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FRONT-END DA INOVAÇÃO: PAPÉIS E MECANISMOS DE INTEGRAÇÃO

**FRONT-END OF INNOVATION: ROLES AND INTEGRATION
MECHANISMS**

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SÃO PAULO
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the strength to face their challenges,
overcome their weaknesses and fulfill
their dreams.

For my father, who is my example of
a businessman.

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ABSTRACT

The Front End of Innovation (FEI) is the early phase of the Product Development Process, responsible for the concept generation and an important driver of innovation success. The FEI is characterized by roles' dynamism, ambiguity, and uncertainty. Several authors divide the FEI into other sub-phases in order to organize its activities, roles, and understand the function of each role. Despite the growing research about the FEI in recent years, there is a need for further research on the theme to better understand the dynamics and help to reduce the uncertainty in the critical concept phase. The formal processes designed for the front end are insufficient, the rules and roles are not fully described, and it is necessary to balance the interactions between the activities in the FEI to get a better-structured New Product Development – NPD – later. The main FEI models developed at the literature have discussed some key roles such marketing, engineering, customers, but they do not discussed the role of design, which is critical in creative activities which, in turn, are the nature of the new product development process. The literature also has not discussed the external integration in the FEI, that is, how the Brand Owners integrate the partners, especially the suppliers and design agencies, in this critical and uncertain phase. To tackle this issue, this research aims to examine the FEI in a dynamic industry, examining the integration of roles in an iterative process. The objective of this research is to identify the roles that play in the Front End of Innovation and the mechanisms of integration, whether internal through cross-functional teams; or external through interfirms integration. The main question that guided this research is “What roles are involved in each FEI activity and what are the mechanism that integrate these roles in the FEI?”. This is qualitative and exploratory research, based on multiple-cases-studies. For this study, the packaging industry was selected because of its value chain in the

concept phase, which has a complex set of relationships among its parties, Brand Owner, Design Agencies and Packaging Producers. The consumers buy the product by the performance of the same and also by the packaging. Packaging is considered a second product at the point of sale and a vital buying decision factor. Brand Owners understand that they need to integrate suppliers into the FEI to assist them in identifying opportunities, ideation, and conceptualization. Five brand owners were interviewed, and the FEI has been divided into five activities: Opportunity Identifications and Analysis, Idea Generation, Idea Enrichment, Idea Selection, and Concept Development. The most executed activities are Opportunity Identification and Evaluation – OIA (with 92% of their tasks performed by the 5 Brand Owners) and Concept Development – CD (with 96% of their functions performed by the 5 Brand Owners). This is due to two reasons: because the OIA is the initial phase, quite uncertain, the Brand Owners seek to perform the maximum tasks such as participation in fairs, congresses, formation of research groups and agreements, to identify opportunities and partnerships; and because the CD is the final phase of the FEI, a step prior to the development process itself, the project is already matured, making it more natural to perform tasks such as feasibility of plans with regards to manufacturing, marketing and sales, technical requirements; and economics. The phase that had the most integration of partners is the OIA and IG, and the stage that had the least integration of partners is that of IE. The Opportunity Identification and Idea Generation are activities that most require the collaboration of the partners because the Brand Owner alone cannot be in all events, not being able, therefore, to identify and create all possible ideas. Concerning Idea Enrichment being the phase with less collaboration of partners, the justification is due to the constructs defined in this research, which measure this activity through the use of IT systems. It is suggested that in future research, other

variables be set to measure the Idea Enrichment phase. The managerial contribution of this work is the description and the organization of the roles in the FEI, explaining how different players work in each activity of the FEI. Choosing the correct relationship among players, it will be possible reduce fuzziness and uncertainty, changing from a fuzzing phase to a more formalized phase.

KEY WORDS: Front-End of Innovation, Fuzzy Front End, Integration Mechanisms, Incremental Innovation, Brokering.

RESUMO

O Front End de Inovação (FEI) é a fase inicial do processo de desenvolvimento de produtos, responsável pela geração de conceitos e um importante motor de sucesso na inovação. O FEI caracteriza-se pelo dinamismo, a ambiguidade e a incerteza dos papéis. Vários autores dividem o FEI em outras subfases, a fim de organizar suas atividades, papéis e compreender a função de cada função. Apesar da crescente pesquisa sobre o FEI nos últimos anos, há necessidade de novas pesquisas sobre o assunto para entender melhor a dinâmica e ajudar a reduzir a incerteza na fase conceitual crítica. Os processos formais projetados para o front-end são insuficientes, os papéis e as regras e não são totalmente descritos e é necessário equilibrar as interações entre as atividades no FEI para obter um melhor estruturado Desenvolvimento de Novos Produtos - NPD - depois. Os principais modelos de FEI desenvolvidos na literatura discutem alguns papéis fundamentais como marketing, engenharia, consumidores, mas não discutem o papel do design, crítico nas atividades criativas, que, por sua vez, são a natureza do processo de desenvolvimento de novos produtos. A literatura também não tem discutido a integração externa no FEI, ou seja, como os clientes integram os parceiros, especialmente os fornecedores e agências de design, nesta fase crítica e incerta. Para abordar esta questão, esta pesquisa visa examinar o FEI em uma indústria dinâmica, examinando a integração de papéis em um processo iterativo. O objetivo desta pesquisa é identificar os papéis que desempenham no Front End de Inovação e os mecanismos de integração, sejam eles internos através de equipes multifuncionais; ou externos através da integração entre firmas. A principal questão que guiou esta pesquisa é "Quais papéis estão envolvidas em cada atividade do FEI e quais são os mecanismos que integram estes papéis no FEI?". Trata-se de uma

pesquisa qualitativa e exploratória, baseada em estudos de casos múltiplos. Para este estudo, o setor de embalagens foi selecionado por sua cadeia de valor na fase conceitual, que possui um conjunto complexo de relacionamentos entre suas partes, as Indústrias de Bens de Consumo, as Agências de Design e os Produtores de Embalagens. Os consumidores compram o produto pela performance do mesmo e também pela embalagem. A embalagem é considerada um segundo produto no ponto de venda e um fator de decisão de compra vital. As Indústrias de Bens de Consumo entendem que precisam integrar fornecedores no FEI para ajudá-las a identificar oportunidades, ideação e conceituação. Foram entrevistados cinco Indústrias de Bens de Consumo e o FEI foi dividido em cinco atividades: Identificações e Análises de Oportunidades, Geração de Ideias, Enriquecimento de Ideias, Seleção de Ideias e Desenvolvimento de Conceitos. As atividades mais executadas são Identificação e Avaliação de Oportunidades - OIA (com 92% de suas tarefas realizadas pelas 5 Indústrias de Bens de Consumo) e Desenvolvimento de Conceito - CD (com 96% de suas tarefas realizadas pelos 5 Indústrias de Bens de Consumo). Isso se deve a dois motivos: como a OIA é a fase inicial, bastante incerta, os proprietários da marca buscam realizar o máximo de tarefas como participação em feiras, congressos, formação de grupos de pesquisa e convênios, para identificar oportunidades e parcerias; e como o CD é a fase final da FEI, um passo anterior ao processo de desenvolvimento em si, o projeto já está amadurecido, tornando mais natural a realização de tarefas como a viabilidade de projetos em relação à fabricação, marketing e vendas, requisitos técnicos e economia. A fase que teve mais integração de parceiros é a OIA e a IG; e a fase que teve menos integração de parceiros é a do IE. A Geração de Ideias e Identificação de Oportunidades são atividades que mais exigem a colaboração dos parceiros, porque a Indústria de Bens de Consumo, sozinha, não pode estar em todos os eventos, não podendo, portanto, identificar e criar todas as ideias

possíveis. Com relação ao Enriquecimento de Ideias ser a fase com menor colaboração de parceiros, a justificativa se deve aos construtos definidos nesta pesquisa, que medem essa atividade através do uso de sistemas de TI. Sugere-se que, em pesquisas futuras, outras variáveis sejam definidas para medir a fase de Enriquecimento da Ideia. A contribuição gerencial deste trabalho é a descrição e a organização dos papéis no FEI, explicando como os diferentes atores trabalham em cada atividade do FEI. Escolhendo o relacionamento correto entre os parceiros, será possível reduzir a ambiguidade e a incerteza, mudando de uma fase ambígua para uma fase mais formalizada.

PALAVRAS-CHAVE: Front End of Innovation, Fuzzy Front End, Mecanismos de Integração de Papéis, Inovação Incremental, Brokering.

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LIST OF ABBREVIATIONS AND ACRONYMS

ABRE –Brazilian Packaging Association (Associação Brasileira de Embalagem)

FEE – Fuzzy Front End

FEI – Front End of Innovation

NCD – New Concept Development

NPD – New Product Development

DNA – Discovery, iNcubation, Acceleration

PoC – Proof of Concept

PoS – Point of Sale

R&D – Research and Development

RTD – Ready-to-drink

SUP – Stand-up Pouc

1. INTRODUCTION

Building on the work of front-end scholars from the innovation literature, this research called the predevelopment phase as Front End of Innovation – FEI. The Front End of Innovation process – FEI, also called the Fuzzy Front-End – FFE, is the predevelopment phase (Cooper, 1988) which refers to the early stages of the New Product Development – NPD process (Koen et al., 2001; Smith & Reinertsen, 1992), in which is developed the concept of the project; in which it is decided whether or not funds should be invested in order to develop the idea (Moenaert, De Meyer, Souder, & Deschoolmeester, 1995) and the first official meeting of team alignment (Reid & De Brentani, 2004) is made.

In this phase, activities such as identifying opportunities for innovation, identifying customer needs, analyzing competitive products, establishing target specifications, generating product concepts, selecting one or more final ideas, performing economic analysis, and planning the remaining project activities are developed. The main result of the FEI is the mission statement and concept of the project.

Smith & Reinertsen (1992) were pioneers in using the term “fuzzy front end” for the early stages of new product development – NPD. Cooper (1988) has indicated that the predevelopment phase is responsible for idea generation. Later, Murphy & Kumar (1997) expanded the Cooper’s ideation stage, adding three stages to manage technical uncertainty, but technology uncertainty is one of the difficulties of the front-end activities. Other authors such as Koen et al. (2001) and Khurana & Rosenthal (1997, 1998) use the term Front End of Innovation (FEI), because they say that using the term “fuzzy” implies in the difficulty in determining who is responsible for managing the activities at this stage.

Moenart, de Meyer, Souder & Deschoolmeester (1995) investigated the critical information exchanges occurring in the integration of marketing and R&D activities, which affects the success in the front-end of innovation. Khurana & Rosenthal (1997) indicate that the success of innovations can be found in the front-end process, which is the point just preceding the go/no-go decision.

Because at the Front-End, there is confusion about project priorities, incomplete resource planning, and inadequate contingency planning (Khurana & Rosenthal, 1997); it is a long, poorly understood phase, but usually full of opportunities for improvement that can be analyzed quantitatively and transformed into benefits to the companies (Reinertsen, 1999). Management of the front-end and other front-end elements and activities require balance between getting things right and being flexible during NPD execution (Khurana & Rosenthal, 1997) and some crucial decisions of the project are made during this period regarding to the size of the market opportunity, the target customer, alignment with corporate strategy; and availability of critical technologies and resources (Smith & Reinertsen, 1992).

Backman, Börjesson & Setterberg (2007) pointed that in the fuzzy front end, the managers have been neglecting concepts based on customer or market knowledge. Björk, Boccardelli, Magnusson (2010) found some paradoxes about ideation capabilities: firms with an explicit focus on ideation practices experience some negative consequences of the resulting formalization, and then both freedom and limitations on a search for creative solutions can facilitate ideation process. Heising (2012) suggested that managers of project portfolios need to pay attention to the front end, focusing on the strategic setting of ideation, the formalization and institutionalization of the ideation process, integration mechanisms, stakeholder management and ideation culture. Eisenhardt (1989) identified that solutions provided by problem solvers from analogous markets demonstrated

substantially higher levels of novelty, suggesting search across external sources of innovation that were formerly out of scope for most managers of new product ideation.

Several authors divide the Front End of Innovation phase into other sub-phases to organize its tasks, assess and understand the function of each one. Thus, Cooper (1988) classifies the FEI phase into idea generation and screening, market and technical assessment, concept definition, concept development, concept test and concept evaluation. Smith & Reinertsen (1992) subdivide the initial planning activities into three stages: the general nature, the detailed business plan, and a complete product specification, budget, and schedule. Khurana & Rosenthal (1997) present a system view of the front end consistent with growing empirical evidence of the need to simultaneously examine overall product strategy (foundation elements) with project-relevant input such as product ideas, market analysis, and technology options. Koen et al. (2001) developed a circular model to indicate that ideas flow, circulate and iterate across and among five elements (idea genesis, idea selection, concept and technology development, opportunity identification, opportunity analysis).

Among the papers on Front End of Innovation founded in the Web of Science, some focus on knowledge management (Artto, Kulvik, Poskela, & Turkulainen, 2011; Heising, 2012; Oliveira & Rozenfeld, 2010; Stevens, 2014; Verworn, 2006); some discuss the needed competences and capabilities in the FFE (Biedenbach & Müller, 2012; Björk et al., 2010; Murphy & Kumar, 1996; Soukhoroukova, Spann, & Skiera, 2012; Vandenbosch, Saatcioglu, & Fay, 2006) (Murphy & Kumar, 1996; Vandenbosch, Saatchioglu & Fay, 2006; Björk, Boccardelli & Magnusson, 2010; Biedenbach, 2011; Soukhoroukova, Spann & Skiera, 2011; Hirunyawipada & Paswan, 2013).

Other studies focus on organizational structure, cross-divisional teams and

collaborative foresight (Grote, Herstatt, & Gemünden, 2012; Im, Montoya, & Workman, 2013; Rauniar & Rawski, 2012; Smith & Reinertsen, 1992); discussing the operations of integration and the degree of the involved parties such as technology integration (Gerwin, 1993; Montoya-Weiss & O'Driscoll, 2000) Marketing & Technology integration (Brem & Voigt, 2009); Customer Integration (Nambisan & Baron, 2010; Sandmeier, 2009); discussing the characteristics of a specific role such as the role of Marketing (Langerak, Jan Hultink, & Robben, 2004; Schoonmaker, Carayannis, & Rau, 2013). Moreover, one study about interfirm collaboration (Gillier, Piat, Roussel, & Truchot, 2010).

Other studies on FEI also focus on integration: cross-functional teams (Brettel, Heinemann, Engelen, & Neubauer, 2011), MKT- Manufacturing integration (Song & Swink, 2009), knowledge-based project (Akbar & Mandurah, 2014), collaborative foresight (Weigand, Flanagan, Dye, & Jones, 2014), inter-functional culture and link among operations practices (Morita, James Flynn, & Ochiai, 2011); open innovation (Sjödín, Eriksson, & Frishammar, 2011), customer integration (Gassmann, Kausch, & Enkel, 2010).

Despite the growing research about the FEI in recent years, there is a need for further research on the theme to understand the dynamics better and help to reduce the uncertainty in the critical concept phase. The formal processes designed for the front end are insufficient, the rules and roles are not fully described, and it is necessary to balance the interactions between the activities in the FEI to get a better-structured New Product Development – NPD – later. The main FEI models developed at the literature have discussed some key roles such marketing, engineering, customers, but they do not address the role of design, which is critical in creative activities which, in turn, are the nature of the new product development process. The literature also has not discussed the external integration in the FEI, that is, how the Brand Owners integrate the partners, especially the

suppliers and design agencies, in this critical and uncertain phase.

To tackle this issue, this research aims to examine the FEI in a dynamic industry, exploring the integration of roles in an iterative process. The objective of this study is to identify the roles that play in the Front End of Innovation and the mechanisms of integration, whether internal through cross-functional teams; or external through inter-firms combination.

The central question that guided this research is “What roles are involved in each FEI activity and what is the mechanism that integrates these roles in the FEI?”.

The packaging sector was selected because of its value chain in the concept creation phase: there is a dynamic relationship among its parties and, as in other industries involving many players, the interaction among different companies is problematic. These parties are the Consumers Good Industry, which here we call “Brand Owner”, the Design Agencies and the Packaging Producers. In this study, five brand owners were interviewed, and the FEI has been divided into five activities: Opportunity Identifications and Analysis, Idea Generation, Idea Enrichment, Idea Selection, and Concept Development. The consumers of the interviewed companies buy the product by the performance of the same and by the packaging. Packaging is considered a second product at the point of sale and a vital buying decision factor. Brand Owners understand that they need to integrate suppliers into the FEI to assist them in identifying opportunities, ideation, and conceptualization.

This proposal is divided into the following sections: this section about the relevance of this work and the objective. Then, a review on the primary models of the Fuzzy Front End and on the integration of roles; the Method; and the discussion and a proposal of a framework of analysis. At last, the Final Considerations, References, and Appendix.

2. THE FRONT-END OF INNOVATION

The predevelopment phase is the part of the product development cycle before actual development begins and the scholars have called the predevelopment phase as Fuzzy Front End - FFE or Front End of Innovation - FEI.

FEI is the earliest stage of the New Product Development - NPD (Reid & De Brentani, 2004; Smith & Reinertsen, 1992), in which it is decided whether or not funds should be invested in order to develop the idea (Moenaert et al., 1995), and the first official meeting of team alignment (Reid & De Brentani, 2004). FEI is characterized by the activities that come before the formal and well structured New Product and Process Development (NPPD) or Stage Gate™ process (Koen et al., 2001). At the Front-End, there is confusion about project priorities, incomplete resource planning, and inadequate contingency planning (Khurana & Rosenthal, 1997). Therefore, it is a long, poorly understood phase, but usually full of opportunities for improvement that can be analyzed quantitatively and transformed into benefits to the companies (Reinertsen, 1999). Management of the front-end and other front-end elements and activities require balance between getting things right and being flexible during NPD execution (Khurana & Rosenthal, 1997) and some crucial decisions of the project are made during this period regarding the size of the market opportunity, the target customer, alignment with corporate strategy, and availability of critical technologies and resources (Smith & Reinertsen, 1992). To Biedenbach (2011), the early phase determines the conditions for the success of a project, and it has a multiproject character concerning idea selection.

The concepts generated in the Fuzzy Front End contain elements that can succeed or fail and therefore this phase needs to be managed carefully so that the internal competition in the FFE can be productive (Kim & Wilemon, 2002). The FFE has many

opportunities for lower costs and great enhancements towards the market (Smith & Reinertsen; 1988). Kim & Wilemon (2002) define the FFE phase as the period between the moment when an opportunity is first examined and the moment when an idea is deemed as ready (Fig. 1).

