quality standards that distinguish *made in Italy* glasses on the international market. This capacity depends on knowing how to: a) reduce the *time-to-market* (TTM); b) acquire the ability and knowledge needed to create a difference in *Know-How* compared to the rivals; c) adopt organisation and work methods oriented towards product development; d) use computer support technology for the process.

Product innovation is strategically important not only for end producers, but for subcontractors of parts and workings too, as the possibility of promptly changing or customising the product depends also on the design and innovation capability of the supply network. One of the most important vendor selection criteria is therefore its ability to sustain an advanced technical dialogue with the main contractor, quickly adapt to product engineering changes and contribute to product innovation. In other words, the dense network relations that characterise the district situation call for all the participants to pay particular attention to the NPD process. The research project, the first results of which are presented here, aims to suggest interventions that will help in the rationalisation of the phases and activities which lead to the fabrication of eyewear. In greater detail the objectives are the following:

- Throw light on the distinctive aspects of eyewear products and the consequent design and manufacturing problems;
- Map the product development activity singling out the organisational interdependence between the units involved (internal and external), possible overlapping of activities, and the milestones in the process;
- Identify difficulties and problems that the SMEs usually encounter in these activities;

- Propose some instruments and practices of a technological, organisational and managerial nature to carry out the NPD process;
- Test some of this practices in a sample of SMEs ;

As far as methodology is concerned, the research project has been sub-divided into the following phases:

- Analysis of the literature concerning different subjects: industrial districts, best practices in product development, and the eyewear sector and its evolution.
- Mapping and description of NPD activities and identification of the most serious problems. For this purpose data relative to 5 buyer firms and 49 subcontractors gathered during a previous investigation on the evolution of relations with subcontractors in the district (De Toni et al., 1997; Nassimbeni, 1999) were used. This database contains information concerning firms of different sizes working in almost all segments of the market. Thus the sample is able to furnish sufficiently general information on the activities of product development in the district. A further case-study was carried out on a firm renowned for product innovation in order to consider some aspects of the process in greater detail,
- Implementation of some practices and instruments in a sample of SMEs so as to verify their usefulness.

The results presented in this paper regard only the first two phases since the third phase has not yet been completed.

## **Eyewear and its development process**

Here we briefly describe the phases through which eyewear pass during their development, as emerged in the interviews. This summary is deliberately simplified and constitutes a generalisation of a process which can have variations and differences according to the function of the end product, the technology used and the entity of the external resources.

*Design and production particularities of glasses.* They can be described thus:

- The **variety and variability of shape and structure of the product**, as a consequence of three linked determinants. In the first place the strong link to fashion. Eyewear has become almost completely governed by fashion trends. The trademark has become therefore one of the most important competitive weapons capable of profoundly influencing sales and therefore marketing and production policies. The most famous fashion stylists and designers carefully choose the eyewear manufacturers that they will entrust with their brand, privileging those equipped with greater productive and commercial solidity. Sound management of the brand calls for investments in research and development and a solid commercial structure. Collaboration between stylist/designer and producer is no longer just occasional as it was in the past. It has become a medium to long-term investment. In the second place, the life cycle of the product, which is determined by seasonal variations in fashion elements (form, size and colour). Manufacturers now perceive the need to update product designs faster in an attempt to predict market demands. Currently, the larger groups renew approximately 40% of their production line every year. Finally, there is a growing segmentation of the market,

as a function of a series of factors such as age, sex, life style, function of the product, etc. The eyewear market has progressively changed: product standardisation has been replaced by strong differentiation policies. Thus, the complexity of forecasting, product design, manufacturing planning and control phases has been enhanced;

- The **variety of technology** used, as a consequence of the variety of materials used in distinct (plastic or metal glasses) or even in the same model (e.g. glasses with plastic rings and metal temples or models made entirely of plastic but with metal decorations),
- The **high number of processes** required and the incidence on the workforce costs.

