

## Front end of innovation: Generating new ideas

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### Abstract

The objective of this research is to contribute to the improvement of knowledge of the 'front end' or pre-development of innovation, a process that comprises all the activities prior to the formal start of the development of innovation projects. In this aspect, we identify the most relevant 'front-end' techniques that have been developed in the previous literature.

**Keywords:** Innovation, creativity, front end, pre-development.

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## 1. Introduction

Innovation can be defined as ‘the introduction of a new, or significantly improved, product (good or service), process, a new marketing method, or a new organisational method in business practices, workplace organisation or external relations’ (OCDE, 2005, p. 46). Innovation can be applied in different areas of life, such as organisations or the educational system. Previous literature has divided the innovation process into three different phases: an initial pre-development phase (commonly called ‘front end’), the innovation development phase and the launch/marketing phase (Deppe, Kohn, Paoletti & Levermann, 2002). This research focuses on the ‘front end’, a process that composes all activities prior to the formal initiation of innovation project development (Cooper, 1988; Khurana & Rosenthal, 1998). The ‘front end’ is a key factor in innovation (Cooper, 2019) since it is the phase of the process that provides the greatest opportunity to improve the results of the innovation process at a lower cost (Wagner, 2012).

This research tries to answer the following research question concerning the process of predevelopment of innovation: What are the most suitable techniques applicable to the ‘front end’ of innovation?. To solve the scientific problem described above, we propose as an objective in this research: identify and analyse the ‘front-end’ techniques developed in the previous literature.

This paper begins with a review of the ‘front-end’ literature, highlighting the importance of ‘Khurana and Rosenthal’s front end model’. This is followed by a description of the methodology used in this research. The results obtained in this research are detailed below. Finally, a series of conclusions are indicated, as well as a suggested future line of research.

## 2. Theoretical framework

Khurana and Rosenthal (1998) emphasise that the ‘front end’ begins when an opportunity is first considered valuable for a relevant evaluation and ends when it is decided to invest in the idea, committing significant resources to the next phases of the innovation process. According to Khurana and Rosenthal (1998), ‘front end’ activities result in a product concept (clear and aligned with customer needs), a product definition (explicit and stable) and a project plan (priorities, resource plans and project timing). Among the ‘front-end’ models developed in the previous literature, this model by Khurana and Rosenthal (1997,1998) stands out for its relevance in the previous literature. Therefore, we have made a detailed description of each of the phases that make up this model: creative idea, product definition and project definition.

### 2.1. Phase 1: creative idea

This phase is divided into three distinct sub-phases.

#### 2.1.1. Sub-phase 1: preliminary identification of opportunities

In this sub-phase, the company seeks to identify opportunities that can be pursued through a combination of management, market and technological forces. However, organisations do not always use systematic approaches to collect information and make decisions in this phase, but often rely on available information (Albar & Jetter, 2009). In order to identify relevant opportunities, a fundamental activity in this pre-phase is environmental prospecting.

#### 2.1.2. Sub-phase 2: idea generation

This sub-phase refers to the birth, development and maturation of a concrete idea in a creative process that is not yet well understood (Paulus, 2000). In this ‘front-end’ phase, ideas are constructed, rejected, examined, debated, combined or modified and may go through several iterations before moving on to the next phase of the process (Koen et al., 2001). Despite the importance of this phase in the innovation process (Langerak, Hultink & Robben, 2004), the problem of companies is not usually

to generate ideas since there are many of them within organisations (Montoya-Weiss & O'Driscoll, 2000).

### **2.1.3. Sub-phase 3: Market/technology analysis**

At this stage, an idea is assessed in a preliminary way to confirm whether it is worth further development. Generally, at this stage, decision-makers have uncertain and incomplete information at their disposal, so they often tend to make assessments of uncertain markets and technologies. Therefore, mechanisms for identifying and separating the most promising ideas are considered a key factor in innovation; poor implementation of this phase often leads to high-cost problems in subsequent phases of the innovation process (Broring et al., 2006; Elmquist & Segrestin, 2007; Khurana & Rosenthal, 1997). Despite this, in many companies, enormous efforts are made to encourage creativity, although without a market-oriented discipline (Stevens, Burley & Divine, 1999).

### **2.2. Phase 2: product definition**

The definition of the concept of innovation that is pursued in the 'front end' makes it possible to evaluate, on the one hand, whether an idea deserves further exploration and, on the other hand, facilitates the understanding of which areas and how to prioritise in the following phases of the innovation process (Khurana & Rosenthal, 1997; Kohn, 2006). However, the creation of a detailed concept is difficult and sometimes companies fail to develop it (Kohn, 2006). The information requirements and criteria to be used in the definition of the concept in each 'front-end' project vary depending on the nature and type of concept, as well as the attitude towards risk of the decision-makers. In this aspect, it is advisable to have project protocols, i.e., parameters that a concept may have such as characteristics, priorities, client segments, etc.

### **2.3. Phase 3: project definition**

This 'front-end' phase defines the workloads, budgets and responsibilities of the following phases of the innovation process (Archer & Ghasemzadeh, 2004). According to Stockstrom and Herstatt (2008), a correctly carried out planning favours the efficiency and effectiveness of the rest of the phases of the innovation process by facilitating communication between the development team and the adherence to the project plans and budgets. However, Stockstrom and Herstatt (2008) do not give such a significant importance to this phase, since they argue that it is more appropriate to have the ability to react quickly to the changes that will occur in the formal process.