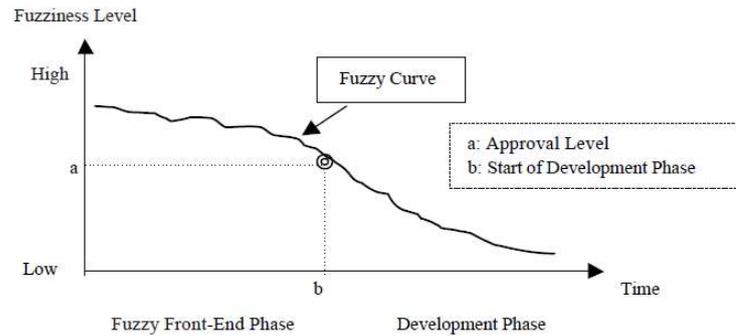


Figure 1: Pattern of the fuzziness level through the NPD (New Product Development)
Source: Adapted from Kim and Wilemon (2002)

The pre-development phase is difficult to define because there are many challenges in this phase (Khurana & Rosenthal, 1997) such as its dynamism and the low levels of formalization (Murphy & Kumar, 1997); or the problematic interaction between different departments (Griffin; 1997). Backman, Börjesson & Setterberg (2007) pointed that in the fuzzy front end, the managers have been neglected concepts based customer or market knowledge. Verworn, Herstatt & Nagahira (2008) developed a structural equation model based on the information-processing approach and suggested that the front end is an important driver of NPD project success of the Japanese new products. These findings could be evaluated in other countries or industries and, then, to valid the NPD in general. Björk, Boccardelli, Magnusson (2010) found some paradoxes about ideation capabilities: firms with an explicit focus on ideation practices experience some negative consequences of the resulting formalization, and then both freedom and limitations on search for

creative solutions can facilitate ideation process.

Several attempts to define pre-development phase have been made in the literature as detailed in table 1. The terms used by some authors are equivalent, with the prevalence of the name of Fuzzy Front End, followed by Front-end of Innovation. To set a name for this phase, the boundaries between this stage and the following, the New Product Development Process itself; and the features of this period are established.

Table 1: FEI definitions

Research	Terminology	Concept of Front-End of Innovations
Cooper (1988)	Predevelopment stages	Steps that precede development of product (ideation, preliminary assessment, concept) often ignored, but where success and failure are largely decided.
Moenaert, De Meyer, Souder & Deschoolmeester (1995)	Fuzzy Front End	The planning stage of an innovation project that has a great effect on the commercial performance of the project. Successful project teams are characterized by a maximum uncertainty reduction during planning, by a maximum increase of R&D and marketing integration and communication. Information flows between these functions help to achieve this efficient uncertainty reduction.
Murphy & Kumar (1996, 1997)	Predevelopment stages	From the generation of an idea to its development. Particular activities play pivotal roles in achieving the objectives of each stage (Cooper's model).
Khurana & Rosenthal (1997, 1998)	Fuzzy Front End of NPD or Front end (FE)	The early phases of New Product Development (NPD), cross-functional, strategic, conceptual and planning activities which typically needed the detailed design and development of a New Product (NP). The Front end (FE) related success factors are identified as foundation and project-specific elements. The project-specific activities focus on the individual project and require the project team's effort to ensure a useful product definition and project plan. The foundation elements cut across projects and form the basis for project-specific activities.
Reinertsen (1998, 1999)	Front end planning – Fuzzy Front End	The fuzziest zone between when the opportunity is known and when we mount a serious effort on the development project. Fuzzy front-end can be described in terms of its economics: the expense, time to screen an opportunity, and the effectiveness of the screening process.
Koen, Ajamian, Boyce et. al. (2002)	Front End of Innovation (FEI) The NCD model	The activities that take place prior to the formal and well-structured New Product and Process Development or "Stage Gate™" process, in comparison with NPPD, the activities in the FEI are often chaotic, unpredictable and unstructured They use the term FEI, as opposed to FFE that implies that this portion of the innovation process is mysterious, resulting in a lack of accountability and difficulty in determining who is responsible to manage the activities in this area. They define the outputs in each phase (elements of Engine) and Technology Development Process.
Kim & Wilemon (2002)	Fuzzy Front-end	Period between when an opportunity is first considered and when an idea is judged ready for development. The outcomes of the FFE are classified into product definition, time, people, and people dimensions.
Herstatt & Verworn (2002, 2003,2004, 2008)	Fuzzy Front-end	The early phases that have the highest impact on the whole process and the result (I put-output process), since it will influence the design and total costs of the innovations extremely. The FFE is the least-well structured part of the innovation process, and has market and technology uncertainty

The authors that define the pre-development phase as Fuzzy Front End claim that this is the fuzziest phase, characterized by uncertainty. However, other authors such as Koen et. al. (2001) and Khurana & Rosenthal (1997, 1998), use the term Front End of Innovation (FEI), because they say that using the term “fuzzy” implies in the difficult to in determining who is responsible to manage the activities in this area. The difficult to in determining who is responsible to manage this portion implies in the difficult to establish the rules and the roles; and to reduce the ambiguity. In this work, it will be used the term “Front End of Innovation, because we understand that this is the initial phase of the innovation process but that due to the studies carried out in this area it has evolved to a less ambiguous and uncertain stage.

Building on the work of front-end scholars from the innovation literature, this research called the predevelopment phase as Front-End of Innovation or FEI. FEI is the earliest stage of the New Product Development - NPD, the predevelopment, in which is developed the concept of the project. Before the design and suppliers team begins the project, that is, develop the design and the technology; other activities are developed such as identifying opportunities for innovation, identifying customer needs, analyzing competitive products, establishing target specifications, generating product concepts, selecting one or more final concepts, performing an economic analysis, and planning the remaining project activities. The main result or the FEI is the mission statement and concept of the project.

In this phase, is decided the roles and it requires excellent integration across the different functions on the development team. Because the FEI has many difficulties such as dynamism, low levels of formalization, uncertainty, and ambiguity; but contain elements that can succeed or fail; this phase needs to be managed carefully. From the

primary authors that define the “Fuzzy Front End” phase, then, it will be analyzed the primary models for this stage.

2.1 Models for Front End of Innovation

Several authors divide the Front End of Innovation phase into other sub-phases to organize its tasks, assess and understand the function of each one. Griffin (1997) classifies the FEI phase in two stages: the concepts generation and the project assessment. Also, O’Connor (1998); Crawford & Di Benedetto (2000); Reid & de Brentani (2004), Backman, Börjesson & Setterberg (2007) classify the FEI into two phases, initial and late activities. The primary activities are broad and include the structuring of the problem (Reid & De Brentani, 2004), identification and exploration of opportunities (Backman et al., 2007). In these activities, technology has a higher weight (O’Connor; 1998). The later operations consist of the information gathering and concept development, preparing the transfer for the product development process (Backman et al., 2007); the later activities also involve aspects of idea generation (Reid & De Brentani, 2004), and in these events, market is seen as having higher weight (O’Connor; 1998). Murphy & Kumar (1997) suggest splitting the FEI into three phases, namely: generation of ideas, definition of the products, project assessment.

Thus, Cooper (1988) classifies the FEI phase into idea generation and screening, market and technical assessment, concept definition, concept development, concept test and concept evaluation. Fig. 2 illustrates a detailed process model for undertaking these predevelopment activities.

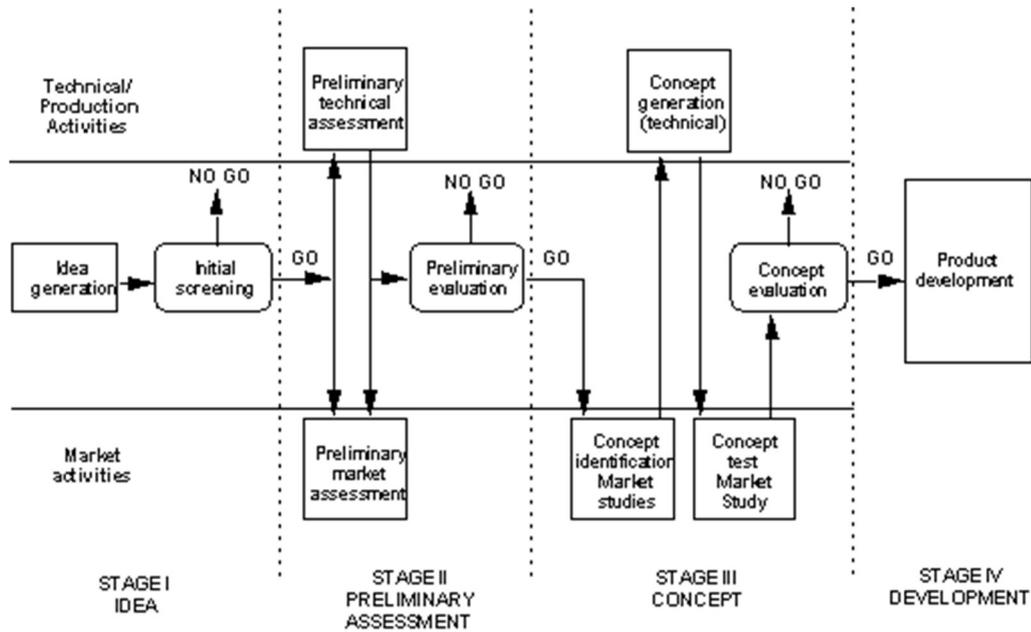


Figure 2: Up-Front or Predevelopment Steps in the new Product Process

Source: Cooper (1988)

Murphy & Kumar (1997) tested the Cooper's model in 11 companies and verified that this model serves as a checklist for the activities and find the critical factor in pre-development stages. In addition, they checked that actual 'go/no-go' development decision might be influenced by non-analytic factors including management 'gut feel'. However, the authors did not describe the responsibilities and integration in each stage. This model is presented in Fig. 3.

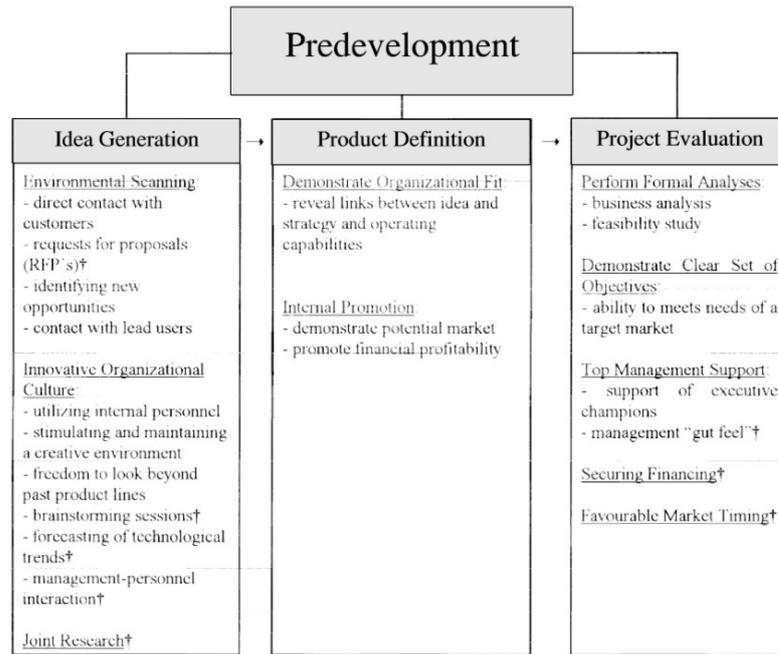


Figure 3: Predevelopment stages
 Source: Murphy & Kumar (1996)

Reinertsen (1999) subdivide the initial planning activities into three stages: in the first phase, the company determines the general nature. Then, the company will prepare a detailed business plan, creating an investment opportunity for the project and once the decision to invest has been made, the company enters the third stage, a complete product specification, budget, and schedule. The Reinertsen's model is illustrated in Fig. 4.

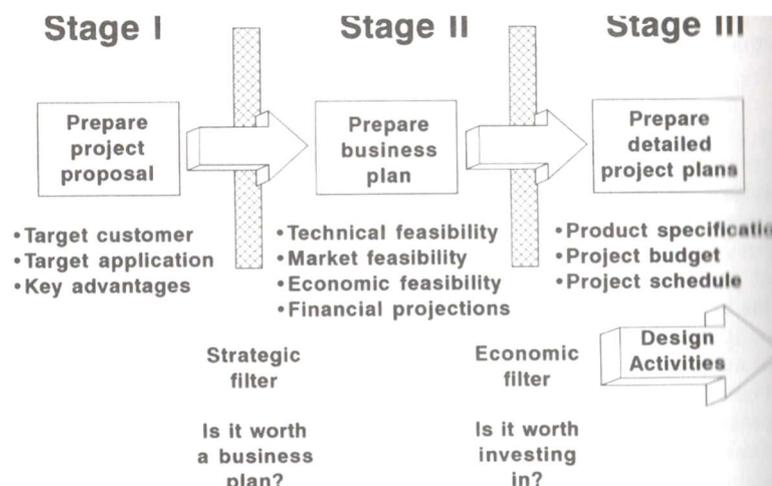


Figure 4: Subdividing front-end planning into three stages
 Source: Smith & Reinertsen (1991)

Khurana & Rosenthal (1997) present a system view of the front end (Fig. 5) consistent with growing empirical evidence of the need to simultaneously examine overall product strategy (foundation elements) with project-relevant input such as product ideas, market analysis, and technology options.

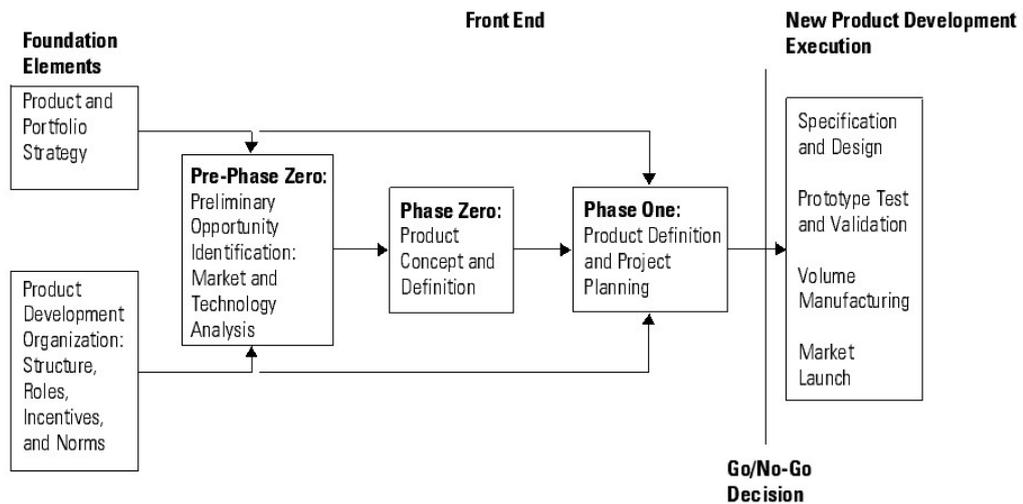


Figure 5: A Stylized model of the Front End of NPD

Source: Khurana & Rosenthal (1997, 1998)

Koen et al (2001) use the term “Front End of Innovation” (FEI) as opposed to Fuzzy Front End (FFE) because that FFE implies that this stage can never be managed due to lack of accountability and difficulty in determine who is responsible to manage the activities in this area. The authors developed a theoretical construct – defined as the New Concept Development (NCD) model, demonstrated in Fig. 6. In contrast to linear, staged-and-gated processes, the model is circular to indicate that ideas flow, circulate and iterate across and among the five elements. This NCD model consists of three essential parts:

1. The inner area defines the five essential elements comprising the Front End of Innovation (FEI);
2. The Engine or “bull’s eye” portion which drives the front-end elements and is fueled by the leadership and culture of the organization;

3. The Influencing Factors, or environment on the periphery, consists of organizational capabilities, business strategy and the outside world (i.e., distribution channels, customers, and competitors).

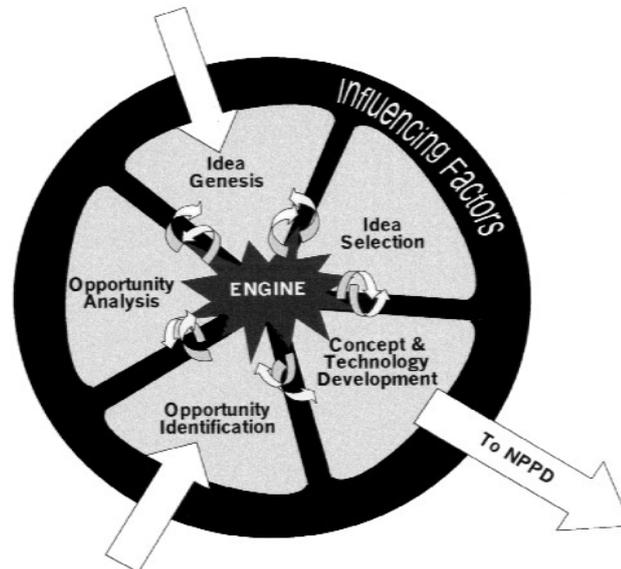


Figure 6: The NCD model

Source: Koen, Ajamian, Boyce et. al. (2002)

All these sub-phases precede the detailed design phase and product development and can contribute to the success of the product development process (Cooper, 1993; Dwyer & Mellor, 1991; McGuinness & Conway, 1989). The primary models are presented in table 2.

Table 2: Diagnosing FE activities

Research	Findings	Gaps in this research
Cooper (1988)	- Deficiencies in each step	
Murphy & Murphy & Kumar (1996)Kumar (1996)	- Actual 'go/no go' development decision may be influenced by non-analytics factors including management 'gut feel'; - This model serves as a check-list for the activities and factor found to the important predevelopment stages.	- Small sample size - Disproportionate number of managers and engineers - Cooper's model is short - No definition about responsibilities and integration in each phase
Khurana & Rosenthal (1997, 1988)	- Successful companies effectively integrate their business and product strategy when identifying new opportunities in their front end - Identify problems that are symptoms of poor practices in the	- Small sample size - More focused research is needed on varieties of effective formality - Better understand the relation product strategy and product innovation (two-way interface)

	Front end	<ul style="list-style-type: none"> - Identify transferable techniques to assist product development teams in distinguish at the outset from those which must be left uncertain until a later time
Reinertsen (1998)	<ul style="list-style-type: none"> - One alternative for structuring Front-end processes, measuring time, defining responsibilities and some activities about documentation 	<ul style="list-style-type: none"> - No definitions about integration in each phase - It doesn't describe knowledge sharing activities and ideas / concept assessment activities - Small sample size
Koen, Ajamian, Boyce et. al. (2002)	<ul style="list-style-type: none"> - High correlation between Leadership and Culture and the innovation level of the company; - The importance of managing the technological component and suggested that more firms should adopt the methodologies indicated in some research – technology Management articles. - Establishes terminology to describe its key elements, describe the activities and outputs in each phase (elements of Engine) 	<ul style="list-style-type: none"> - Explain better why the concept and technology development's proficiency levels of highly innovative companies are similar to those of low-innovation companies. - Determine and evaluate multiple components and key characteristics of each element of the NCD model and develop reliable constructs

The models demonstrated here have not discussed the essential elements such as characteristics of the roles, or how to plan budget and schedule in this stage. Besides, they have not addressed the roles and rules; and the integration between functional areas, departments, and companies; how the information is shared between the actors; how are the division of labor and the logic that explains this section. To each activity, one or more roles are applied and a relationship, with rules, is established. Explain how and why each role is established could help to understand how to reduce the uncertainty in the front-end phase.