*Product development activities.* The above mentioned specificity dictates a careful design approach, which should take into account all constraints due to the complexity of production: product and process engineering phases must be closely integrated. As an example, the principal activities involved in manufacturing metal-framed glasses, the foremost product, are the following. The first step is *product concept* resulting from a market analysis and has the objective of formalising the initial concept of the new product. Next comes *prototyping* when an actual model is constructed according to the original design, so the new-style eyewear becomes tangible. The similarity between the aesthetic idea of the product and result actually obtainable can be verified from the prototype while, at the same time, showing up processing difficulties and identifying the specifications needed. Then *product and tools design* starts. The new model is broken down into its various components (temples, rings, end-pieces, nose-pieces, bridges, hooks) and the technical specifications and a detailed design for each is made. At this point the *1<sup>st</sup> supplier involvement* takes place. It can assume different forms depending on the buyer's design choice and the supplier's profile: a) suppliers of catalogued semi-manufactured component, b) suppliers of designed or co-designed components, c) suppliers of parts entirely designed by the buyer. Regardless of the amount and type of involvement, this is the moment when co-design begins. Some suppliers are invited to take part in the development activity and the type and characteristics of the components to be manufactured are disclosed to them. Next follows the *cost analysis and part rationalisation* which consist in an estimate of the manufacturing cost, a check that could suggest ways to rationalise the components defined in the previous phases. For example: an ad hoc component might be replaced by one already available on the supply market, different materials can be selection, the product mix can be limited, etc. When the design phase has been concluded a decision must be taken on which parts will be made externally and by which suppliers (*sourcing decision*). This involves not only suppliers of parts but also small workshops capable of carrying out specific workings. Once the designing activities have been completed and the models chosen, internal or external manufacturing begins (*2<sup>nd</sup> supplier involvement*). It is important to contact the suppliers quickly so as to reserve their productive capacity, fix the working times and delivery dates. At the same time as the semi-finished products are being manufactured the tools and equipment for welding must be made. When the parts have been delivered the cycle of *assembly* begins, i.e. welding of the ring pieces together to which then the temples are joined to complete the samples. Finally the operations of finishing, packaging and distribution through the sales channels are carried out.

*The macro-phases.* The preceding activities single out three macro-phases:

- **Creative phase.** This consists of mainly creative activities aimed at the formalisation of the aesthetic content of the finished product. The principal moving spirit is the "creator", that is, whoever has created the new model, taking care of the stylistic aspects, the innovations derived from shape, semi-worked particulars, and colour variations.

- **Design (technical) phase.** Converts the product concept of the new model into a project containing the technical specifications and tools necessary for its manufacture.
- **Manufacturing phase.** The tools needed to produce the new model are realised and tested and its manufacture arranged.

These phases involve a large area of overlapping. In fact it is important that the contribution made by the “creators” should benefit from contact with the designers, just as it is necessary for the design project to be successively verified with the people responsible for production.

Figure 1: The Flow Chart of activities

*Current problems.* This phase of mapping and describing the activities of product development enabled us to indicate the typical problems faced by the small and medium sized firms investigated when carrying out their work. Most of all there are organisational and managerial problems connected with the process phases, and can be summarised as:

- **Poor or approximate formalisation** of the steps in product development. We think that significant improvements in the planning performances of the SMEs could be obtained only through a clearer reconstruction of the phases, activities and tasks of the plan.
- **Weak connections and overlapping** between the creative, technical/design and productive phases. Instruments for organisational co-ordination that would link the different competencies and responsibilities are lacking. As was seen the overlapping of some activities not only is possible, but even necessary, though, in the firms examined, only a few ones have systematically tried to achieve it.
- **Limited monitoring** of the temporal milestones. We believe that project management instruments able to distribute over time the activities and monitor their progress could be very useful.

Side by side with these problems there are others related to the technological and managerial techniques used. Among the 49 companies surveyed, only 4,1% have an EDI or Internet-based link with the supplier and 2,0% with the customers. The level of use of modules and standardised components evaluated on a 5-point Likert scale is equal to 1.76, and that relative to DFM and DFA practices is 1.91. The use of techniques for defection analysis is equal to 1.3. Computer Aided Design and Computer Aided Manufacturing instruments are present in 8.2% of the firms investigated, though it is planned to introduce them in respectively 28.5% and 16.3% of the cases. Three factors hinder their use: 1) the level of investment, judged by those interviewed too high with respect to the volume of products manufactured, 2) the low level of importance attributed by entrepreneurs to the design phase; 3) the difficulties they have in understanding the potentials of such systems.

### **Innovate product development activities in the SMEs: some suggestions.**

Downstream from the analysis of the NPD processes in the sampled SMEs, we tried to individuate possible interventions aimed at re-appraisal and re-organisation of these activities. In our opinion these interventions should develop in three phases:

**1. Process Description.** This consists in the identification of the phases, activities and tasks throughout the entire development process. As pointed out above, frequently the sequence of activities and the corresponding responsibilities are vague, not formalised and confused.



However it is important that all organisational units involved in NPD have a clear understanding, and not just a sectarian view, of the complete process. The first step is then to separate the process into basic activities (Work Break-down Structure) so as to obtain the flow chart indicating their sequence.

