From customer needs to partners network specifications: (Design-Manufacturing-Supply) needs matrix

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Abstract: New Product Design (NPD) projects go sequentially through various phases of a new product design project: customer needs clarification, product specifications, design process, partners selection. Such sequencing ignores possible impacts of partners on the way that the product will be designed and realised. This paper explores early consideration of partners network for building up relevant partnerships in NPD projects. We attempt to highlight the gain of visibility through a suggested Design-Manufacturing-Supply Needs matrix. The new product is decomposed into three parts and by using needs matrix early in the design process, it will be possible to define design roles and profiles of needed partnerships and therefore of needed partners.

Keywords: Early design phase, NPD project, Co-design, Network specification

I. Introduction

Charles Fine in (Fine, 2003) proposes a method, called Double Helix, to define clearly the firm' strategy based on its relationships with suppliers, customers and its market position. The design process starts and progresses until the partners' selection phase; partners with whom the *focal company* should collaborate. The focal company is that studied company within a complex network linked with its direct customers and suppliers. Vonderembsea resumes the design of supply chain as an issue of product design: "Supply chain design should be, in part, a function of the product characteristics and expectations of the final customer", in (Vonderembsea et al., 2006).

Recently some considerations of network of partners emerged in the scientific literature. NPD project improvement through partners consideration seems to be quite promising either for academics or for organizations. It has been shown that the nature and type of interactions between different actors during the product design process often affects the nature of the final product and its subsequent manufacturing (Sharifi et al., 2002). We observe a gradual shift from intra organizational to inter organizational consideration of the design function in order to enhance organizational and product performance. A product design process is an iterative process. Performing design activities means redefining and redesigning. Customer's requirements, stakeholder's interpretations might be reviewed and redefined because of some appearing incompatibilities. Obviously coordination and communication are essentials to cope with these iterative process executions and they represent a confirmed mean of NPD improvement. In (Zolghadri et al, 2008) the parallel modelling of product and network development has been initiated. Authors outlined the necessity of parallel consideration and evolution of product specification and network characterization for enhancing NPD project performance.

However it still remains some lack of effective analysis tools, helping managers to get visibility on how the partners' profile impacts its future product. It is necessary to be aware of partners' impact on product, but it is necessary to have tools allowing to build effective network of partners in parallel with the product design. The aim of this research reported partly in this paper is to analyse progressively the way that customer needs lead to network specifications enabling the focal company to make right choices in terms of partners. The article is structured as follows. Next section discusses the relationships between the product design and network design. Section three presents the Design-Manufacturing-Supply needs matrix and discusses the way that this matrix supports decision-makers. Some conclusions will end the paper.

II. Network of Partners Development & New Product Development (NPD) projects

The effectiveness of new product introduction is a key competitive capability of companies. Of outmost importance to this capability is to focus on its core competence and delegate other functionalities to other members of the network thanks to their specific know how. Partners are selected for their specific skill and know-how. These partners may be *consulting companies*, *sub-contractors*, *suppliers, research centres and universities*.

(Booz et al.,1982) suggest 6 major classes of products: New to the World, New to the Company, Additions to Existing Product Lines, Improvements in/Revisions to Existing Products, Repositionings, Cost Reductions. Nevertheless this classification does not consider the way that collaboration with partners could be necessary. According to the kind of innovation undergone in the product, it induces a specific behaviour of the focal company regarding its partners. That is the reason why, we suggest decomposing the product into three parts according to the degree of the possessed knowledge about them: Innovative part, Improvable part, Standard part (see Table.1).

Product parts	Defined as…
Innovative part	Undefined components to design, not yet elaborate, without precise specifications, thus requires a consequent investment for its design and its control, which according to the situation will be supported either by the company or in collaboration with partners or entirely externalized.
Improvable part	Known components, but not corresponding to the current needs or not enough, because of organizational, human or technological developments, leading to an effort of adaptation and design , with a possibility of calling up external resources to Focal Company.
Standard part	Known component, whose design is well known, optimized requires a work of adaptation and dimensioning.