On the other hand, it is possible to identify, from the primary models examined, there is a generalist flow of the FEI activities: opportunity identification, target customer, and technology evaluation, ideas generation, and screening. The development process described until here are generic, and, according to Ulrich & Eppinger (2008), a particular method will differ following a firm's unique context. The generic process is most like the

process used in a market-pull situation: the team begins product development with a market need and selects appropriate technologies to meet customer needs. To this approach, there are several variants:

- Technology-push products: the team begins with a new technology, then finds an appropriate market;
- Platform products: the team assumes that the new product will be built around an established technological subsystem, that is, a technology platform has already demonstrated its usefulness in the marketplace in meeting customer needs;
- Process-intensive products: the properties of the product are highly constrained by the production process. In many cases, process-intensive products are produced in very high volume and are bulk;
- Customized products: these new products are slight variations of existing configurations and are developed in response to a specific order by a customer;
- High-risk products: these entail large technical or market uncertainties that create high risks of failure;
- Quick-build products: some products have rapid modeling and prototyping that enables many design-build-test cycles;
- Complex systems: large-scale products and complex systems must be decomposed into several subsystems and many components.

The generic process flow diagram depicts the process used to develop market-pull, technology-push, and platform, process-intensive, customized, and high-risk products. Each stage is followed by a review to confirm that the phase is completed and to determine whether the project proceeds. For the quick-build products, teams can take advantage of rapid iteration to achieve a more flexible and responsible product development process called a spiral product development process. The process flow

diagram for the development of complex systems shows the decomposition into parallel stages of work on the many subsystems and components. Detail design of the components is a highly parallel process in which the many development teams work at once, usually separately (Fig. 7).

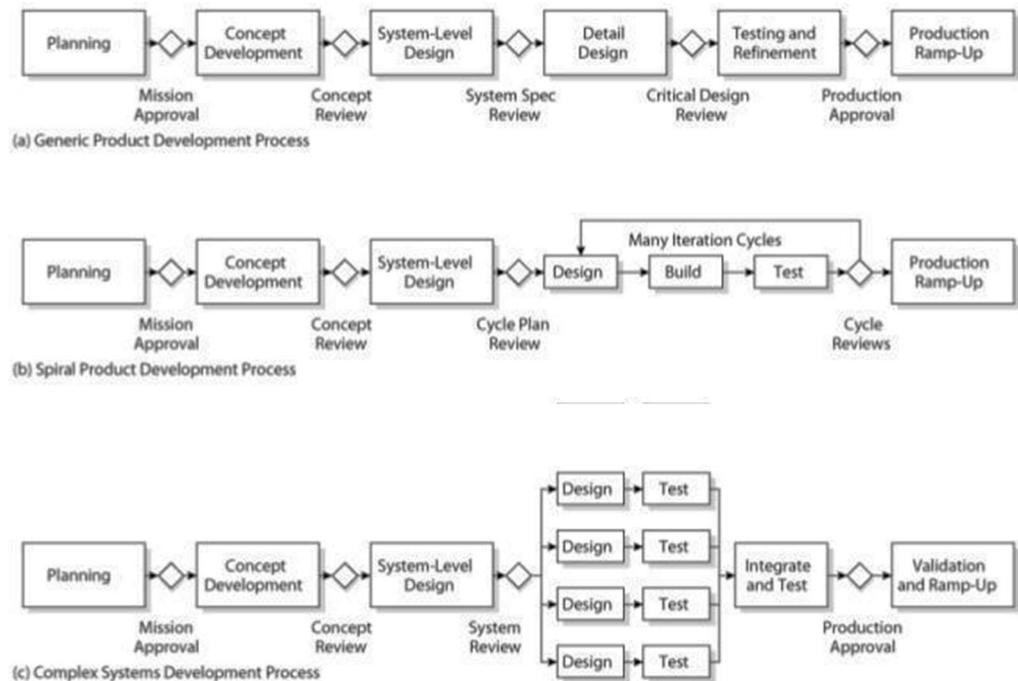


Figure 7: Process flow diagrams for three product development process

Source: Ulrich & Eppinger (2008)

2.2 Front End of innovations considerations

Mendes and Oliveira (2015) presents a systematic literature review of the FEI research field, analyzing the state-of-the-art of the literature. According to the authors, there are few studies which aimed at clarifying the knowledge structure of the FEI research field, and some of them focus on discovering and discussing specific topics rather than looking for the entire area.

Among the papers on Fuzzy Front End founded in the Web of Science, some focus on knowledge management (Arto et al., 2011; Heising, 2012; Oliveira & Rozenfeld, 2010; Stevens, 2014; Verworn, 2006); some discuss the needed competences and capabilities in the FFE (Björk et al., 2010; Murphy & Kumar, 1996; Soukhoroukova et al., 2012; Vandenbosch et al., 2006; Biedenbach, 2011; Soukhoroukova, Spann & Skiera, 2011; Hirunyawipada & Paswan, 2013). Other studies focus on organizational structure, cross-divisional teams and collaborative foresight (Grote et al., 2012; Im et al., 2013; Rauniar & Rawski, 2012; Smith & Reinertsen, 1992); discussing the operations of integration and the degree of the involved parties such as technology integration (Gerwin, 1993; Montoya-Weiss & O'Driscoll, 2000); Marketing & Technology integration (Brem & Voigt, 2009); Customer Integration (Nambisan & Baron, 2010; Sandmeier, 2009); discussing the characteristics of a specific role such as the role of Marketing (Langerak et al., 2004; Schoonmaker et al., 2013). In addition, one study about interfirm collaboration (Gillier et al., 2010).

Other studies on FEI also focus on integration: cross-functional teams (Brettel et al., 2011), MKT- Manufacturing integration (Song & Swink, 2009), knowledge-based project (Akbar & Mandurah, 2014), collaborative foresight (Weigand et al., 2014), inter-functional culture and link among operations practices (Morita et al., 2011); open innovation (Sjödín et al., 2011), customer integration (Gassmann et al., 2010).

Despite the growing discussion about roles and integration, it will still be explored in this sense to develop more propositions and theories about the FFE that help to reduce the uncertainty in this phase. Besides the integration of roles, another important topic that is little discussed on the FEI is how the concepts are worked according to the degree of newness. Backman, Börjesson, Setterberg (2007) suggest exploring the FEI on concept

characteristics to understand the dynamics in the critical conceptualization phase better. The concepts may be based on technology, services, and visual impressions or on the company's core value, specific customer groups or business opportunity. The authors also suggest exploring the FEI on discontinuous innovations, because most research has been done on incremental innovations.

According to the degree of newness of a project, that is, if the innovation is radical or incremental, specific roles are played in the FEI: client, design, and suppliers can work together in some stages in some projects; or only client and design work in other stages; or single client and suppliers in others. It happens because of the competencies necessary for each project.

Even so, the found solutions can be new for a specific client, but not for other clients of the same industry. In cases like this, the projects are not radical or incremental, because the solutions are new for some player but not for others. Here, the knowledge of the design function is significant, because it works like a broker, bringing technological and customer's solutions from other markets to a specific demand. The literature discusses very little the integration of these roles in each stage of the FEI according to the degree of newness. Even more, the literature does not address the importance of design's role as strategic design, working with its broker knowledge to find the better solutions for a project. Therefore, from the verification of these gaps, this study aims to identify how is the integration of roles in the FEI according to the degree of newness in a dynamic industry. For this research, the authors chose the Brazilian packaging industry, because of its value chain in the concept creation phase. There is a complex and dynamic relation among its parties and as in other industries involving many players, the interaction among different companies is problematic, these parties are the Consumer Goods Industries, which here we call Brand Owner, the Design Agencies, and the Packaging Producers.

The packaging industry could use a market-pull approach because it drives its development process with a market need and seeks out whatever technology is required to meet that demand. However, because of the design and creation activities, this industry enables a spiral product development process whereby create and detail design, prototype and test activities are repeated sometimes. In addition, packaging can be translated as a quick-build product, because the brand owner may prefer to test the product rapidly in the market than spent more time planning. Completing some design and test activities earlier in the process may reduce the uncertainty regarding customer's acceptance of a new product or concept. Therefore, the packaging industry can establish a development process similar to the spiral process.

For this research, we used the NCD model (Koen et al., 2014 b), that cover the main stages and activities for the predevelopment phase, according to the literature review. As stated, it is possible to identify, from the primary models examined and empirical experience, there is a general and circular flow of the FEI activities: Opportunity Identification and Analysis, Idea Generation, Idea Enrichment, Idea Selection, Concept Development. We assumed the innovations in the Packaging Industry are incremental. The NCD Model used by Koen et al. (2014 b) consider five elements (or activities) for incremental innovation related in figure 8 and the definitions for each operation of the NCD model are presented it the table 3.

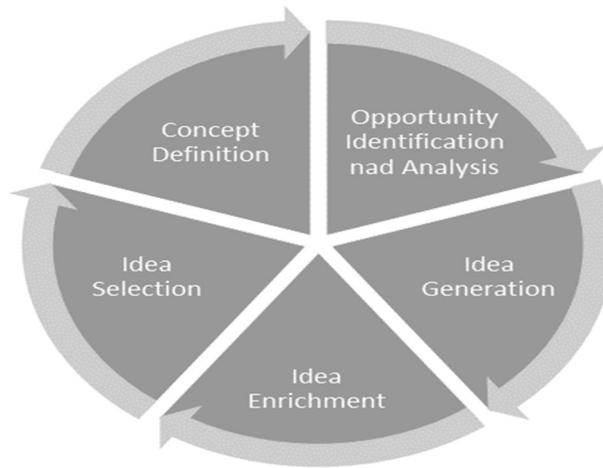


Figure 8: Process flow diagrams for the NCD process
Source: Adapted from Koen, Ajamian, Boyce et. al. (2002)

Table 3: Constructs for NCDs activities

Activities	Constructs
Opportunity Identification and Analysis	Evaluating of the external environment with a formal process.
Idea Generation	Capturing, sharing, recording; and providing feedback on ideas through a systematic way.
Idea Enrichment	Having an IT-based system for sharing, capturing, and assessing ideas as well as the ability to identify R&D people and find what they are doing.
Idea Selection	Having an idea review board, a comprehensive method for idea evaluation, and a defined set of selection criteria.
Concept Development	Assessing the feasibility of manufacturing process, the marketing and sale effort, technical requirements, and economic factors connected with a project.

The Project Definition is the final activity of concept development, in which the team creates a detailed development schedule, devises a strategy to minimize development time and identifies the resources required to complete the project.

For each stage, a specific division of labor and relationship between the main functional areas and inter-firms is established, and each company is involved or not in each activity. The ties in each stage can depend on the degree of innovation. Thus, next sections will analyze studies that focus on the integration of roles and exploration the FFE according to the degree of newness; explaining why each player is involved according to the project.

3. THE ROLES IN THE FRONT-END OF INNOVATION

In order to highlight the New Product development process, consider the following simplified model of the entire process depicted by Gerwin (1993):

- 1) Development of long-range plans for an entire product line and investigations of new technologies;
- 2) Exploring market requirements and new concepts;
- 3) Generating a form product concept with definition of requirements and feature-cost tradeoffs;
- 4) Technical specifications, designs, and prototypes;
- 5) Testing, pre-productions, and ramp-up;

According to Gerwin (1993), R&D and Marketing interact during phases 1, 2 and 3. Manufacturing, through concurrent engineering, has joined with product planning and R&D for Phase 4's activities, and parts of Phase 5 (testing and pre-production). Each role resolves tactical issues within a well-defined framework. The communication and shared knowledge among the players during the product development process are beneficial to the efficiency and innovation of the project and the company (Moenaert et al., 1995).

The integration of roles activities is a necessary condition for success in innovation projects. If in the new product development process there are iterations, the more in the Front End of Innovation process (Moenaert et al., 1995). To an effective FEI, innovative firms must organize their staffs for participation in the earliest stages (Gerwin, 1993; Khurana & Rosenthal, 1997; Murphy & Kumar, 1996) describing who does what, and thus reducing ambiguity in the flow of information (Moenaert et al., 1995), eliminating the delays associated with synchronization (Smith & Reinertsen, 1992), and risk of re-work (Rauniar & Rawski, 2012). In this section, we describe some types of

roles used for product development and the integration among these roles in the FEI.

In the product development process, the division of labor among the players performs particular activities at each stage of the process (Smith & Reinertsen, 1992). The critical functions in product development are general manager, marketing, engineering, design, manufacturing, quality assurance, purchasing, and customer service and these features have essential activities in predevelopment phase, such as: project selection, product definition and business plan, project review, concept development, preliminary design, detailed design, initial testing, design review, tooling fabrication, test, production training, sales initiation, service manuals, field training, production training, quality plan, pilot production, prototype installation, production review (Ulrich and Eppinger, 2008).

In turn, the early or the concept development process includes the following activities: identifying customer needs, establishing target specifications, concept generation, concept selection, concept testing, setting final specifications, project planning, economic analysis, benchmarking of competitive products, modeling and prototyping (Ulrich and Eppinger, 2008). The front-end process rarely proceeds in purely sequential fashion. Instead, the front-end activities may be overlapped in time and iteration is often necessary (Koen et al., 2001; Smith & Reinertsen, 1992) Ulrich and Eppinger, 2008). During the early stage, the sharing of information between the parties involved is crucial to the success of later stage product development (Khurana & Rosenthal, 1997), because the nature of the future product is still unclear at the beginning of this stage; leading the players to face a high level of uncertainty and dynamism (Grote et al., 2012). The essential management task is to identify and remove communication barriers and unproductive conflicts through team cohesion (Im et al., 2013). Information flows between the leading players such as client (which demands the project), suppliers,

including design; and consumers or the main functions help them to achieve this efficient uncertainty reduction and the successful projects have project teams characterized by a maximum uncertainty reduction during planning (Moenaert et al., 1995).

In the literature on FEI, 26 papers discuss the roles of the players and integration, listed in Table 4. Each article is not exclusive to a theme, but a topic is highlighted in each paper. In the early years, the literature on FEI explains what the roles work at this early stage of product development, emphasizing in marketing, R&D and technology integration. From 2006, it is possible to find studies discussing contingencies for choosing times and forms of integration according to the type of project to be developed. Here, the role of the manager is crucial to correctly select the team according to the skills of each function. Papers on the role of manager usually discuss teams or integration between functional areas and management of knowledge, that is, how knowledge is shared between people and the players. From 2009, arise papers on consumer collaboration. Finally, the papers about competences gather features of roles in FEI.

Table 4: Distribution of themes throughout the papers

Theme (number of papers)	Papers
The role of marketing (3)	Moenart, De Meyer, Souder, Deschoolmeester (1995)
	Langerak, Hultink & Robben (2004)
	Schoonmaker, Carayannis & Rau (2013)
Technology integration (2)	Gerwin (1993)

	Montoya-Weiss & O'Driscoll (2000)
The role of customer (3)	Sandmeier (2009)
	Nambisam & Baron (2010)
	Schirr (2012)
The role of manager (7)	Khurana & Rosenthal (1997)
	Verworn (2006)
	Björk & Magnusson (2009)
	Williams & Samset (2010)
	Artoo, Kulvik, Poskela & Turkulainen (2011)
	Rauniar & Rawski (2012)
	Stevens (2014)
The role of teams (3)	Smith & Reinertsen (1992)
	Im, Montoya & Workman Jr (2012)
	Hirunyawipada & Paswan (2013)
The inter-firm integration (1)	Gillier, Piat, Roussel & Truchot (2010)
Integration of roles (1)	Brem & Voigt (2009)
Competences (6)	Murphy & Kumar (1996)
	Vandenbosch, Saatcioglu & Fay (2006)
	Björk, Boccardelli & Magnusson (2010)
	Biedenbach (2011)
	Soukhoroukova, Spann & Skiera (2011)
	Grote, Herstatt & Gemünden (2012)

In this study, we describe the roles that are usually involved in the FEI, such as marketing, technology, design, and customer. These roles emerged naturally from the NPD.

3.1 The role of marketing

The role of marketing is to mitigate inconsistency between the needs of consumers and the NDP project (Langerak et al., 2004; Soukhoroukova et al., 2012; Brem & Voigt, 2009; Soukhoroukova, Spann & Skiera, 2011) avoiding re-work in the final phase of the DP (Moenaert et al., 1995; Rauniar & Rawski, 2012) as well as between the company's strategy and concepts generated, as the role of marketing is to accurately communicate function on the project to key stakeholders for the company to request resources still in the FEI (Soukhoroukova et al., 2012)(Soukhoroukova, Spann & Skiera, 2011). The role of marketing is involved in most of the activities in the FEI such as distinct planning, concept development, detail design, testing and refinement, and production ramp-up (Eppinger & Ulrich, 2008).

What are the structural relationships among market orientation? Firms in the b2c

oriented - business to consumer - focus more on end-users, and therefore, market-induced impulses, that is, the team begins product development with a market opportunity and then select appropriate technologies to meet customer needs (Brem & Voigt, 2009)(Ulrich & Eppinger, 2008; Brem & Voigt, 2009). The market orientation is an organizational culture that creates an environment that maximizes opportunities for learning about markets, for sharing information that allows for conventional interpretations; and taking coordinated actions. The rationale is that a market-oriented culture, and the associated information processing behaviors in the FEI, reduces many risks related to NPD (Langerak et al., 2004).

According to Moenart, De Meyer, Souder, Deschoolmeester (1995), with correct communication between marketing and R&D, the marketing task variability, will decrease and marketing task analyzability will increase.

3.2 The role of Technology

Technology can mitigate technical failures (Brem & Voigt, 2009; Gerwin, 1993; Montoya-Weiss & O'Driscoll, 2000). A reason for manufacturing to have difficulty in being useful in the front-end is that it is not privy to information that the other functions take for granted such as market requirements, the characteristics of competitor's products, and the firm's product strategy. A significant portion of the manufacturing cost and quality of a new product is determined by the end of the product concept stage before most of the design begins (Gerwin, 1993). The suppliers must be included in the FEI core team, because their knowledge of technology, costs, and design manufacturing may lead times to contribute to product definition and project planning (Khurana & Rosenthal, 1997).

What are the underlying characteristics of manufacturing's integration into the

strategic phases of NPD?

Gerwin (1993) offers a set of guidelines for effective implementation of manufacturing's new role such as direct contact with customers, joint competitive analyses, and attendance at informational meetings about product strategy are ways of overcoming this barrier. Other best practices include intertwining the business functions plans (Gerwin, 1993; Montoya-Weiss & O'Driscoll, 2000). The intention is to have each function develop its strategy using input from the others. According to Murphy & Kumar (1996), the core team includes selected suppliers as partners; their knowledge of technology, costs, and design a manufacturing lead-time can contribute to product definition and project planning. Technology managers may use the results as a conceptual mirror, especially regarding the influencing factors of innovation impulses and the use of interdisciplinary teams (with people from inside and outside the company) to accomplish successful corporate technology and innovation reserved (Brem & Voigt, 2009).

3.3 The role of Design

Few papers about FEI has been discussing the importance of the role of design in the strategic phase of the process. In Brazil, the design is not involved in the pre-development phase. In other countries, especially in Europe, strategic design is crucial to the success of product development projects.

Each company/team needs to ensure that the design and development decisions made at various concurrent stages are consistent with the past decisions and the future decisions to meet the overall project and customer requirements (Rauniar & Rawski, 2012). Design acts as a broker sharing information and accessing past project history and learning to avoid rework (Rauniar & Rawski, 2012; Schirr, 2012).