**2. Process re-design.** The aim of this second action is to compile a GANTT diagram indicating the activities, times and any possible overlapping. Following the interviews we tried to identify the activities that constitute the critical path, and possible overlapping. The results are shown in Fig.2. On the basis of the available data we also tried to identify the milestones in the process, that is, the main appointments which determine the temporal evolution of the process. These are:

- At the end of product design. This is the moment at which the “creator’s” drawing (usually consisting of a greater number of models than will be eventually manufactured) has been re-elaborated and transformed into technical specifications. Thus the new model has been completely defined and is now ready for industrialisation.
- Upstream from the start of production. At this point the costs and times (based on the suppliers’ lead times) as well as the technological cycle of the project have been estimated, and the decision made regarding work that must be carried out externally. It is useful to examine the situation at this moment to see whether the model is viable in terms of times and costs. It is also the right moment to verify if the design can reconcile the creative work of the stylists with the economic and productive constraints put forward by the technicians.
- Upstream from assembly. The third milestone is represented by the moment at which the activities of production of the semi-manufactured items and the construction of the tools needed for welding, and consequently the assembly of the semi-manufactured pieces, have been concluded. This is a most important point because if even one single activity (fabrication of the semi-manufactures items and tools) has not been concluded, inevitably, this whole phase must be postponed.
- Start of the distribution phase. The last checking step is situated at the end of the production phase, that is, before selling the product to the wholesaler. This passage should be taken into consideration right from the first phases in the NPD process for two main reasons. First, the distribution lead time can be significantly high for small producers, since they generally have not got their own selling points (this notably increases the risk of not punctually meeting the launching date on the market). Second: the high cost of distribution.

**3. Process innovation,** that is the implementation of some practices targeted at a more efficient management of the NPD. These practices can be sub-divided according to the area of intervention:

- *Organisational area.* In many of the companies investigated it has become necessary to move beyond the present functional structure and adopt matrix forms, that is, introduce project teams guided by a project manager. It is important to instruct and formalise development teams able to integrate the contributions made by experts from different units through the NPD process. Above all, this involvement must regard the external “creators” (stylists) and be extended also to the suppliers. Therefore, a partnership logic with external resources should be developed, aiming at more stable and participative relations.

- *Managerial area.* Some of the *Concurrent Engineering* techniques, such as Failure Mode Effect Analysis, Quality Function Development, DFM/A tools, together with *Project Management* techniques could be very useful. The joint development of product and process require the setting up of adequate informatic resources and organisational tools (circles, committees, teams) that will help circulate information within the firm and its network. An intense flow of information (i.e.: concerning the technological potentials and the capacity constraints of the downstream phases) is particularly important during the first phase of the NPD, when it is easier to introduce modifications and the impact of the decisions on the cost is greater. In this sense the use of prototyping, which lessens the risk of error and helps design, is of great importance.
- *Technological area* The adoption of some technologies to support development, in particular CAD and CAE and interfaced with NC systems, can make NPD much quicker and more efficient, so error and modifications can be forestalled. These technologies that at present are mostly used in making moulds could be extended to other phases. Nowadays the costs of CAD and CAM instruments is limited and is well within the reach of SMEs. Another area in which it would be advisable to invest is communication technology. Data communication networks speed up information exchange between buyers and suppliers and establish direct contact with the customers. In this regard, an on line catalogue linked to an efficient dispatch system would bypass the long and slow distribution channel which the SMEs today rely.

Fig. 2. Overlapped phases and milestones of NPD

## Conclusions

The aim of this research project is to point out some hints and suggestions on how to rationalise phases and activities involved in eyewear development and manufacturing process. In this area the SMEs are heavily solicited as much from the industrial market as from the end market. On the bases of an analysis of product development activities in a sample of firms, the specificity of this product as well as the main developmental phases were identified. The problems and limitations the SMEs usually face in this process are highlighted and an appropriate methodology proposed. The suggested rationalisation does not require the investment of large financial resources, being mainly based on interventions aimed at improving the allocation and use of available resources. The selfsame small size of the firms, to which this study is primarily addressed, favours some interventions providing easier and more direct processes of co-ordination and communication. However the changes proposed require an increase in management know-how and the capacity to exploit the opportunities offered by the new technologies, in particular design and communication. These changes are not easily understood and achieved for entrepreneurs who have a mostly productive culture, but the future of many small industries probably depends on them.