Table 1: Definition of product parts

In a NPD project, it will be then necessary to design and develop the network step-by-step according to the class of components required for the global product. NPD project consists in different phases that we match with network design and development project. The target is to initiate the build up of network simultaneously with the product.

Our first analysis was to observe and deduce the parallelism during product specification phase. (Ulrich et al.,2003) define six phases of the generic development process: planning, concept development, system-level design, detail design, testing and refinement, production rump-up. During the concept development phase "alternative product concepts are generated and evaluated and one or more concepts are selected for further development and testing". The system-level design "includes the definition of the product architecture and the decomposition of the product into subsystems and components". Finally, the detail design phase "includes the complete specification of the geometry, materials, tolerances, of all of the unique parts in the product and the identification of the standard parts to be purchased from suppliers".

We focus in NPD phase called: concept development (see figure 1). *Customer needs* obtained by interviews with potential purchasers and by observing similar products in use. They include hidden needs, those that customers are not aware of or accept them without question and explicit needs, those generally expressed and reported by potential purchasers. The customer needs are then depicted into wished *product specifications.* Product specifications are established through product benchmarking of concurrent products. Target specifications are essentially a wish-list tempered by technical constraints. We suggest parallel analysis carried out to check whether these specifications imply collaboration, if yes we must know at which

level. This additional step will be called: *Identify expected collaboration*. At this step the focal company would be able to define its partnership strategy according to its internal expertise and external required one, allowing more precise specification based on market analysis. *Generate product concepts***:** development of a various product concepts to identify what types of products are possible in term of technicality and best matching to the announced target specifications. Simultaneously, it becomes possible to identify collaboration needs in design, manufacturing and supply. *Select product concept*: Through assessment and comparison between attributes the experts finalizes the choice and adopts one of the suggested concepts concluding hence on set of *final specifications*. Set partners *technical profiles: once* the final specifications established ensuring technical feasibility, the implied collaboration needs would be also identified by the Design, Manufacturing, Supply needs approach introduced hereafter.

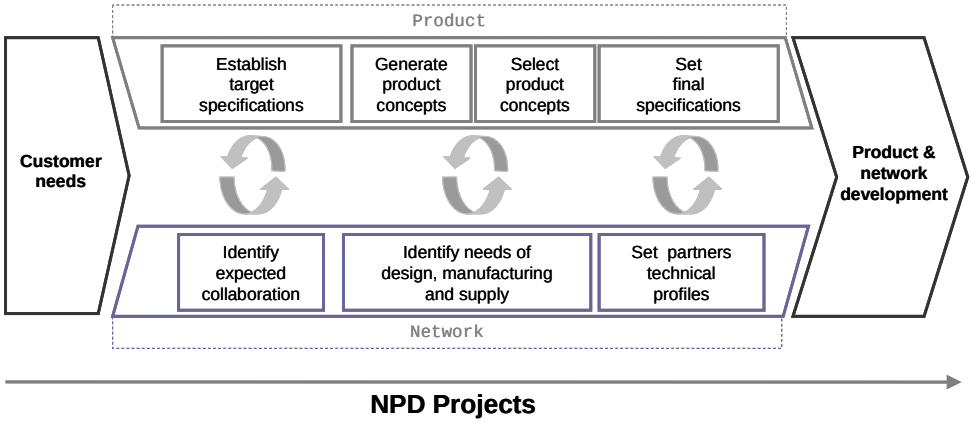

Figure 1: Parallel launching of NPD projects

III. Design-Manufacturing-Supply Needs Matrix

Concepts are generated from different kind of specifications; we quote *Functional* (Forces involved, Energy need, and used materials), *manufacturing* (production of components, purchase of components, assembly) *Economic* (design costs, development costs manufacturing costs) and *Aesthetic:* (Fashion, Future expectations). In order to satisfy that specification several know-how and skills are required in various fields such as: *Marketing, Industrial design, Mechanical engineering, Electronic engineering, manufacturing processes, Graphic arts Packaging design*. The main idea of suggested approach is to situate the contribution of these competencies and know-how in the activities of NPD project phases, namely Design, Manufacturing and Supply. For that, we propose to build for each product concept a *DMS needs Matrix* (see figure 2).