Conflicting and inconsistent decisions to the design solutions at different

concurrent stages of the innovation project can lead to design and development of product plagued with problems, or glitches that can have substantial impact on project performance, such as re-work, scrap, reduced resource utilization, cost-overruns, poor quality of design, poor quality on conformance, etc. (Williams & Samset, 2010). A critical barrier to deliberate cross-divisional learning activities, and thus the launch of joint projects, is that communication channels evolve around those interactions that are critical to practical design and this should involve design skills (Grote et al., 2012).

Micheli & Gemser (2016) founded that design innovativeness has a positive impact on financial performance and Design can work as developer, creator, broker, influencer (Grote et al., 2012; Rauniar & Rawski, 2012; Schirr, 2012; Williams & Samset, 2010).

Sutton and Hargadon (2002) named designer as a broker, whose skills are: access existing resources, move resources between fragmented worlds, bring knowledge from a particular into the organization, recognize how old resources can address new and problematic situations by sharing experience within the body; built new networks ties, embedding the emerging recombination within a new domain. About the brokering concept, Schirr (2012) define the Sutton and Hargadon's six consequences: (1) supporting the organizational memory of design solutions, (2) providing skill variety for designers, (3) promoting an attitude of wisdom (acting with knowledge while doubting what one knows, (4) creating a status auction (a competition for status based on technical skill, (5) impressing clients, and (6) providing income for the form.

To define the role of design, we accessed other papers that did not discuss only FEI. A good design does not emerge by chance or by simple investing in design but rather as the result of a managed process (Chiva and Alegre, 2000). The involvement of design

skills and talents of the designers impact on company performance (Chiva and Alegre, 2000; Eppinger, 2001; Hargadon and Sutton, 2004). Ulrich and Eppinger (1995) consider specific management activities, practices or skills as design management. The technical-creative phase involves a formal and creative interpretation of the analytical-conceptual phase and the technical-creative phase as well as the technical resolutions required to determine the product (Ulrich and Eppinger, 1995).

Design can be used as ambiguous and complex interaction mechanisms (Siomeone, Secundo & Schiuma, 2017) as in FEI. The designer can transform technical documents in simple documents such as sketches, mockup, videos, 3D models, etc (Bogers & Horst, 2013; Siomeone, Secundo & Schiuma, 2017). The use of design patterns as external cognitive artifacts improves design quality, reduces time to taken to solve a design problem, and leads to higher participants satisfaction (Mangalarj, 2014).

3.4 The role of customer

One way to disseminate information among the players and reduce product uncertainty is integrating the customer in FEI through the role of marketing (Schirr, 2012).

The role of customers in the FEI is to guide the team in establishing product specifications, generating product concepts, and selecting a product concept for further development (Ulrich & Eppinger, 2008). Integrating customer in the FFE helps to anticipate the needs of consumers and help the company to not forget these (Nambisan & Baron, 2010; Sandmeier, 2009; Schirr, 2012). There are several techniques to integrate as focus groups, brainstorming and online forums (Nambisan & Baron, 2010; Schirr, 2012), and a way that the integration of consumer occurs effectively is making him feel part of the company through rewards as prizes, gifts, the factory visits, etc., so that the

project makes sense for customers and increase their spirit of partnership with the company behind the brand (Grote et al., 2012; Nambisan & Baron, 2010; Stevens, 2014). So, the consumer has been integrated increasingly early and collaborated in the ideation phase (Schirr, 2012).

How is the type of customer contribution to the FEI phase?

Sandmeier (2009) recognizes the need to inject more customer knowledge into the product innovation processes. The author acknowledges three customer integration strategies:

1. Anticipating customer needs: company's effort to push product innovation resources and technological potential into areas which they are likely to achieve improvements. Close, long-lasting relationships with leading customers help the company not to miss evolving customer trends;
2. Technology and application brokering: experimentation, improvisation, and rapid learning. Developers should participate in distributed resource networks in which customers play significant roles and operate across traditional corporate boundaries, collaborate to achieve innovative solutions, and learn from one another to speed their capability building. Clients and customer take the perspective of third parties and provide insights about the different needs associated with the latest technological solutions;
3. Hybrid strategies: customers are integrated at a very early stage to develop a product with a high degree of newness (brokering), but let them participate only punctually in the latter stages since its in-house development knowledge and experience was sufficient for a matching concept development (anticipation). That is, consumers generate ideas, but not the test.

Creating a high-quality information channel from customers to the innovators

ensure that those are directly involved in the project fully understand the needs of the customer - the explicit and the latent needs - and that no critical customer need is missed or forgotten (Ulrich & Eppinger, 2008).

Table 5 presents the three central roles identified in the literature: marketing, engineering (here, we included the industrial design), and the manufacturing/technology, that is, the technical role.

Table 5: The Roles in the Front-End of Innovation

ROLES	COMPETENCES	EVIDENCES
Marketing	<p>Knows the consumer behavior. Source of decision-making information; manage the invention pipeline; manage both technical and market risk. Creates information flows between R&D and MKT functions helping the firm to achieve the efficient uncertainty reductions. Understanding the customers' needs and wants. Uses creativity to the commercialization of NPs. Communicates their own value proposition to target stakeholders in order to obtain resources; Creates "Halo effect" (institutional prestige)</p>	<p>Smith & Reinertsen (1992); Moenart, De Meyer, Souder, Deschoolmeester (1995); Langerak, Hultink & Robben (2004); Brem & Voigt (2009); Im, Montoya & Workman Jr (2012); Schoonmaker, Carayannis & Rau (2013).</p>
Design	<p>Design works on the anticipated effect of a perceived project that should guide the choice of concept. Design should be called in a identifying real alternative concepts as the basis for designing projects, resulting in a subsequent analysis, deliberation, and decision making to the strategic level. Design as a Broker, ensuring the design and development decisions made in each team at various concurrent stages are consistent with the past decisions and the future decisions to meet the overall project and customer requirements. Design is a key role to deliberate cross-divisional learning activities, and thus the launch of joint projects. Design new combinations of technologies so that new offerings can be produced. Design, as a Broker, supporting the organizational memory of design solutions, providing skill variety for designers, supporting an attitude of wisdom (acting with knowledge while doubting what one knows, creating a status action (a competition for status based on technical skill), impressing clients, and providing income for the firm.</p>	<p>Williams & Samset (2010); Rauniar & Rawski (2012); Grote, Herstatt & Gemünden (2012); Schirr (2012); Stevens (2014)</p>
Manufacturing/ Technology	<p>State-of-the-art technology owner, Influencer, the idea generator, unfamiliar with marketing, business, and human factors areas, he or she may need support to understand how to address the questions in a specific context. Technology managers may use the results as a conceptual mirror for the early stages, especially regarding the influencing factors of innovation impulses and the use of interdisciplinary teams (with people from inside and outside the company) to</p>	<p>Gerwin (1993); Montoya-Weiss & O'Driscoll (2000); Brem & Voigt (2009); Sandmeier (2009); Rauniar & Rawski (2012)</p>

	<p>accomplish successful corporate technology and innovation reserved.</p> <p>As a broker, ensuring that resources allocation occurs appropriately and retaining transparency among the departments involved.</p> <p>It is need to avoid conflicting and inconsistent decisions to the engineering design solutions at different concurrent stages of the IPD project because these events can lead to design and development of product plagued with problems, or glitches that can have substantial impact on project performance, such as re-work, scrap, poor resource utilization, cost-overruns, poor quality of design, poor quality on conformance, etc.</p>	
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The models demonstrated here have not discussed the essential elements or uncertainty in the front-end phase. Besides, they have not addressed the roles and activities, how is the integration and information sharing, the division of labor and the logic that explains this division. On the other hand, it is possible to identify, from the primary models examined, there is a general flow of the FEI activities: opportunity identification, target, and technology evaluation, ideas generation and screening. From the verification of these gaps, it is essential to analyze how the integration in each of these FEI activities is in a complex industry with dynamic relationships.

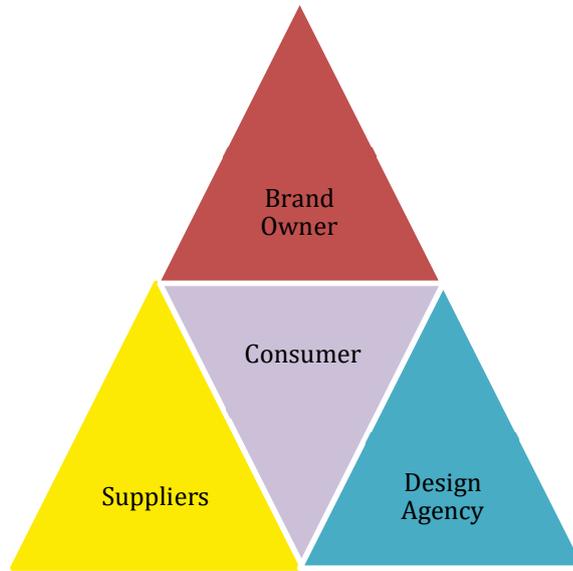


Figure 9: Roles in the Packaging Industry

4. THE INTEGRATION MECHANISMS

The industries that involve thousands of functions of the development process such as R&D, marketing, engineers, suppliers, designers and customers; and that spend months or years in planning, designing, prototyping, and testing activities; and integrating thousands of parties of the product through parallel process and separately teams are named complex industries. In the complex sectors, there are conflicts of interest and difficulty to align issues between organizational objectives and project objectives (Ulrich & Eppinger, 2008; Rauniar & Rawski, 2012). Similarly, the dynamic industries are characterized by a rapid process that the design-build-test cycle can be repeated many times (Knapp, Zeratsky, & Kowitz, 2016), and the ideation phase entails decomposition of the product into high-, medium-, and low-priority features (Ulrich & Eppinger, 2008) and the most of the revenue can come from new products (Cooper, 2001).

Managing the network of interactions across the subsystems and the teams is a crucial task in complex or dynamic industries because includes not only players integration but also the strategic objective of each agent; so the interfaces among the players are vital. Sometimes, the client, who drives the market research, does not share the market data and consumer surveys, because it is afraid that competitors will use this data. In addition, the supplier, who usually provide the state-of-the-art technology; do not share this state of the art, because it is afraid that the client will use this technological information to develop with other suppliers.

According to Murphy & Kumar, (1996), organizational conflict is significantly related for firm age: members from older forms possessed a good understanding of other departments, thus reducing levels of horizontal conflict. Vertical conflict is relatively

more abundant in mid-aged firms. Older firms stressed the importance of contact with competitors. Therefore, firm size, age, and R&D intensively are significant predictors of predevelopment practices.

Conducting project alignment meetings still in the FEI phase allows each company to create their project plans based on the strategy of the other companies involved in the project (Gerwin, 1993).

The integration reduces information gaps that arise when they are not shared. Each player has its role in combination, namely: clients - or brand owners - have a market research and identify the needs of consumers; suppliers own the state of the art technology, and designers usually know the state of the art technology at the same time know how to translate consumer behavior and customer needs in product's attributes. Lastly, the customer collaboration allows fully understand the needs of the customer - the explicit and the potential needs - and that no critical customer need is missed or forgotten. The integration of roles allows that all knowledge from all stakeholder, knowledge about consumer behavior, trends, technologies, economics, to be shared among all stakeholders.

In this study, we describe the of management as the orchestrator, integrator. We define two more types of integration: internal and external. For interior combination, we consider cross-functional teams; for external integration, inter-firm alliances. Lastly, we determine the importance of the design brokering, based on the literature and our experience.

4.1 The role of management

The literature on innovation has spoken about the importance of a leader or a manager to coordinate the knowledge from all stakeholders and align the project objectives according to organizational goals, involving many people completing many

different tasks. Effective project management is crucial to the successful completion of the project, and the role of project management is to plan and coordinate resources and functions to achieve these goals (Ulrich & Eppinger, 2008).

With regarding to the FEI, the managers are characterized by the competence of stimulation, identification, selection, and implementation of ideas (Björk et al., 2010), they are responsible for making decisions about developing or not the product - “go/no go” type decisions (Khurana & Rosenthal, 1997; Montoya-Weiss & O’Driscoll, 2000), carefully choosing the team that will work in this early stage to resolve consumer problems (Smith & Reinertsen, 1992; Vandenbosch, Saatcioglu, & Fay, 2006; Williams & Samset, 2010). The manager should encourage the generation and explicit formulation of ideas through the coordination of relations between internal teams and external (Arto et al., 2011; Björk et al., 2010; Grote et al., 2012; Im et al., 2013; Nambisan & Baron, 2010).

There are many ways to encourage innovation, for example, by fostering creativity and personal curiosity or building scientific networks. Achieving an outcome of constant change cannot be based solely on successfully managing R&D projects but needs holistic management of the whole innovation pipeline (Biedenbach, 2011).

Khurana & Rosenthal (1997) discuss how companies should manage the front end as part of a normative model of the process, highlights best practices based on the assessment of critical activities. Manager can shorten development time dramatically: be flexible about the process, let economics be the guide, what out for complexity, manage the invention pipeline, to avoid the “thinking stage” trap, staff teams adequately, staff with generalists, let the team lead the team, manage both technical and market risk,

develop a reserve (Smith & Reinertsen, 1992).

Vandenbosch, Saatcioglu & Fay (2006) describe five idea management types: incrementalism, consensus builders, searchers, debaters, assessors. These archetypes together constitute a spectrum of possibilities for the way idea management affects organizational life. Each archetype is likely to be useful in certain situations and ineffective in others. Managers engage in recognizable patterns of idea management and that five archetypes of idea management can be discerned through four three codes: inquiry approach, impetus for idea generation relationship to others and evaluation approach.

The primary task of a decision maker is to compare and contrast rated ideas and to choose concepts for further development. Because the decision maker usually has many funding decisions to make with regard to new product/service concepts, he or she needs support that enable comparing and contrasting the most salient attributes for each concept as they relate to the business imperative of the organization (Montoya-Weiss & O'Driscoll, 2000).

About management decision making, problems can be classified as “dynamic complexity”, the underlying complexity of the problem situation itself, and “behavioral complexity”, the complexity of the group effect. Problems that are complex in both dimensions are known as “wicked messes” Williams & Samset (2010). The decision-making behavior is subjective and the ideas are “go/no-go” type decisions. This individual behavior is primarily due to insufficient information being available when the decision has to be made (Montoya-Weiss & O'Driscoll, 2000). Management of the front-end and other front-end elements and activities require a balance between getting things right and being flexible during NPD execution (Khurana & Rosenthal, 1997). The critical management task is to identify and remove communication barriers and unproductive

conflicts through the high level of social cohesion, which will result in generating meaningful new initiatives for products and programs through effective communication, social ties, and team citizenship (Im et al., 2013).

Heising (2012) suggested that managers of project portfolios need to pay attention to the front end, focusing on the strategic setting of ideation, the formalization and institutionalization of the ideation process, integration mechanisms, stakeholder management and ideation culture.

What control mechanisms can managers use in managing the front end of innovation projects? There is a variety of management control mechanisms that can be considered as integrative organizational arrangements. Such arrangements include: coaches, facilitators, groups, boards, innovation strategy, innovation process, coordinators for strategy and process implementation, idea management software systems, idea campaigns, specialized task forces for supporting executives and the staff, and challenge-driven idea generation processes (Artto et al., 2011). The management control mechanisms can be belief systems, boundary systems, diagnostic control systems, and interactive control systems. Each of these types of management control systems categorizes control mechanism representing specific organizational arrangements (Artto et al., 2011; Simon, 1994, 1995). To facilitate collaboration in the early stage, integration mechanisms and incentives need to be linked to the organization strategy (Grote et al., 2012). In the context of online customer forums, organizational mechanisms may include defining new roles and procedures to manage the relationships between internal product development teams and external customer partners, establishing new processes that integrate online customer interactions with specific product development phases and

activities, and holding offline events that bring together customers and product development team members at one stage (Nambisan & Baron, 2010).

About integration mechanisms, the impact of instruments to facilitate inter-divisional networks should not be underestimated (Grote et al., 2012). Concerning decision-making, the management is a source of decision-making information, not a source of decisions (Smith & Reinertsen, 1992). The primary task of a decision-maker is to compare and contrast rated concepts and to choose concepts for further development (Montoya-Weiss & O'Driscoll, 2000).

4.2 The role of cross-divisional teams

The role of teams is to reduce uncertainty about innovation, reduce the variability of activities between functional areas and increase the effectiveness of the activities shared between functional areas through flows of formalized information during the planning phase (Grote et al., 2012; Moenaert et al., 1995; Sandmeier, 2014).

The team structure varies in composition, size, and leadership; and are characterized by a small core team such as of 6-10 full-time members (Smith & Reinertsen, 1992), including the cross-functional development teams, concurrent engineering, and the role of R&D manager idea champion (Brem & Voigt, 2009; Smith & Reinertsen, 1992), selected suppliers as partners - because of their knowledge of technology, costs, and design-, a senior manager, and a potential project leader met early on and negotiated vital roles and responsibilities (Khurana & Rosenthal, 1997). These staff teams adequately quick and efficient the product development process (Smith & Reinertsen, 1992).

Interdisciplinary teams can be composed by people from inside and outside the company (Brem & Voigt, 2009); influencing the product and marketing creativity. The

internal team factors are social cohesion and superordinate identity, which is the degree to which team members identify with the team to which they belong, are committed to its overarching goals, and feel a stake in its success and failure. The external team factors are market-based reward system, planning process formalization; and encouragement to take risks (Im et al., 2013). Internal personnel should be valued for their contribution to the idea generation process by two factors: first, in-depth knowledge of firm strengths ensures that development ideas are consistent with the firm's development expertise. Second, employee knowledge of market trends is based on market needs (Murphy & Kumar, 1996). External information (for example, participation in conferences), the building of a research network, and the ability to utilize research findings; are essential aspects of absorptive capabilities to successful innovation (Biedenbach & Müller, 2012).

To increase the number of high-quality innovation ideas created by individuals, the possibility of interacting with other people should be supported and facilitated (Björk et al., 2010) (Björk & Magnusson, 2009). Teams with higher levels of social cohesion provide more valuable and meaningful ideas for R&D and marketing because they remove inefficiencies and inadequacies through their close interaction and collaboration (Im et al., 2013). Successful project teams are characterized by a maximum uncertainty reduction during planning, by a maximum decrease of R&D and marketing task variability, and a maximum increase of R&D and marketing task analyzability (Moenaert et al., 1995).

Communication between team members should be apparent that the responsibility to be well executed (Björk et al., 2010; Bjork & Magnusson, 2009; Brem & Voigt, 2009; Khurana & Rosenthal, 1997; Moenaert et al., 1995). The collaboration within the team leads not only to create more ideas but also mainly to create better ideas (Bjork &

Magnusson, 2009; Grote et al., 2012; Im et al., 2013). Well integrated teams eliminate losses and duplications of concepts, avoiding rework in the later stage of product development (Moenaert et al., 1995; Rauniar & Rawski, 2012); and increasing the number of high-quality ideas (Bjork & Magnusson, 2009). In successful innovation projects, the project team has during the planning stage 1) profoundly identified the actions that have to be taken for the development of the project, that is, increase analyzability and challenged most of the surprises and the new elements that characterize a particular innovation project, that is, decrease variability. Information flows between the members of the core team help them to achieve this efficient uncertainty reduction (Moenaert et al., 1995).