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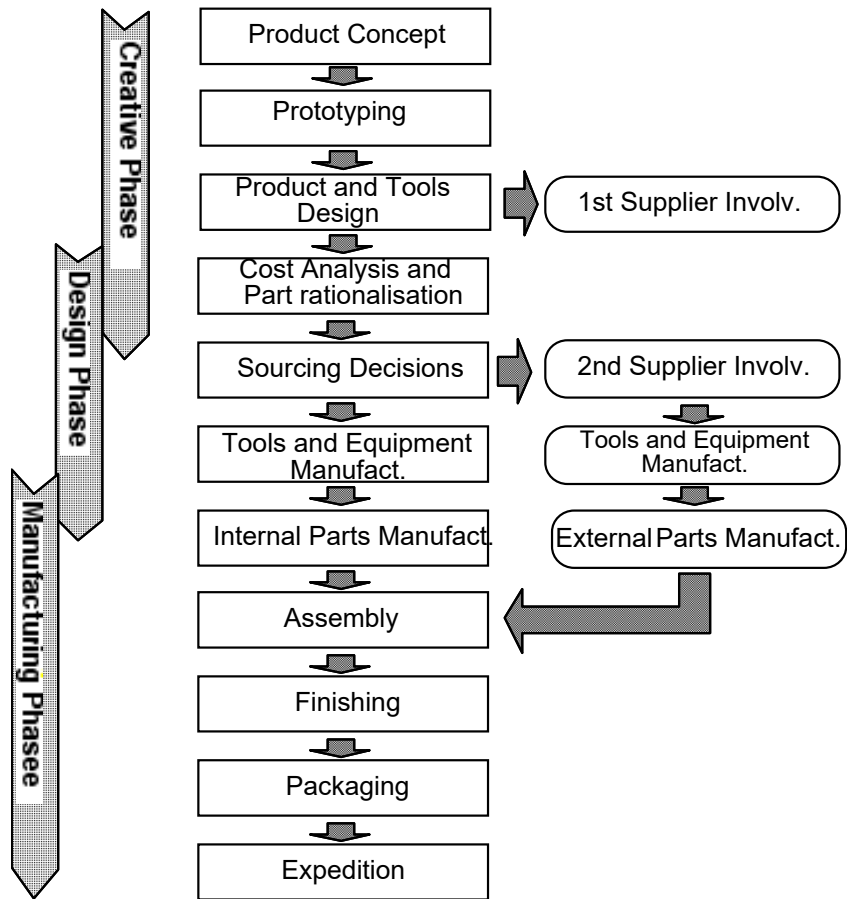


Figure 1: The Flow Chart of activities

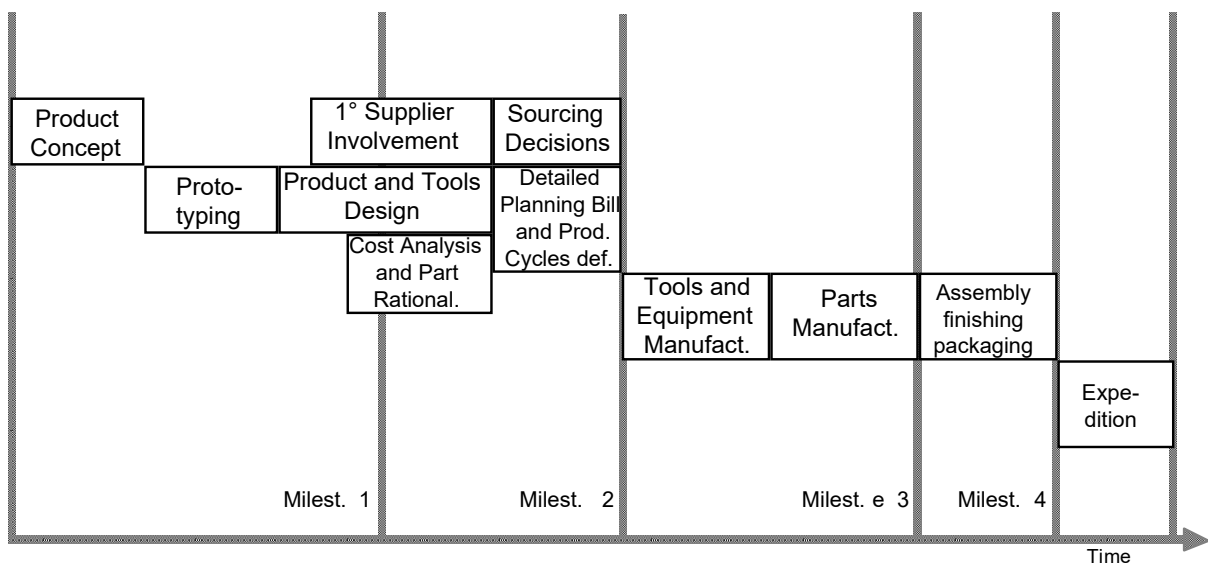


Figure 2. Overlapped phases and milestones