## **3. Methodology**

To conduct this research, we have conducted a detailed review of the previous literature in the 'front end'. The choice of sources to carry out a literature review is a process of inclusion and exclusion of articles; therefore, we have followed some steps to include the appropriate literature. In this sense, we have made special emphasis on the most relevant sources of empirical research in innovation provided in the literature review of Page and Schirr (2008): *Academy of Management Journal*, *IEEE Transactions*, *Industrial Marketing Management*, *International Journal of Research in Marketing*, *Journal of Business Research*, *Journal of International Marketing*, *Journal of Marketing*, *Journal of Product Innovation Management*, *Journal of the Academy of Marketing Science*, *Marketing Letters*, *Technovation* and *R&D Management*. Also, for the search of articles, we have used several combinations of words related to the 'front end', such as idea, pre-development or creativity.

## **4. Results**

As a result of this research, we have identified several techniques applicable to the 'front end', classified into six model typologies.

#### **4.1. Linear models**

These models follow a linear and sequential process based on a rational logic that tries to control the process in a very fixed way. Organisations that use these methods tend to provide less funding for radical innovations (Sperry & Jetter, 2009). Identified techniques: Stage Gate™ (Cooper, Edgett & Kleinschmidt, 2002; Khurana & Rosenthal 1997), SCR (Cooper et al., 2002), Fast Track (Cooper et al., 2002), Full Process (Cooper et al., 2002), Compression (Cunha & Gomes, 2003), Waterfall model (Royce, 1970) and the compression model (Eisenhardt & Tabrizi, 1995).

#### **4.2. Recursive models**

These models are based on flexible iterative learning, since technical and market requirements are not usually fixed and explicit (Sandmeier et al., 2004; Zomerdijk & Voss, 2011). Identified techniques: New Concept Development - NCD (Koen et al., 2001), Technology Stage Gate TSG (Ajamian & Koen, 2002), Integrative (Cunha & Gomes, 2003), Deft Product Innovation (Buijs, 2003) and chain-linked model (Kline & Rosenberg, 1986).

#### **4.3. Evolutive models**

These models, in an initial phase, focus on learning in the face of very poorly defined requirements, and are more appropriate in highly innovative environments (Elmqvist & Segrestin, 2007). Techniques identified: Serial experimentation - rapid learning (Thomke, von Hippel & Franke, 1998), Complex adaptive system (McCarthy, Tsinopoulos, Allen, & Rose-Anderssen, 2006), Agile (Myer, 2008), Flexible (Cunha & Gomes, 2003), Nobelius and Trygg's model (2002), Montoya-Weiss and O'Driscoll's model (2000).

#### **4.4. Selectionism**

These models pursue several different approaches and then choose one of them. Identified techniques: Selectionism (Sommer & Loch, 2004) and Parallel (Dahan & Mendelson, 2001; Loch, Terwiesch & Thomke, 2001).

#### **4.5. Trial and error models**

In these models, the initial steps are not linear nor ordered nor stochastic, emphasising trial and error. Massively parallel experimentation may be the ideal strategy in certain contexts, especially if the value of time is relatively high compared to the cost of an experiment (Thomke et al., 1998). Identified techniques: Serial experimentation - minimal learning (Thomke et al., 1998), Chaoti (Cheng & Van de Ven, 1996) and improvisational (Cunha & Gomes, 2003).

#### **4.6. Sectorial models**

These models have been developed specifically for one sector. Identified techniques: Eco-innovation (Eleiche, 2010), nanotechnology (Oliveira, Phaal, Probert & Cunha, 2010; Heubach & Warschat, 2010) and tourism (Dalton, Lynch & Lally, 2009).

### **5. Discussion and conclusion**

In this research, we have identified and analysed the most relevant 'front-end' techniques that have been developed in the previous literature. In that sense, we have identified several techniques applicable to the front end, classified in six typologies of models: linear, recursive, evolutionary, trial and error, selectionism and sectorial models.

Previous literature has developed a great variety of 'front-end' models based on different visions of the level of formalisation and flexibility that this process should have, as well as the degree of uncertainty that each 'front-end' project has. These models try to manage in the 'front end' the interrelations between searches for creativity and the efficiency of resources, given that both objectives have different strategies (Sandmeier et al., 2004). For this reason, certain authors pointed out that there is no single 'front-end' model applicable to all organisations (Nobelius & Trygg, 2002), and therefore each project must be managed depending on specific factors. As a result, greater flexibility is required in the 'front end' than in the rest of the innovation process (Nobelius & Trygg, 2002). In that sense, Biedenbach (2011) states that a standardised project definition of the 'front end' leads to certain conflicts (e.g., strong tension between the different combining capacities). On the other hand, Oliveira et al. (2011) suggest that there are two 'front end' attributes that need to be customised: the development activities and the approach to decision-making.

Likewise, it should be noted that different 'front-end' models developed in the previous literature identify different phases/results in the 'front end', and there is no homogeneity in the previous literature in this aspect. For example, Markham and Lee (2013) defined as a success factor of the 'front end' that these phases always carry the same order, while Koen et al. (2001) highlight that depending on the 'front-end' project, different sequential orders in the phases can be followed.

Moreover, the 'front-end' models developed previously are based on the excellent execution of the different tasks/activities by treating this process as a static and isolated phenomenon. Therefore, previous research does not provide a perspective of sequential phases that organisations must follow to optimise the 'front end' ('maturity model'). A comprehensive maturity model of the front end would help organisations to define sequential action plans to improve the front end, with the model having to be personalised for each specific case.

Organisations and the educational system can use the reflections of this research to improve their innovation results.

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