How can corporate managers stimulate cross-divisional collaboration in the front end of innovation? Each team needs to ensure that the design and development decisions made at various concurrent stages are consistent with the past decisions and the future decisions to meet the overall project and customer requirements. Therefore, the team assumes control of the project, meet daily and make final decisions (Rauniar & Rawski, 2012; Smith & Reinertsen, 1992).

4.3 The inter-firm integration

The literature on FEI discusses the integration between roles as the integration between functional areas of the same company. Nevertheless, there is also inter-firm integration according to level of relationship formalization (informal/formal arrangement), or to type of organizational structure (alliance, joint venture, communities of practices and social networks, R&D agreements); and to the positions of the partners in industry architecture (vertical-horizontal cooperation, public-private partnerships, triple helix). According to the nature of partners involved, the firm can work with

exploitation or exploration of innovative opportunities, highlighting as a useful distinction in cooperation partners (Gillier et al., 2010).

How does the structure of a network offer an approach to evaluate the potential of inter-firm collaboration? Inter-firm collaboration in activities such as idea generation and selection or product definition strongly influences the value of joint innovation at a company level. Joint product strategies, idea generation, and project planning appear to be activities where collaboration is of significant importance (Grote et al., 2012). Exploring innovative opportunities by creating an external entity such as a partnership is highly recommended by the literature. Relational aspects need to be taken into account throughout the project's' life cycle because partners have to build and maintain a consensual vision of the project in progress (Gillier et al., 2010). The intention is to have each function develop its strategy using input from the others (Gerwin, 1993).

Some studies have discussed techniques and activities of integration and collaboration in the FEI and how players perform knowledge exchange in technology and innovation management.

In dynamic industries, the integration of players in the early phase of the product development process is made through an iterative model. The responsibilities of each player have relative importance according to the project objective. Each player is more or less involved in each activity so that the company gets the maximum use of each role in that movement and thus ensures the success of innovation.

When the roles are integrated into the FEI, information about consumers, technology, and market are still shared in the ideation phase, avoiding confusion of concepts and rework at the end of product development process; as well as cost and

quality of production and product launch can be measured before testing the product on the market.

It has been discussed on the accumulation of knowledge, specialization of tasks and skills. The careful organization of activities seems vital to ensure that resources allocation occurs appropriately and experience among the players shared. A player is called to an operation because of its competences according to the degree of newness. To use knowledge brokering, some players work better than others, such as design role, because designers usually know the state-of-the-art technology and consumer behavior. Next sections will analyze studies that focus on the exploration of the functions on the FFE according to the degree of newness.

4.4 The role of Design Brokering

The innovations that are new to the world but not new to the firm and because they did not have radical changes in the system are termed incremental innovations (Griffin, 1997; Goldenberg, Mazurski & Solomon, 1999). They use a standard to solve well-defined problems (Moenaert et al., 1995) and usually occurs in the internal dynamics of the company, allowing the problem solvers to be more creative in exploring new functions for a predefined form rather than searching for solutions for predefined functions (Goldenberg, Mazursky, & Solomon, 1999; Verworn et al., 2008).

Information flow in the FEI moves into the firm through the efforts of certain individuals playing specific roles (De Brentani & Reid, 2012; Reid & De Brentani, 2004); with the expected behavior patterns attributed to a particular position in an organization (Moenaert et al., 1995). The exposure to and acquisition of information and the propensity of individuals to create innovation ideas is therefore not only a result of innate creativity but mainly is on the effect of their position about information (Bjork & Magnusson,

2009).

Innovation projects where companies hold a product leadership position tend to follow a strategy in which they anticipate their customers' needs. By contrast, those firms that cannot claim leadership status find more informal ways to integrate customers and apply more flexible product innovation processes through idea brokering (Sandmeier, 2009). The customer participation seems to be necessary for the early phases of all kinds of projects (Verworn et al., 2008). Development team members should participate in distributed resource networks in which customers play significant roles and operate across traditional corporate boundaries, collaborate to achieve innovative solutions, and learn from one another to speed their capability building (Sandmeier, 2009). By encouraging the creative teams to be cognizant of exploratory scope, this constraint additionally helps the teams to utilize their accumulated knowledge and acquire new relevant information necessary for a creativity task (Hirunyawipada & Paswan, 2013).

To enhance team's effectiveness managers should recognize the specific contingency factors of a new product development project that can either be related to characteristics of the team members (Rauniar & Rawski, 2012). A cross-divisional product can be a radical innovation - e.g., Philips, Roche, Motorola - (Grote et al., 2012), implementing the application brokering successfully, while established firms can choose to use anticipation of their customers' needs. The brokering strategy focus on bringing together the different perspectives of various specialists to cross-fertilize findings from diverse industries. To use brokering, the careful organization of activities seems vital to ensure that resources allocation occurs appropriately and retaining transparency among the departments involved. The brokering strategy potentially leads to product innovations with the highest degree of newness (Sandmeier, 2009).

Sutton and Hargadon (1996) describe six consequences of brokering:

- (1) Supporting the organizational memory of design solutions,
- (2) Providing skill variety for designers,
- (3) Supporting an attitude of wisdom (acting with knowledge while doubting what one knows,
- (4) Creating a status auction (a competition for status based on technical skill,
- (5) Impressing clients, and
- (6) Providing income for the firm.

The learning during the FEI is different according to the degree of innovation: the development team members have an opportunity to broaden their competencies with radical changes, while incremental innovations can experience building (Verworn et al., 2008). According to Gerwin, 1993, it should be considering the manufacturing's background to do brainstorming on what significant features and functions should exist in the next generation and design differently in the existing product. In addition, participating in the previous stages, manufacturing acquires knowledge of market's needs, market structure, the features of existing and anticipated competitive products, and how customers use the product.

Biedenbach & Müller (2012) identified five types of learning skills for the ideation phase: three dynamic capabilities (adaptive, absorptive and innovative), project capabilities, multiproject capabilities. The characteristics of these capabilities are:

1. Adaptive capabilities: ability to respond in a rapid and flexible manner to dynamic market conditions, to change direction, and to think in new ways that are supported by fast decision making,
2. Absorptive capability: ability of a firm to learn from partners, integrating external information and transforming it into organizational knowledge,

3. Innovative capability: ability to develop new products and/or markets through strategic innovative orientation combined with innovative behavior and process,
4. Project capabilities: involve both the ability to compete a project successfully and the ability to win project bids; and the efficient and effective use of resources available,
5. Multiproject capabilities: ability to successfully manage for R&D pipeline of multiple projects for the continuous outcome of numerous innovative products.

The table 6 presents the four FEI integration mechanisms presented here: cross-functional team, which includes integration between marketing and/or engineering and/or technology roles; Inter-firms, which provides integration between firms such as partnerships and alliances; brokering; integrating problem solvers from analogous markets; Orchestrator, which is the manager or, as the older authors define, the decision maker. Table 7 presents the constructs for Integration Mechanisms.

Table 6: The Integration Mechanisms in the Front-End of Innovation

Types of integration	Mechanisms of integration	Evidences
Cross-functional team	Close interaction, collaboration, individuals' responsibilities and a sense of ownership has a positive effect on creativity, especially for complex tasks. Formalization of ideation activities and exchanging intensively with other members of the teams can contribute to the uncertainty reduction. Motivate employees to communicate their ideas and exchange and express this opinions	Smith & Reinertsen (1992); Gerwin (1993); Moenart, De Meyer, Souder, Deschoolmeester (1995); Murphy & Kumar (1996); Khurana & Rosenthal (1997); Langerak, Hultink & Robben (2004); Verworn (2006); Brem & Voigt (2009); Björk & Magnusson (2009); Björk, Boccadelli & Magnusson (2010); Biedenbach (2011); Soukhoroukova, Spann & Skiera (2011); Grote, Herstatt & Gemünden (2012); Rauniar & Rawski (2012); Im, Montoya, and Workman Jr; (2013); Hirunyawipada & Paswan (2013); Stevens (2014)

Inter-firms	Exploring innovative opportunities can be created through an external entity such as a partnership. External team encourage to take risks. Provide informal access to resources and expertise, increasing the level of resources available during the FFE.	Brem & Voigt (2009); Gillier, Piat, Roussel & Truchot (2010); Biedenbach (2011); Im, Montoya & Workman Jr (2012); Schoonmaker, Carayannis & Rau (2013); Stevens (2014)
Brokering	Integrating problem solvers from analogous markets. Combination of knowledge between divisions has a higher impact than knowledge recombination between different firms. Technology and application brokering: experimentation, improvisation, and rapid learning.	Sandmeier (2009); Rauniar & Rawski (2012); Grote, Herstatt & Gemünden (2012); Schirr (2012)
Orchestrator	Manager, orchestrate the system. Chief innovation. Decision-maker. The management is a source of decision-making information, not a source of decisions- Identify and remove communication barriers and unproductive conflicts. Manage for R&D pipeline of multiple projects. Compare and contrast rated concepts and to choose concepts for further development	Smith & Reinertsen (1992); Moenart et al (1995); Khurana & Rosenthal (1997); Montoya-Weiss & O'Driscoll (2000); Langerak, Hultink & Robben (2004); Vandenbosch, Saatcioglu & Fay (2006); Björk, Boccardelli & Magnusson (2010); Nambisam & Baron (2010); Williams & Samset (2010); Biedenbach (2011); Artoo, Kulvik, Poskela & Turkulainen (2011); Soukhoroukova, Spann & Skiera (2011); Im, Montoya & Workman Jr (2012); Rauniar & Rawski (2012); Stevens (2014)

Table 7: Constructs for Integration Mechanisms

Integration mechanisms	Constructs	Evidences
Cross-functional team	The degree to which the company promote cross-divisional collaboration through integration mechanisms	Grote, Herstatt and Gemunden (2012); Im, Montoya, Workman Jr (2012)
	The degree to which the company promote cross-divisional collaboration through rewards system.	
Inter-firms	The degree to which the company involve design agency in the predevelopment phase.	Gupta, Raj and Wilemon (1085); Zhang, Hu and Kotabe (2011)
	The degree to which the company involve the suppliers in the predevelopment phase.	
Design Brokering	The degree to which the company creates and manages social networks.	Hargadon (2002)
	The degree to which the company access to distributed knowledge in his network.	
	The degree to which the company assimilate the distributed knowledge.	
	The degree to which the company recombines learned knowledge through analogical reasoning.	
	The degree to which the company move from innovative ideas to accepted innovations by building new network ties, embedding the emerging recombination within a new domain networks.	

5. DEGREE OF INNOVATION

Front-end phase includes activities such as reduction of a market and technological uncertainty (Cooper, 1993; Khurana & Rosenthal, 1997; Stockstrom & Herstatt, 2008). However balancing efficiency and innovation in this environment of uncertainty is difficult, because the ability requires management process such as control and standardization; while innovation exhibit a greater need of flexibility, autonomy, risk-taking, and tolerance for mistakes, breaking the existing paradigms (Brown & Eisenhardt, 1997; Stockstrom & Herstatt, 2008).

Innovations typically are characterized by the improvement in performance and reduction in costs; and have risks such as the technical, marketing, or organizational resources (Booz, Allen, & Hamilton, 1982; Rice, Kelley, Peters, & Colarelli O'Connor, 2001) (Griffin, 1997). Some authors advocate that the more market and technological uncertainty are reduced during the fuzzy front-end phase, the fewer divergences occur during the development phase, and the higher the probability of success (Moenaert et al., 1995; Stockstrom & Herstatt, 2008). The degree of newness influences the choice of the process and the way of how the players interact in the FEI (Brem & Voigt, 2009; Gillier et al., 2010; Im et al., 2013; Sandmeier, 2009; Stevens, 2014).

According to Booz, Allen & Hamilton (1982), concerning to the degree of newness, 29% of the products are new to the world, 36% new products lines, 14% modifications of existing product, and 22% have a rather low degree of newness with repositioning in the market or cost reduction products. In exceptionally dynamic industries, 100% of revenues may stem from new products (Cooper, 2001).

Incremental innovations are characterized by efficiency practices flexibility

(Stockstrom & Herstatt, 2008) and standardization (Goldenberg et al., 1999); in contrast to this, radical innovations demands higher degree of flexibility (Stockstrom & Herstatt, 2008). Incremental innovations have been evaluated based on internal point of view of the firm and are characterized by repositioning in the market and product modification, while radical changes have been assessed based on external factor to the company and are familiar to the world (Booz et al., 1982; Salomo, Weise, & Gemünden, 2007; Verworn et al., 2008) (Griffin, 1997; Song & Montoya-Weiss, 1998).

Breakthroughs innovations usually start with technologists, who are the generators of radical ideas. The idea generator is the primary performer in the system. It is the idea generator's responsibility to provide the relevant information about his or her idea. Because the need for information is higher for radical products and the idea generators may be unfamiliar with marketing, business, and human factors areas, they may need support to understand how to address the questions in a specific context (Akbar & Tzokas, 2013; Bessant, von Stamm, Moeslein, & Neyer, 2010; De Brentani & Reid, 2012; Montoya-Weiss & O'Driscoll, 2000; Reid & De Brentani, 2004)(Song & Montoya-Weiss, 1998).

Rice, Kelley, Peters & O'Connor (2001) identified three primary technology-to-organization links with an assessment of the radicalness of the technology, dialoguing between the technologist (the idea generator) and the business development manager (the idea receiver): the evaluation between the technology and the organization's technology capabilities; the potential impact of the technology's applications on the market and within the firm; and the assessment of the applicability of the technology to the firm's core business.

The commercialization of radical technology development is more likely successful when there is a link to existing technological capabilities (Christensen &

Bower, 1996; Green, Gavin, & Aiman-Smith, 1995). The technology team must have or have access to the skills needed to accomplish technical feasibility, or achieve this expertise through an alliance partner (Rice et al., 2001).

About the second question, internal communication is a critical point, insofar, as the timing of information is a crucial element of the cooperation between technology and market (Brem & Voigt, 2009). In addition, when the technical direction diverges from the organization's current business, management may be averse to support the development of the new technology (Rice et al., 2001).

The primary task of a decision maker is to compare and contrast rated concepts and to choose concepts for further development. Because the decision maker usually has many funding decisions to make with regard to new product/service concepts, he or she needs support that enable comparing and contrasting the most salient attributes for each concept as they relate to the business imperative of the organization (Montoya-Weiss & O'Driscoll, 2000).

Not all innovations are driven by an exogenous factor such as client needs, changes in available technology, and the state of the economy. Some patterns in the internal dynamics of innovations may yield technological changes that demand less adjustment effort by the manufacturer. These innovations are new to the world but not new to the firm and because they did not have radical changes in the system, they are termed incremental innovations (Goldenberg et al., 1999)(Griffin, 1997).

The contributions of an innovation can be analyzed with two dimensions: newness to the market and newness to the company. The first dimension related to market fuzziness comes from a lack of understanding of clients' preferences or even a lack of information on competitor behavior. The second aspect pertains to a lack of information

on the technologies required to design new combinations of techniques so that new offerings can be produced (Stevens, 2014).

According to the degree of innovation, the companies play different roles in the FEI: technology-push firms are more creative, destructive, with new/ significant improvements, while market-pull corporations work with replacement/ substitute products (Brem & Voigt, 2009); and they can play activities of exploration or exploitation: Exploration projects tend to explore new positions and are often regarded as radical innovations, also qualified as architectural, breakthrough or disruptive (Gillier et al., 2010), establishing competitively dominant positions and building competitive advantage (Danneels, Kleinschmidt, & Cooper, 2001). Firms with an explicit focus on making ideation practices experience that there are some negative consequences of the resultant formalization (Björk et al., 2010). Exploitation project is seen as improving existing solutions and extending existing skills and technologies. Hence, they are more generally qualified as incremental innovations (Gillier et al., 2010).

Regarding novelty, Im, Montoya & Workman Jr, 2013, defines two dimensions to the creativity: novelty and meaningfulness novelty. Originality is the degree to which outputs are perceived as new and different from those of competitors in a domain. Meaningfulness is the extent to which the targeted audience perceives outputs as appropriate and useful.

5. METHOD

Social research has three main phases: planning, execution, and reporting. The plan has to anticipate how the study will be done and detail the research method is necessary at the planning stage to make right decisions, with appropriate guidance, avoiding running the risk of losing control of the project and failing to complete it successfully. It is essential to perform a discussion of the core elements of the research design, and the connections between them (Blaikie, 2009).

Despite the growing research about the FEI in recent years, there is a need for further research on the theme to understand the dynamics better and help to reduce the uncertainty in the critical concept phase. The formal processes designed for the front end are insufficient, the rules and roles are not fully described, and it is necessary to balance the interactions between the activities in the FEI to get a better-structured New Product Development – NPD – later. The main FEI models developed at the literature have discussed some key roles such marketing, engineering, customers, but they do not address the role of design, which is critical in creative activities that, in turn, are the nature of the new product development process. The literature also has not discussed the external integration in the FEI, that is, how the Brand Owners integrate the partners, especially the suppliers and design agencies, in this critical and uncertain phase.

To tackle this issue, this research aims to examine the FEI in a dynamic industry, discussing the integration of roles in an iterative process. The objective of this study is to identify the roles that play in the Front End of Innovation and the mechanisms of integration, whether internal through cross-functional teams; or external through inter-

firms combination. Besides, the objective is to define the boundaries within the FEI and between FEI and the New Product Development.

Based on the discussion concerning the Front-End models, the central question of this research is recalled: “What roles are involved in each FEI activity and what is the mechanism that integrates these roles in the FEI?”. The research question leads to the description of the supply chain, activities and division of labor into the front end phase, and the types of roles integration, internal and external.

For instance and following the Eisenhardt (1989) and Yin (2015) recommendations, this study is a qualitative and exploratory method with a multiple-cases-studies approach. To examine this topic of literature on innovation, the case study method is suitable, showing the roles of the players on several projects to form a basis for meaningful generalizations (Barratt, Choi, & Li, 2011; Ellram, 1996; Ketokivi & Choi, 2014; Voss, Tsikriktsis, & Frohlich, 2002; Yin, 2015).

This method can offer a logic or a description of the analysis through which research outcomes are drawn (Barratt et al., 2011), providing new things to be gleaned about the FFE, such as the constituent parties' effort in order to work in a very integrated manner and through the sharing of such information in this phase according to the type of project. There is no control of behavioral events, so a survey is not sufficient for such facts basis because this study aims to know why the performance of each role in each project.

5.1 The Theoretical Framework

For planning the theoretical framework, we chose the Web of Science database as the source of information, which is one of the most extensive multidisciplinary databases, and according to the following “search string”: select the keywords "front end of

innovation" OR "front end innovation" OR "fuzzy front end" OR (predevelopment AND product), select the Research areas “MANAGEMENT” OR “BUSINESS” OR “ENGINEERING INDUSTRIAL”) and focus on document types “ARTICLE” OR “REVIEW”, examining the period between 1988 (when Cooper first wrote about this phase) and 2017. The result is 221 papers.

From this first survey, we made some selections. First of all, we divided the papers per year, aiming to analyze the evolution of the theme since 1988. Then, based on the work of Mendes & Oliveira (2015), we selected the journals that more discuss the FEI (Table 8), and we identified the papers of this sample with colors according to these journals (Fig. 10 and 11), aiming to indicate what field of interest is in each journal.