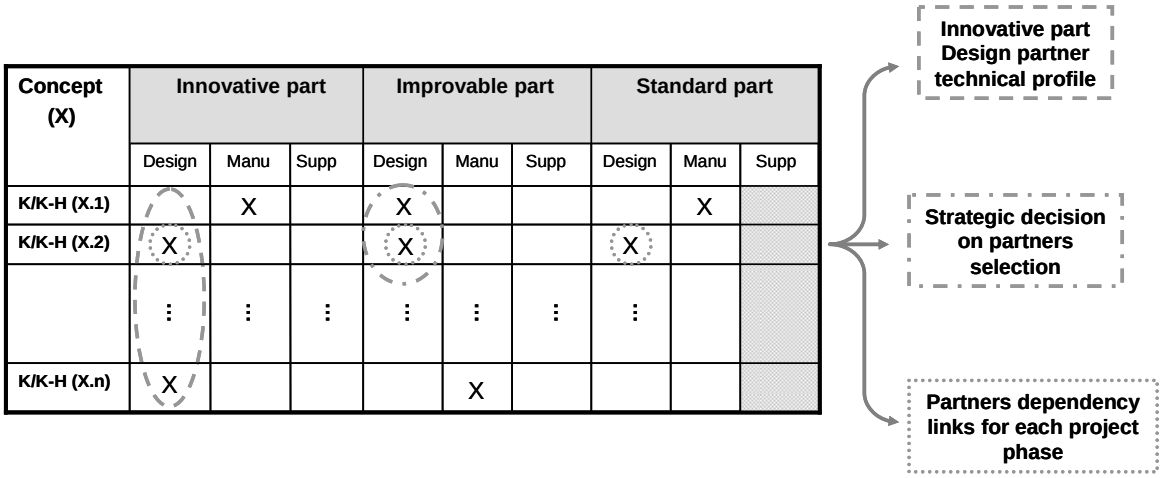

Figure 2: Design, Manufacturing, Supply needs Matrix

The columns represent the various activities (Design, Manufacturing, Supply) for each part (Innovative, Improvable, Standard) of the product. Various lines correspond to Knowledge or Know-How (K/K-H from 1 to n). The same K/K-H can be necessary for various parts and with various activities. An activity can require several K/K-H.

Such needs matrix reveal by a fusion of the corresponding matrices of selected concepts:

- Cumulated competencies by phase constitute the *technical profile* and will be used in the following phase of partner selection to identify the relevant partner for a specific identified need.
- Once technical needs are identified, strategic decisions can be made for each need based on the total or partial involvement of a partner regarding to internal expertise and capability, and based on the choice between a partner who has all the K/K-H needed or one partner for each K/K-H need.
- For each phase we can build the dependency links between the potential partners during the selection phase to ensure a functional and structural compatibility among partners directly or indirectly linked.

IV. Conclusion:

To succeed in NPD projects, early network specification identification from customer needs is relevant for enhancing the performance of the whole project thanks to the anticipating reasoning about the technical profiles of required future collaboration. We suggest the Design, Manufacturing, Supply needs matrix. Once filled, these matrixes allow detecting essential knowledge/know-how and technical profiles of partners. This analysis can be done in a recursive manner from the highest-level concepts into lower-level ones.

The main purpose of this matrix is to offer an extended *visibility* of what is really needed in term of collaboration and potential partners' Knowledge/Know-How. It aims at guaranteeing an overall coherence of the way that the network of partners will collaborate with the focal company. One starts by identifying technical compatibility necessary to the project required during the selection phase. This identified compatibility added to others (time, costs, flexibility, geographic location, etc.) represent a new crucial indicator for managers. In the final paper, the described approach will be applied to a simplified illustrative case taken from bicycle manufacturing.

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