Table 8: Number of papers published per Journals

Journals	Nº of papers
Journal of Product Innovation Management (JPIM)	25
Research Technology Management (RTM)	17
R&D Management (RDM)	12
Creativity Innovation Management (CIM)	11
International Journal of Technol. Management (IJTM)	9
IEEE Transaction Engineering Management	6
Technovation	6
Management Science	5
Journal of Eng. Technology Management	4
Research Policy	4
Industrial Marketing Management	3
International Journal of Project Management	3
Journal of Marketing Research	3

Source: Adapted from Mendes & Oliveira (2015)

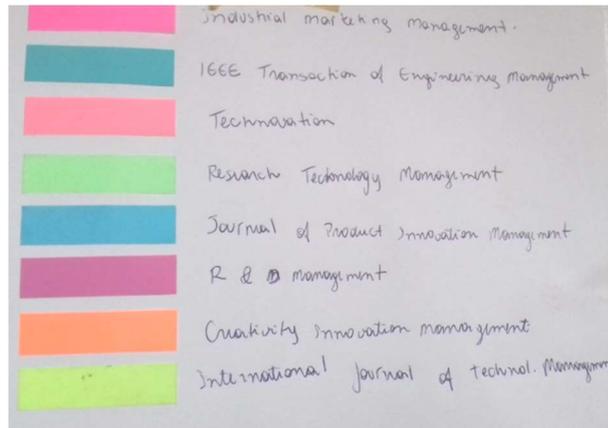


Figure 10: Categorization of the papers published per Journals

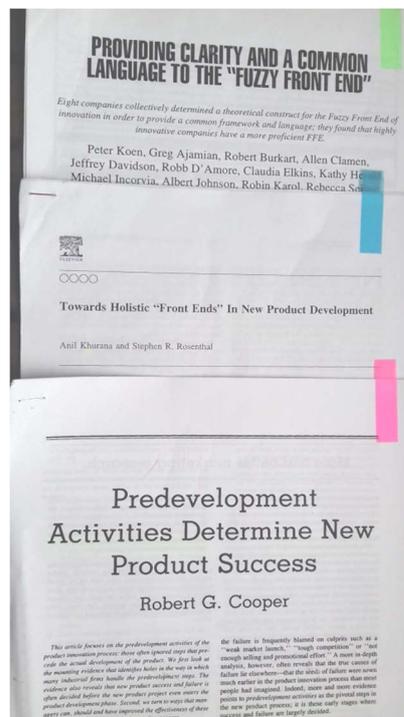


Figure 11: Categorization of the papers published per Journals

Next step, we refined the search, selecting papers that address the following themes, which then turn into chapters of this study (Table 9).

Table 9: The sections of this study (chapters)

The sections of this study (chapters)	Papers
FFE models	51
Roles and integration of roles	27
Types of innovation according to the degree of newness (radical, incremental, brokering)	27

This selection aims to discuss the critical elements in the primary front-end models, identifying the activities and roles of the main players such client, creation, suppliers, and customers. Also, this selection aims to describe how the organization is structured in each project, how the roles are integrated, and how the teams are created, and the decisions are taken. This literature review realized that there are gaps such as learning and shared knowledge for further innovations development, and the description of the role of brokering, especially the strategic design as a broker.

The last step of the bibliographic research was making the book report of the selected papers on “roles” and “mechanisms of integration”. The first theme, “FEI models”, just had already been stressed in the chapter 2. Then, the main thoughts of each paper were carried to a large picture (Fig. 12). Each paper was categorized in one of four codes, named: roles, newness, contingency, and brokering and received a different color: roles-red, newness-blue, contingency-green, and brokering-orange. The code “role”, in turn, was divided in other codes, named: the role of technology, the role of marketing, the role of customer, the role of manager, the role of design, the role of team, the inter-firm integration, the integration of roles, and competences (Table 10).



Figure 12: Visual map for book report

Table 10: The codes to the selected papers on roles

Theme/Codes	Papers
The role of marketing (3)	Moenart, De Meyer, Souder, Deschoolmeester (1995)
	Langerak, Hultink & Robben (2004)
	Schoonmaker, Carayannis & Rau (2013)
Technology integration (2)	Gerwin (1993)
	Montoya-Weiss & O'Driscoll (2000)
The role of customer (3)	Sandmeier (2009)
	Nambisam & Baron (2010)
	Schirr (2012)
The role of manager (7)	Khurana & Rosenthal (1997)
	Verworn (2006)
	Björk & Magnusson (2009)
	Williams & Samset (2010)
	Artoo, Kulvik, Poskela & Turkulainen (2011)
	Rauniar & Rawski (2012)
Stevens (2014)	
The role of Design (1)	Micheli & Gemser (2016)
The role of teams (3)	Smith & Reinertsen (1992)
	Im, Montoya & Workman Jr (2012)
	Hirunyawipada & Paswan (2013)
The inter-firm integration (1)	Gillier, Piat, Roussel & Truchot (2010)
Integration of roles (1)	Brem & Voigt (2009)
Competences (6)	Murphy & Kumar (1996)
	Vandenbosch, Saatcioglu & Fay (2006)
	Björk, Boccardelli & Magnusson (2010)
	Biedenbach (2011)
	Soukhoroukova, Spann & Skiera (2011)
Grote, Herstatt & Gemünden (2012)	

With this big visual map, we analyzed in the early years, the literature on FEI explains what roles exist into the early stage of product development, emphasizing in marketing roles, R&D, and technology integration. From 2006, it is possible to find studies discussing contingencies for choosing times and forms of integration according to the type of project to be developed. Here, the role of the manager is crucial to determine the team correctly according to the skills of each function. Papers on the role of manager usually discuss teams or integration between functional areas and management of knowledge, that is, how knowledge is shared between the players. From 2009, arise

papers on consumer collaboration, and the papers about competence. Finally, the only article that discusses inter-firm integration, in 2010, and other paper that examine the role of design in 2016. The use of post-its it was possible to gather the same ideas and transfer these ideas to these report (Fig 13).



Figure 13: Visual map with post-its

Besides, it was carried out documentary research through trade journals of the packaging industry, websites, communication materials and Annual Reports of the companies to identify specific terms of the packaging sector and innovations process.

From the literature, three major themes emerged: FEI models, functions and integration mechanisms. For this study, we chose the Koen et. al. (2001) model which, in turn, five FEI activities: Opportunity Identification and Analysis, Idea Generation, Idea Enrichment, Idea Selection, and Concept Development.

To identify the roles in each activity, as well as marketing roles, engineering, and design. Marketing is associated with Brand Owner; engineering to Manufacturer/Converter, and design to the Design Agency.

To identify the integration mechanisms, cross-divisional teams, inter-firm integration, and brokering design were defined. The reason for establishing brokering design as integration mechanism was in the first phase of the study, by interviewing, exploratory, some companies in the packaging industry value chain. Design can act as a driver of the innovation process when using their skills as a broker, integrating past experiences with current problems, translating knowledge, integrating players and making analogies with other sectors.

Table 11 presents the constructs and variables for the three themes, based on the literature. The variables became questions in the interviews script of the second phase of the research.

Table 11: Constructs for FEI, Roles, and Integration Mechanisms

Activities/Roles	Constructs	Variables (Questions)
Opportunity Identification and Analysis	The degree to which the company spends time evaluating the external environment with a formal process.	The degree to which the company performs a through analysis of the external environment.
		The degree to which the company uses a formal documented process review of the external environment.
Idea Generation	The degree to which the business unit has a systematic way to capture, share, record and provide feedback on ideas.	The degree to which the company has a systematic method to capture and share ideas.
		The degree to which the company records ideas.
		The degree to which the company provides feedback on ideas received.
Idea Enrichment	The degree to which the business has an IT-based system for sharing, capturing, and assessing ideas as well as the ability to identify R&D people and find what they are doing.	The degree to which the company has IT-based systems for sharing, capturing, and assessing R&D project information.
		The degree to which the company has IT-based systems for allow people to find R&D people and what they are doing.
Idea Selection	The degree to which the business unit has an idea review board, a comprehensive method for idea evaluation, and a defined set of selection criteria.	The degree to which the company has an idea review board.
		The degree to which the he company has a comprehensive idea selection and evaluation method .
		The degree to which the company has a defined set of selection criteria for idea selection.
Concept Development	The degree to which the company assess the feasibility of manufacturing process, the , marketing and sale effort, technical requirements, and economic factors connected with a project.	The degree to which the company seeks to understand the feasibility of projects with regards to manufacturing.
		The degree to which the company seeks to understand the feasibility of projects with regards to marketing and sales.
		The degree to which the company seeks to understand the feasibility of projects with regards to technical requirements.
		The degree to which the company seeks to understand the feasibility of projects with regards to economics.
Integration Mechanisms	Constructs	Variables
Cross-functional team	The degree to which the company promote cross-divisional	The degree to which the company promote informational exchange by the use of information technology.

	collaboration through integration mechanisms	<p>The degree to which the company foster job rotation between its division</p> <p>The degree to which the company sustain permanent committees for cross-divisional R&D topics.</p> <p>The degree to which the company create specific cross-divisional units for cross-divisional R&D topics.</p>
	The degree to which the company promote cross-divisional collaboration through rewards system.	<p>The degree to which the company reward its employees based on corporate performance.</p> <p>The degree to which the company promote non-monetary incentives cross-divisional collaborations.</p>
Inter-firms	The degree to which the company involve design agency in the predevelopment phase.	The degree to which the company spends time evaluating the external environment with a formal process
		The degree to which the business unit has a systematic way to capture, share, record and provide feedback on ideas
		The degree to which the business has an IT-based system for sharing, capturing, and assessing ideas as well as the ability to identify R&D people and find what they are doing.
		The degree to which the business unit has an idea review board, a comprehensive method for idea evaluation, and a defined set of selection criteria.
		The degree to which the company assess the feasibility of manufacturing process, the , marketing and sale effort, technical requirements, and economic factors connected with a project
	The degree to which the company involve the suppliers in the predevelopment phase.	The degree to which the company spends time evaluating the external environment with a formal process
		The degree to which the business unit has a systematic way to capture, share, record and provide feedback on ideas
		The degree to which the business has an IT-based system for sharing, capturing, and assessing ideas as well as the ability to identify R&D people and find what they are doing.
		The degree to which the business unit has an idea review board, a comprehensive method for idea evaluation, and a defined set of selection criteria.
		The degree to which the company assess the feasibility of manufacturing process, the , marketing and sale effort, technical requirements, and economic factors connected with a project

Design Brokering	The degree to which the company creates and manages social networks.	The degree to which the company recombine innovations, existing ideas, artifacts, and people in new ways.
	The degree to which the company access to distributed knowledge in his network.	The degree to which the company exploit small worlds in the pursuit of innovation.
	The degree to which the company assimilate the distributed knowledge.	The degree to which the company convert experience into knowledge.
	The degree to which the company recombines learned knowledge through analogical reasoning.	The degree to which the company use past knowledge to solve current problems.
	The degree to which the company move from innovative ideas to accepted innovations by building new network ties, embedding the emerging recombination within a new domain.networks.	The degree to which the company construct new networks around those combinations in order to ensure its success.

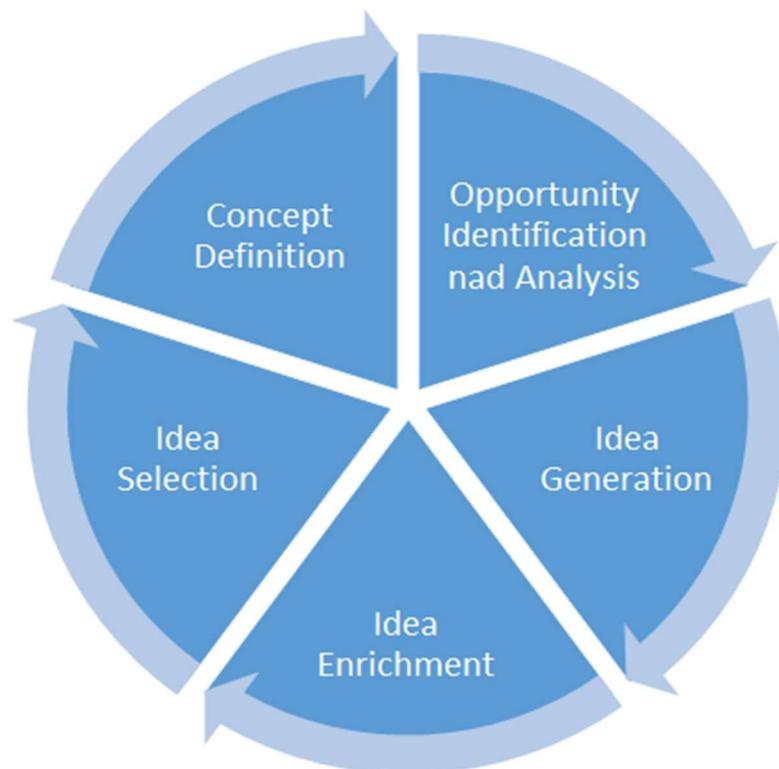


Figure 14: FEI Model

Source: Adapted from Koen, Ajamian, Boyce et. al. (2002)

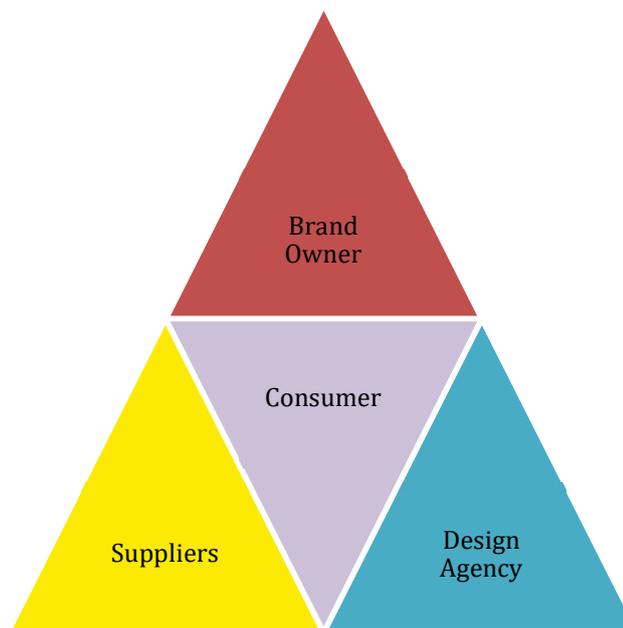


Figure 15: Roles in the Packaging Industry

5.2 The research protocol

It was adopted the method of multiple cases (Barratt et al., 2011; Yin, 2015), having as units of analysis the Brand Owners connected to value chain of the Brazilian Packaging Industry. The sample is composed of the executives from different Brand Owners, and from design agencies and converters that are suppliers of Brand Owners and have been involved with them for the past three years.

The field research have had two phases:

Phase 1: Exploratory, from 2014 to 2016. At this stage, the researcher interviewed some Brand Owners, Design, Agencies, and Suppliers to investigate the pre-development phase of the innovation process, the most recurring activities, and tasks, the difficulties, the challenges, the barriers, the boundaries between pre-development and development

itself.

The interviews were recorded and transcribed. From the transcriptions, the most cited topics became codes that indicated great themes: Ideation, Idea Selection, Concept, technical viability, commercial viability, information sharing, and collaboration. These issues were researched in the literature. Annex 1 presents the interview guide for phase 1.

Phase 2: Exploratory, in 2017. This phase had five steps:

First of all, we selected some success or failure projects, the last that have been launched in various sectors such as foods, personal care, beverage and others. Then, we identified the brand owner that demands each project, and the design agency and suppliers involved in each project.

In step two, the interview script was constructed applied to the Brand Owner based on the constructs and variables (table 11). This scenario was tested with two companies. Annex 2 presents the interview guide for phase 2/step 2.

For the fourteen FEI activities defined in this study, each interviewee responded, through the Likert scale, about their perception of how their company operates in each activity. The Likert scale ranged from 1 to 5, where one means "Strongly Disagree" and five means "Strongly Agree". Then, the interviewee narrated cases to justify the choice of answers.

Regarding the integration mechanisms, the questionnaire was divided into three sections: cross-functional team, inter-firms, design brokering. For the cross-functional team and design brokering sections, Likert Scale from 1 to 5 was used, where one means "Strongly Disagree" and five means "Strongly Agree". Each respondent answered his perception of how his company integrates cross-functional team and how it uses the skills of design brokering. Then, the interviewee narrated examples to justify the choice of

answers.

For the inter-firm section, multiple-items were used, and each respondent selected which suppliers (Design Agencies and Manufacturers / Converters) acted in each FEI activity or scored "neither" when there was no partner integration. It was possible to select more than one supplier, indicating that the two suppliers were integrated into a particular activity.

Means of four items measured the performance: project development time, if this time has decreased in the last three years, if the product remains in the market, the percentage that the company invests in innovation.

In step three, the interviewees were identified: managers responsible for innovation management and packaging development, such as director and manager of R&D, engineering, new business, design, marketing. The study was conducted with the presence of the interviewer, and when this face meeting is not possible, by Skype, and ultimately by phone.

In the fourth step, we interviewed design agencies and converters who are suppliers of the Brand Owners talked in step 3, to cross-reference supplier responses with Brand Owner responses. Annex 3 presents the interview guide for phase 2/step 4.

In the last step, interviews were carried out by support companies and learning institutions, aiming to know the thoughts of these constituent parts of the value chain. Annex 4 presents the interview guide for phase 2/step 5.

5.3 Sample

The sample consists of the constituent parties described at Fig. 16 about the Packaging Value Chain, and it is based on literature review (Porter, 1993) and our experience. Each of the companies plays several roles. On top of the Value Chain, we have the Brand Owner who demands the job from the Design Agency. In addition, we have five kinds of producers: Machinery and Equipment's Manufactures, Converters and packaging printing industry, Suppliers of Raw Materials, Suppliers of lids and labels.

Converters and packaging printing industries are divided into steel, aluminum, aseptic carton, composite can, wood, paper (mono and composite bags), carton paper, undulated cardboard, flexible plastic (mono and composite), rigid plastic, glass.

We also have other organizations that support this Industry. For example, Retail Chain, like Walmart or Kmart, Learning Institutions, which are the universities on general and sectorial entities that regulate the rules in this industry.

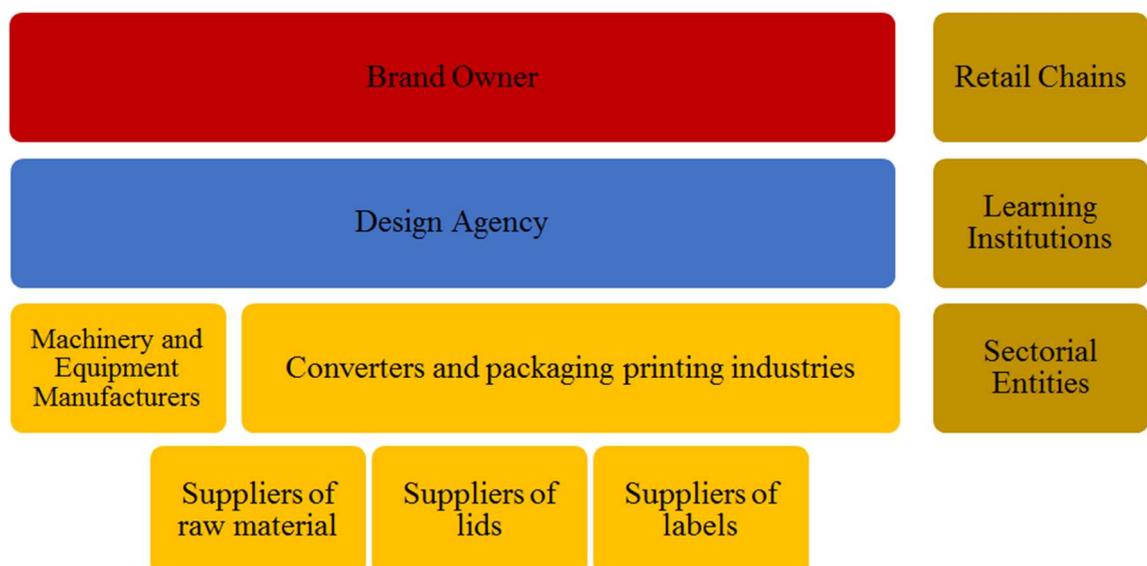


Figure 16: Value Chain of the Brazilian Packaging Industry

This value chain contains constituent parties, which are more involved in packaging development projects. Other constituent parties are not represented in this

value chain but may work in some specific projects. These component parties are consultancies, research and data companies, adhesive, paint, pigment and varnish suppliers, manufactures of containers and big bags, drum recovery and remanufacturing companies. The Brazilian Packaging Association (ABRE) has 247 associated companies, of which, 24 Brand Owner (Table 12).

Table 12: The Brazilian packaging list

Player	Number
Brand Owner	24
Design agency	30
Manufactures of machines and equipment	17
Converter/Packaging printing industry	53
Suppliers of raw materials	40
Suppliers of lids	9
Suppliers of labels	8
Retail chains	5
Learning institutions	3
Sector entities	9
Consultancies	19
Research and data companies	6
Manufactures of containers and big bags	6
Adhesive, paint, pigment and varnish suppliers	15
Recyclers	1
Drum recovery and remanufacturing companies	2

Source: Adapted from ABRE, 2016

There were 17 contacted companies, totaling 43 collaborators contacted. There were seven Brand Owners, four Design Agencies, three Suppliers of Raw Material, three Learning Institutions, and one Support.

Of these, 29 employees from 14 companies responded to the interview in phase 1:

six Brand Owners, three Design Agencies, three Suppliers of Raw Material, two Learning Institutions, and one Support Institution.

In the second phase, a Brand Owner and two manufacturers who participated actively in the first step, were left out of the research because they were not available for the interview. Data were collected from five Brand Owners, two Design Agencies, one Supplier of Raw Material, two Learning Institutions, and one Support Institution.

The average interview time is 1.5 hours, ranging from 30 minutes to 2 hours and some lasting almost 6 hours. Table 13 presents the samples of interviewees.

Table 13: Interviewees

	Role	Category	Time
1	Life-cycle Management	Suppliers of Raw Material	2h
2	Creative Director	Design Agency	30'
3	Coordenadora do Comitê de Educação da ABRE	Support	2h
4	CEO	Support	4h
5	Packaging & Dispense Innovation (R&D)	Brand Owner: Beverage	30'
6	R&D	Brand Owner: Beverage	30'
7	Packaging & Dispense Innovation (R&D)	Brand Owner: Beverage	30'
8	Corp. Packaging & Dispense Innovation Manager	Brand Owner: Beverage	1h
9	SA/NI - Technology and Innovation	Suppliers of Raw Material	6h
10	Environmental Protection South America SA/TER	Suppliers of Raw Material	30'
11	Regional Operational Excellence Manager	Suppliers of Raw Material	30'
12	Sustainability Manager	Suppliers of Raw Material	30'
13	Innovation & Technology Center Manager	Suppliers of Raw Material	1h
14	Specialist Researcher	Suppliers of Raw Material	1h
15	Leader of Polymer Research	Suppliers of Raw Material	30'
16	Innovation & Technology Center Manager	Suppliers of Raw Material	30'

17	Gestão da Inovação - Centro de Tecnologia de Triunfo	Suppliers of Raw Material	1h
18	pet food	Brand Owner: Food	30'
19	Inovação	Brand Owner: Food	30'
20	Compliance	Brand Owner: Food	30'
21	R&D - Packaging - Innovation Center	Brand Owner: Food	2h
22	Lean Management	Brand Owner: Food	1h
23	Inovação	Brand Owner: Food	1h
24	R&D - Packaging - Innovation Center	Brand Owner: Food	30'
25	Director	Learning Institutions	1h
26	Coordinator of the Post- graduation in Packaging Engineering	Learning Institutions	1h
27	Professor and Packaging Book Author	Learning Institutions	2h
28	Gerente de Desenvolvimento de Embalagem	Brand Owner: Sweets and Desserts	30'
29	Associate Director - R&D Packaging	Brand Owner: Sweets and Desserts	2h
30	Director of Graphic Arts	Design Agency	2h
31	CEO	Design Agency	3h
32	Director Marketing	Brand Owner: Cosmetics, Personal Care, Perfumes	30'
33	General Packaging Development Manager	Brand Owner: Cosmetics, Personal Care, Perfumes	30'
34	General Packaging Development Coordinator	Brand Owner: Cosmetics, Personal Care, Perfumes	1h
35	Design Manager	Brand Owner: Cosmetics, Personal Care, Perfumes	30'
36	Innovation Manager at Committee Coordinator at Assoc.Nacional de P&D das Empresas Inovadoras ANPEI	Brand Owner: Cosmetics, Personal Care, Perfumes	1h
37	Creation Manager	Brand Owner: Cosmetics, Personal Care, Perfumes	30'
38	Packaging Innovation & Renovation Manager	Brand Owner: Food	1h
39	R&D Packaging Manager	Brand Owner: Food	2h
40	Planning & Creative Director	Design Agency	1h30

41	Design Coordinator	Design Agency	5h
42	R&D Packaging Manager	Brand Owner: Home Care, Personal Care, Foods, Refreshment	1h
43	General Packaging Development Coordinator	Brand Owner: Home Care, Personal Care, Foods, Refreshment	1h

5.3 Treatment of Data

For reasons of confidentiality, each Brand Owner, Design Agency, and Converter received a codification, presented in table 14. The interviews were recorded and transcribed, and reorganized according to the Roles and Integration Mechanisms themes.

Table 14: Companies' codification

Company	Sector
BV1	Beverages
SW1	Sweets
CO1	Cosmetics
FB1	Foods and Beverages
FB2	Foods and Beverages
DA1	Design Agency
DA2	Design Agency
CV1	Converter

The Brand Owners' responses were compiled into tables and recorded, transcribed, and presented and classified into three themes: Roles, Integration Mechanisms, and Other Issues, in which it was generally discussed Brokering and Company Performance.

For presentation and discussion of the results, the answers were presented using the corresponding numbers. Thus, when the response selected was "Strongly Disagree", note one was given, and when the response selected was "Strongly Agree", it struck with note 5. Each company received a total of points.

For each company, the total number of activities that each supplier was integrated

was counted, and the total number of activities that the two suppliers were involved in the FEI also was calculated.

For the presentation of cases, in chapter 6, each company was described as a case. For each case, two graphs were presented:

1. Roles: To show the stage in which each firm is concerning the activities of the FEI, describing the level that performs each paper, the radar chart located each event in the radar according to the total score that the company in each activity.

2. Integration Mechanism: to present the level of integration of design agencies and converters in each activity the pie chart considered that each part of the pizza is one of the five events of the FEI. Each piece received a color indicating whether the integration (in that activity) was performed just by converters, only by design agencies, converters, and design agencies together, partly by converters, in part by the design agencies, or by any of the suppliers. Following the same color pattern used throughout this work, full integration of the design agencies is represented by dark blue color, the dark yellow color represents full collaboration of the converters, integration of the design agencies and the converters together is described by the color green (considering that green is the union of yellow and blue), light blue color represents partial collaboration of design agencies, light yellow color represents partial integration of the converters, and gray color represents no cooperation of suppliers. A caption equal to that of table 15 is displayed just after the pie chart.

Table 15: Caption

	CONVERTER
	DESIGN AGENCY
	DESIGN AGENCY + CONVERTER
	CONVERTER + NEITHER
	DESIGN AGENCY + NEITHER
	NEITHER

6. CASE STUDIES

In this section, we present the five Brand Owners, discussing their roles and activities in the Front-End of Innovation, and how each company has been integrated its suppliers into the FEI. Table 23 presents the summary of the company characterization.

6.1.1 CASE BV1

6.1.1 Description

BV1 is a Brazilian brewing company. It is the biggest brewery in Latin America and the fifth in the world. BV1 was born, in 1999, from the merge between two companies that was approved by the Board of Directors on 2000.

BV1 has 32 breweries and two maltarias in Brazil and its product portfolio includes 30 brands of beers, carbonated soft drinks, bottled water, isotonic beverages, energy drinks, and ready-to-drink teas. The company has 46 thousand employees in Brazil, 100 centers of direct distribution and six centers of excellence in Brazil. Totally, BV1 has annual revenue of about \$45 billion and operates in 19 countries.

6.1.2 Roles

The company claims that it performs most of the activities into FEI, except capturing and sharing ideas.

BV1 frequently participates in fairs and exhibitions, investing and sponsoring events in the supermarket, packaging, beverage, marketing and other sectors related to its business. The company takes advantage of these events to know and present news in new

categories. For example, in a supermarket sector event, BV1's chief operating officer was alerted by retail staff that the Brazilian consumer has been looking for specific packaging for each occasion of consumption, identifying that he needs to adapt to this new moment. BV1 has faced the challenge of being consistently present in all distribution channels, bringing benefits to the point of sale and consumers, offering more options, since the customer prefers to migrate to a more advantageous packaging in relation price per liter or less disbursement, instead of stopping consumption. The operations director takes this information to the marketing and packaging development team, so ideas are developed.

Although BV1 allows its employees to register ideas through a platform, the company has not reflected on the ideas created, nor is there a routine of sharing ideas among employees. BV1 encourages internal entrepreneurship through the activities of generating and enriching ideas. For example, by stimulating domestic entrepreneurship, the beverage delivery platform and the creation of pubs with brands made by the brewery were born. But at an earlier stage, when such solutions were just ideas, they were not shared or discussed by other contributors.

Who evaluates if ideas are going to become concepts is the board of directors. Once the ideas are tested, the board has very well defined criteria to revise them and define whether they should be developed as concepts. If approved, the ideas will go to the packaging development team that does the technical, productive and marketing evaluation.

Validated learning: the company does often smoke testing, testing together with marketing a concept or technology that has not yet been applied in solution, revealing characteristics and applicability of the technology/concept. For example, before creating the energy drinks packaging briefing, BV1 conducted smoke testing to see if the concept would be ready to be accepted in the market. At this stage, the name, shape, and color of

the packaging are not yet defined.

Figure 17 shows the radar plot for the BV1 stage in FEI. The company works very well into the Opportunity Identification and Evaluation – OIA, Ideas Selection – IS, and Concept Development – CD. It works more or less into the Ideas Generation – IG and Idea Enrichment – IE phase.

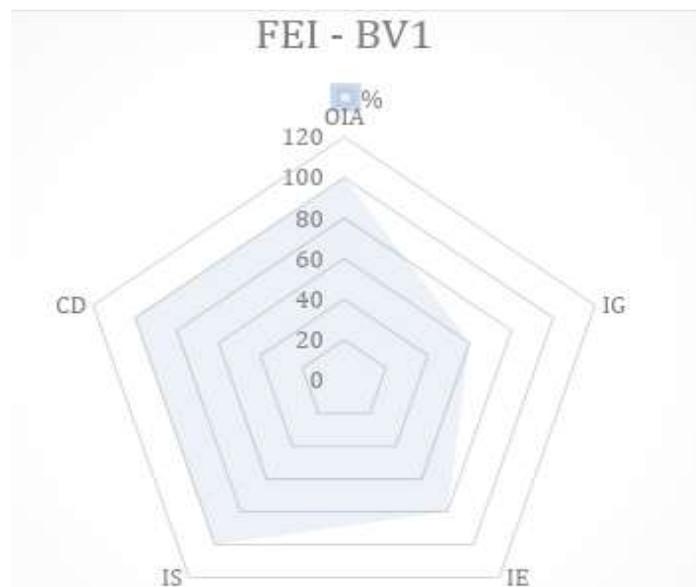
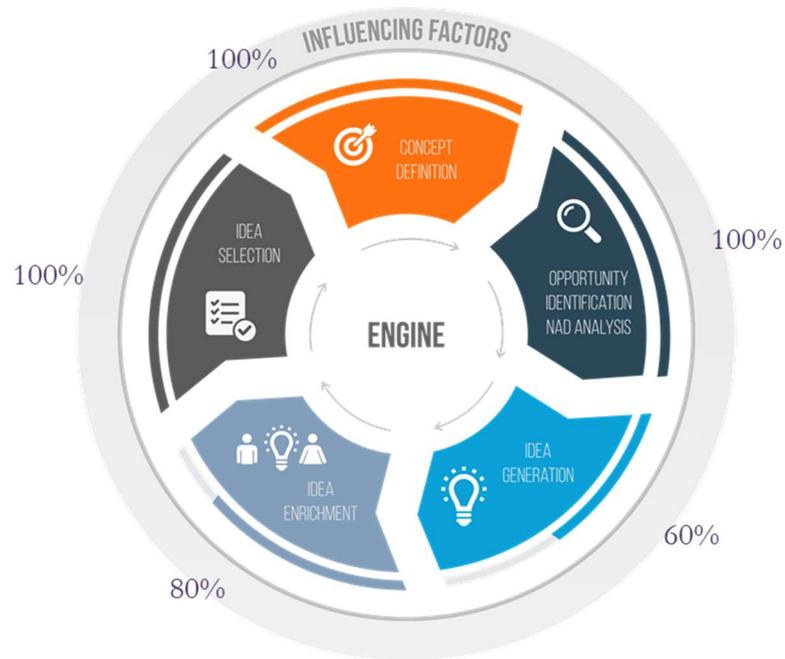


Figure 17: Results - Roles - BV1

6.1.3 Integration Mechanisms

The company integrates the design agency into most FEI activities. The design agency identifies opportunities, and there is a system that incorporates and shares such opportunities. The design agency DA1 also participates in the generation of ideas and the selection of ideas, through a focus group. In an energy drinks packaging project, the design agency built prototypes and tested names, layout, colors, packaging material with consumers. In this test, the DA1 also searched for feelings and perceptions, verifying the one that refers to a given name, color, etc. The design agency can access a platform of ideas from this Brand Owner, contributing with feedback on consumer behavior, etc.

BV1 is often launching edicts and hackathon, aimed at external participation and seeking to find new ideas and technological solutions, through the exchange of experience with external audiences. An example of an initiative built on a public announcement is the creation of teaching materials to help parents and teachers talk about the risks of misuse of alcoholic beverages with their children and students. Another example is the creation of an app that offers free transportation services for a particular cultural spectacle, to prevent people who have consumed alcoholic beverages from driving before or after this event.

Manufacturers/converters also contribute to the identification of opportunity. This Brand Owner has a very well defined supplier list, which goes through a rigorous hiring analysis. Some manufacturers usually present technology solutions and trends for this Brand Owner, which in turn assesses the possibility of using them in one of their brands. For example, in a soft drink packaging project, the converter tried a new lid according the consumers' needs indicated by BV1.

Figure 18 shows the integration of suppliers by BV1 in each of the five FEI activities: Design Agency and Converters are integrated into the Opportunity

Identification and Evaluation – OIA and Ideas Generation – IG phases. Design agency is partially incorporated into the Ideas Enrichment - IE phase. No supplier is incorporated into the Ideas Selection– IS phase and Concept Development.

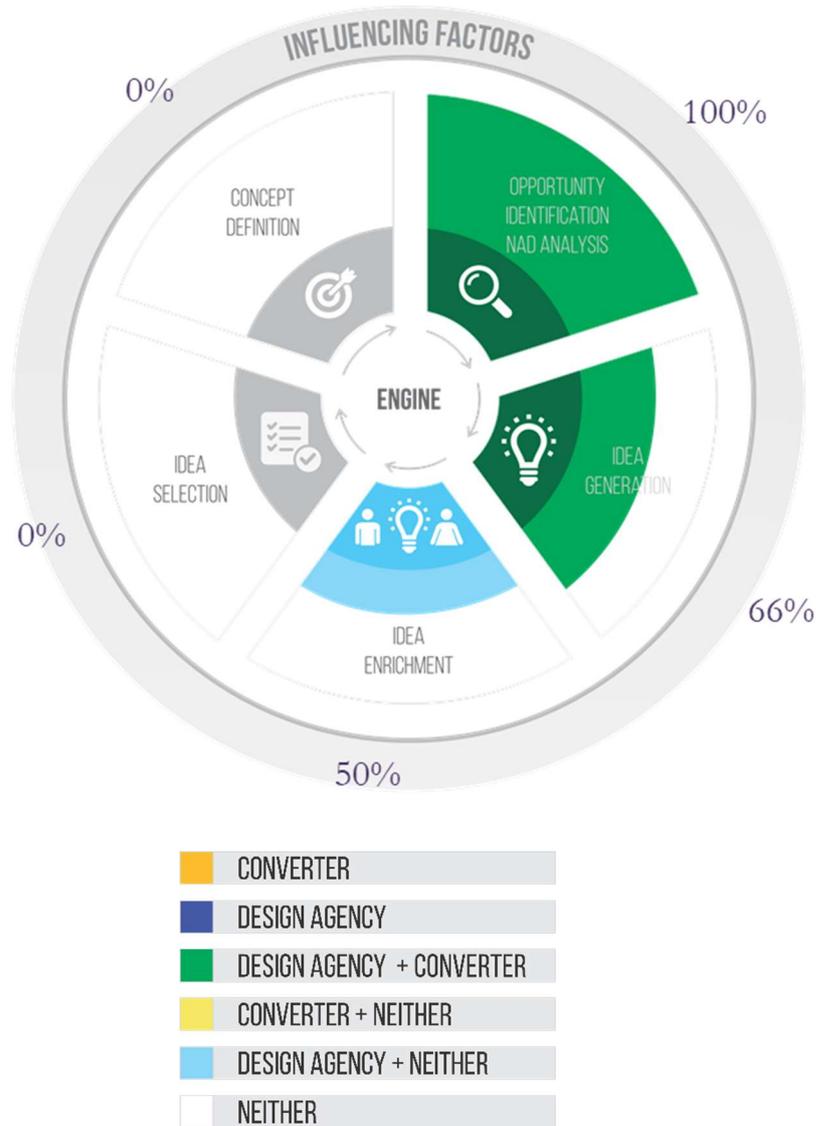


Figure 18: Results - Integration Mechanisms - BV1

The products launched by this Brand Owner spend a lot of time in the market and have a lot of acceptance in the Brazilian market. The packaging development process has an average of 1.5 years, considering the EIF and the development itself.

According to Mestriner (2017), for beer, although there is a law in Germany enacted in 1511, to ensure its 'purity' and prevent it from being made with ingredients other than specified there is an incredible variety today, but the packaging maintains a particular tradition. These examples show how difficult it is, and often quite expensive, to innovate in the product, which is why differentiating the packaging is easier, faster and cheaper. No matter the type of merchandise, everyone can receive a different packaging from the competitors and increase their chances of being chosen and tried.

6.2 CASE SW1

6.2.1 Description

SW1 is an American multinational confectionery, food, and beverage company which was founded in 1923, employs about 99,000 people around the world. It consists of the global snack and food brands. This company's portfolio has 51 brand and includes several billion-dollar brands such cookies and crackers, chocolate, biscuits, gum and cough drop, powdered beverages. The company has annual revenue of about \$30 billion and operates in approximately 165 countries.

6.2.2 Roles

The company SW1 has a Research, Development, Quality & Innovation (RDQI) team, reporting to its Chief Growth Officer, that helps accelerate growth and margins through global innovation platforms, Power Brands and breakthrough technologies. Its RDQI has 2,500 scientists, chemists and engineers - 60% of its global RDQI employees are women-, 9 key research & development centers worldwide, and \$65 million investment in its global facility network in 2017-2018.

SW1 is investing in a global network of technical centers to support its growth

ambition, create a competitive advantage and drive innovation. When fully completed, it will consist of nine large, advantaged hub locations in which SW1 is focusing the vast majority of its technical resources. Many of these locations also have consumer science and packaging labs. Having breadth across key markets maintains its rapid access to talent pools, and changing consumer needs and trends.

The company has very well defined FEI activities. There is a platform on which employees record opportunities and ideas and can be accessed by all teams. But, the company does not yet have a list of well-defined criteria for evaluating and selecting ideas, but has been working to improve this process.

SW1 has focusing on understanding how consumers live, eat and shop in an ever-evolving retail landscape. As such, it has identified five consumer trends that drive its innovation pipeline: Well-being, Time compression, Growing income gap, Digital revolution, Evolving retail. For example, its RDQI team works with cocoa farming communities consulting on best practices in agronomy to help develop more productive and disease-resistant cocoa trees, and collaborate with government and non-governmental cocoa research organizations to boost cocoa yields around the world.

The company actively participates in exhibitions, fairs, and workshops, in which it seeks to know the trends and state-of-the-art technology. The SW1 usually invites its suppliers to attend these events. For example, it asks the Design Agency DA1 to continually participate in fairs related to design, innovations, marketing, aiming to accompany the market trends together. SW1 and DA1 have written some chocolate brand cases that have been turned into book chapters on packaging innovations, and from the repercussion of these publications, other project ideas have emerged. SW1 and DA1 have also been together at the Cannes Lions, the international festival of creativity. The festival

is considered to be the world's biggest celebration of creativity in marketing communications - bringing together top creative minds and advertising from across the globe. Thousands of case studies from all over the world are showcased and judged at the Festival and winners receive the highly coveted Lion trophy, presented at award ceremonies throughout the week.

The company has a platform where the information of these events are registered and accessed by all employees. On the same platform, employees can suggest project ideas and indicate to which category the idea should be directed. The category leader, then, evaluates, along with marketing, whether the idea makes sense and can go ahead or be disapproved. Due to the need for quick launches in the market, marketing SW1 does not spend much time evaluating ideas, harming feedback to those who suggested the idea. The company claims that the method of assessing ideas can get better by creating an extensive list of well-defined criteria for evaluating them. And if there is no feedback, there is no learned knowledge. For example, it is common for similar ideas to be suggested at different times.

The company also has a platform where the research that the R&D team is developing is inserted. For example, one time a chocolate brand decided to develop an idea that was to create a package with the aroma of the candy that would pack. The leaders of other projects were able to access the information on the aromatic packaging project and to know the evolution of the research and suggest insights for this project. After two months, the project was paused, because one of the insights recommended by the technical staff indicated that it was not possible to develop the aromatic packaging at that time. There was not much talk about the reasons that led to pausing the project. There was no room for "lessons learned." This project could have been adapted or postponed if the reasons for not developing the idea had been shared.

The company has the necessary skills to create and enrich ideas, but there is still a need to improve the skills of recording, selecting and feedback ideas. The company should develop a checklist with well-defined criteria to evaluate ideas and invest in a system to document this evaluation, so that the ideation results usually could be accessed, generating learning and avoiding duplication of mistakes, and giving them the freedom to align marketing and sales requirements.

Figure 19 shows the radar plot for the SW1 stage in FEI. The company works very well into the Opportunity Identification and Evaluation – OIA and Concept Development – CD; and it works more or less into Ideas Generation – IG, Ideas Enrichment – IE, Ideas Selection - IS.

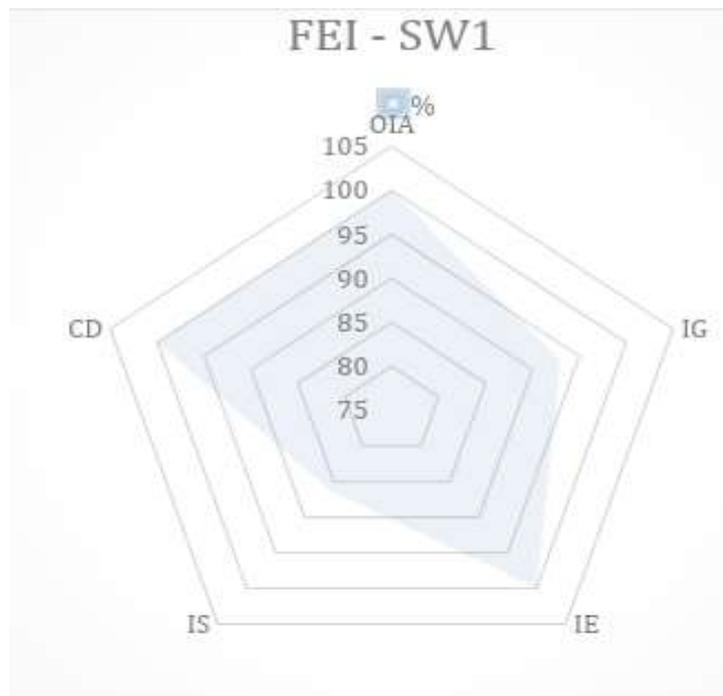
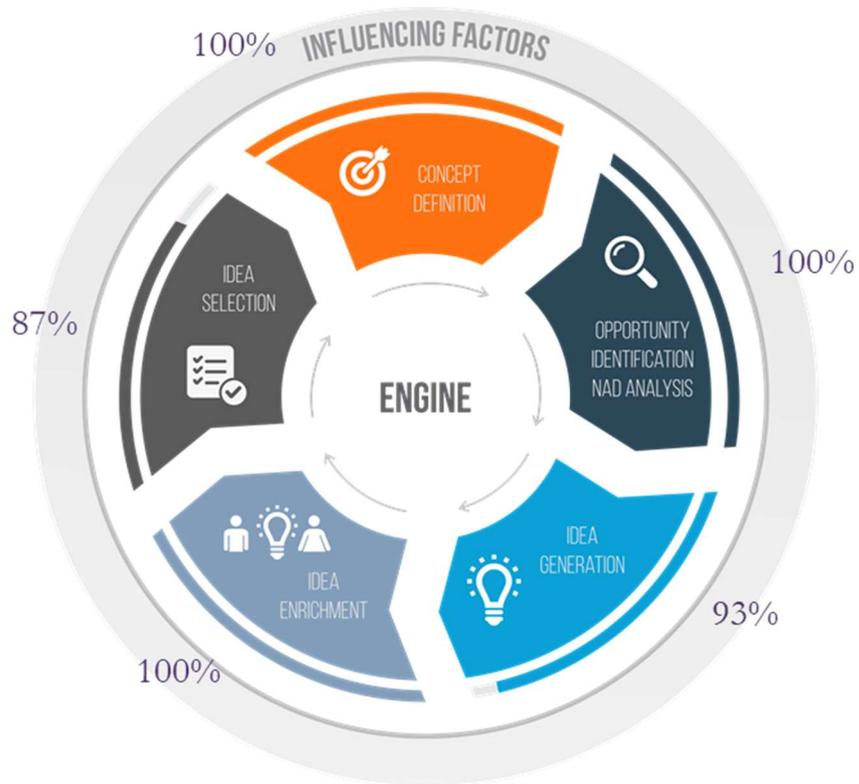


Figure 19: Results - Roles - SW1

6.2.3 Integration Mechanisms

Suppliers often contribute project opportunities and ideas but can not access the

company's internal platform for these activities. Suggestions are sent by email or in workshops and meetings. The company also allows agencies to track production.

A selected idea will be developed in a briefing. For the creation of the briefing, the SW1 company assesses technical feasibility, production, marketing, and sales. This Brand Owner consults with other organizations to obtain information about economic scenarios and to know the risks of the project regarding market acceptance, a commitment of the selected suppliers, ask their suppliers to verify the productive capacity of the project, and consult the design agency and the agency to develop marketing and sales actions jointly. This Brand Owner encourages the design agency and advertising agency to work together at this stage, holding joint meetings and giving them the freedom to align marketing and sales requirements. The company also allows design agency to track production.

The company also selects the suppliers in the pre-development phase and chooses according to the defined strategy for the project. For example, for chocolate design, there are several packages for different purposes. When it comes to promotional packaging, which will be limited time in the market, the material may be cheaper than the one used in a "traditional" packaging, which was designed to stay for two years in the market. Price vs. quality will select the manufacturers of raw material. In promotional packaging, the supplier is selected by price. In traditional packaging, the supplier is selected for quality. In the same way, the design agencies are selected. For promotional packaging, the DA2 agency selected needs to quickly deliver a layout, with less detail and accuracy than the one shown on the permanent packaging. The DA2 agency that will develop the layout of promotional packaging will likely use a ready-made packaging template in the marketplace. The DA1 agency that will develop the permanent packaging will have to

develop the packaging structure, considering shapes, volumes, weight, ergonomics, materials; having, for that, to know the productive capacity of the manufacturer. Thus, in a "traditional" permanent packaging project, DA1 design agency and manufacturer are involved in the FEI and integrate with each other, still in the development phase of the briefing. In a promotional packaging project of the same brand of chocolate, the DA2 design agency, and the manufacturer are not integrated into the FEI. In many projects, the manufacturer builds prototypes to evaluate technical and production characteristics in the FEI. These prototypes are then used by the design agency DA2 to evaluate consumer behavior, in the Concept Development. DA1 also has its digital lab, where it builds prototypes for image manipulation. For example, in the case of chocolate, DA1 performed several density tests with various foods, not only chocolate, but also milk candy, sour cream, and other materials such as modeling dough. This competence makes SW1 select this design agency in more complex projects to be integrated into the FEI, since SW1 is guaranteed that DA1 will collaborate in the definition of the briefing, through its skills.

The external integration that this Brand Owner promotes can be considered an extension of the internal integration culture existing in this company. For example, a few years ago, its Eastern Europe employees launched an initiative to share their diverse cultures, building collaboration across Eastern Europe. As a global family spread across approximately 165 countries, its team is as diverse as the communities where they live. It is an opportunity to learn more about the different countries, cultures, people and brands making up that region. Throughout the week, employees showcased their country, with interesting facts, delicious national food, engaging master-classes, and of course, lots of laughs, discoveries, and joy.

The company does not always access the knowledge learned in previous projects in search of solutions for new projects. The company has an extensive portfolio of brands

and has the need to launch quickly, preferring to learn at launch, reducing the time in the FEI. The development time of packaging, considering the FEI is 6 months and many of the products do not remain more than three years in the market. There is a great turnover of their brands in the market. The FEI lasts an average of 3 months. The AD1 Design Agency says that because of the need for quick launch, there is a lack of planning and therefore lack of time to enable an innovation or a new process. There is still high resistance to changes, especially for new processes on the part of the Brand Owner. This kind of movement requires high energy from all parties to break a pattern and is not always accepted everywhere. On the other hand, new professionals are willing to do a good job and who seek to evolve with the processes hitherto established. This fact makes these innovations possible.

Figure 20 shows the integration of suppliers by CO1 in each of the five FEI activities: Design Agency and Converters are integrated into the Opportunity Identification and Evaluation - OIA, Ideas Generation - IG, and in the Concept Development - CD phase. No supplier is incorporated into the Ideas Enrichment - IE phase. And Converters are integrated into the Ideas Selection– IS phase.

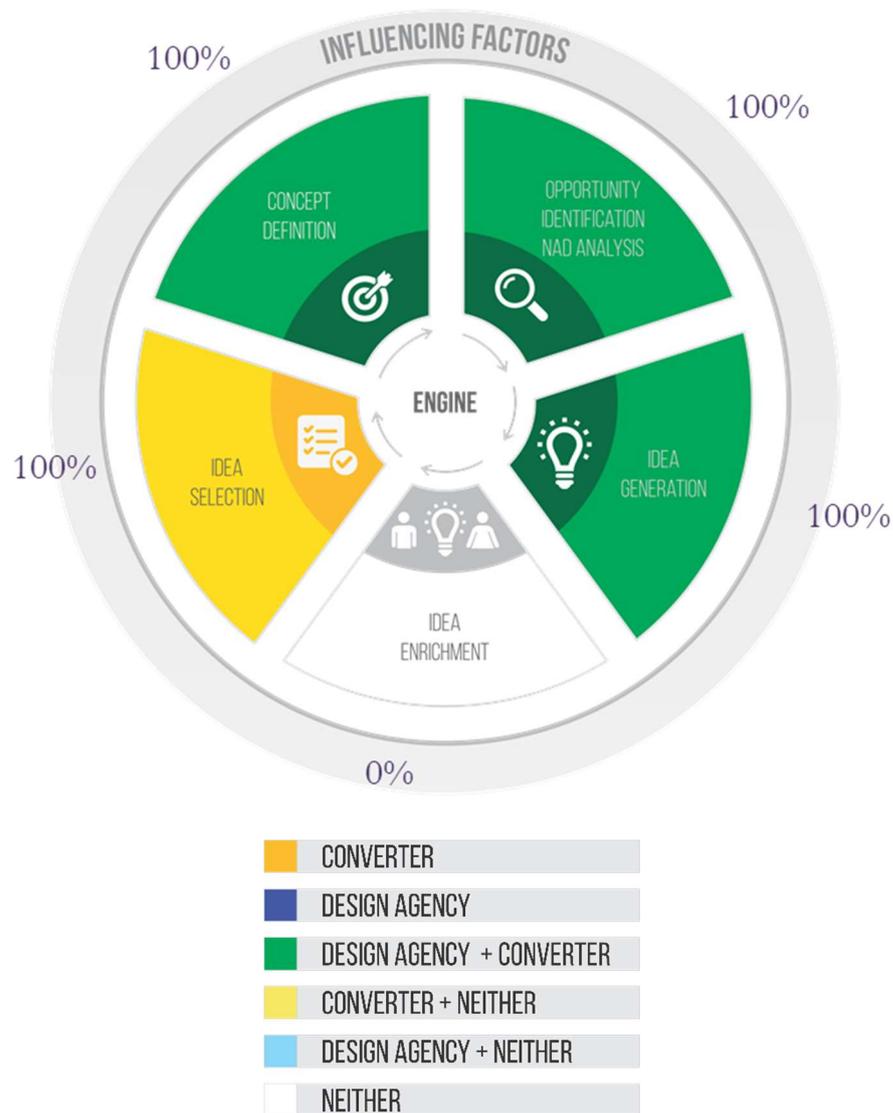


Figure 20: Results - Integration Mechanisms - SW1

6.3 CASE CO1

6.3.1 Description

CO1 is a Brazilian manufacturer and marketer of beauty products, household, and personal care, skin care, solar filters, cosmetics, perfume and hair care products the company that sells products through representatives and in more than 3.200 stores in many countries across the world. The company was founded in 1969, and currently, the company is the most significant Brazilian cosmetics company by revenue.

CO1 is a founding member of the Union for Ethical BioTrade, gradually ensuring that its sourcing practices promote the conservation of biodiversity, respect traditional knowledge and assure the equitable sharing of benefits all along the supply chain. In the steps of their development and production of cosmetics, CO1 does not test on animals and follows the most stringent international safety standards. The company promotes its image as an eco-friendly, sustainable company (using natural products, working toward sustainable environment and social support, etc.). The company also uses ordinary women rather than supermodels in its advertisements.

The company's performance in 2017 shows a consolidated gross revenue of R\$ 4.3 billion, a growth of 10.6% over the previous year. Its consolidated net income was R\$ 462.3 million, generating a return on opening shareholders' equity of 72.1%. CO1 has 7.000 employees, 36 brands and works in 70 countries across the world.

6.3.2 Roles

CO1 has well-defined FEI activities. There is a core of innovation that has been working in recent years to carry out analyzes of the external environment, generating ideas and converting these ideas into projects, but there are still gaps in the process.

The Company actively participates in congresses, conferences, workshops, and sponsors many events related to cosmetics, design, packaging, sustainability, etc. The company understands that in these events will have faster contact with results of scientific research related to the chemical formulas for cosmetics, makeup and perfumery; and will also know the state-of-the-art technology, which is vital for their packaging. The company devotes much of its innovation revenue to the development of packaging that promotes

differentiation in the market. For example, use of less raw material quantity in packaging that is the refill itself; use of metering cover or cover that opens and closes easier, the creation of structures of packaging with different formats that improve the ergonomics, etc.

When returning to "home," the directors who participated in the external events, share what they saw in internal workshops. However, some respondents in this research stated that sessions are not always extended to the feedback stage. The firm shares opportunities and ideas through workshops, and although it has a platform to record thoughts, the company does not use it often.

The company has a technology platform in which employees register ideas, and especially the R&D team shares the research is being created. Employees can access some of the research information, for example, knowing key areas and research stages.

The company uses the stage-gates process to evaluate the go/no-go of packaging ideas through the full and light versions (Cooper, 2014). In the whole phase, the criteria of technical feasibility, design, production, commercial, marketing are very well defined. The light version has only two stages: it combines the steps of ideas generation and enrichment, and unites the stages of development and testing. In general, incremental innovations are demanded by the commercial area and use the light version of the stage-gates process; while radical innovations are required by marketing and use the full version. CO1 has decided to simplify the stage gate for more straightforward projects, avoiding wasting time in many instances of approval by the committee, which is made up of business people. Documentation is mandatory at each gate: to be approved at a gate by the committee, the team must present documents such as requirements analysis, market analysis, technical analysis, etc. In some projects, there is the construction of the Proof of Concept - POC that will be presented in the committee to be evaluated if it will move to

the next phase.

All ideas that emerge from outside events and prospecting are recorded on a platform and directed to which area to go. For example, if the idea is about the packaging of the stand-up pouch model (aiming equalize financial sustainability plus consumption use), the idea is directed, on the platform, to the categories that could use such packaging model. Category leaders will reject or approve the idea. If supported, they indicate the person responsible for the enrichment activity must:

1. Respond to the standard form on the platform, presenting technical solution feasibility information and solution attractiveness as a business to the Brand Owner.

Noting from 0 to 100 for each of the two items;

2. Create the Business Plan, present the idea so that it is evaluated if it is worth converting into a project: indicate if the market has potential, indicate the volume of production, details of the solution, specific characteristics, etc. indicate the person who will enrich it.

Figure 21 shows the radar plot for the CO1 stage in FEI. The company works very well into the Concept Development – CD. In other activities (Ideas Generation – IG, Idea Enrichment – IE, Ideas Selection – IS, and Opportunity Identification and Evaluation – OIA), the company works well but not 100%.

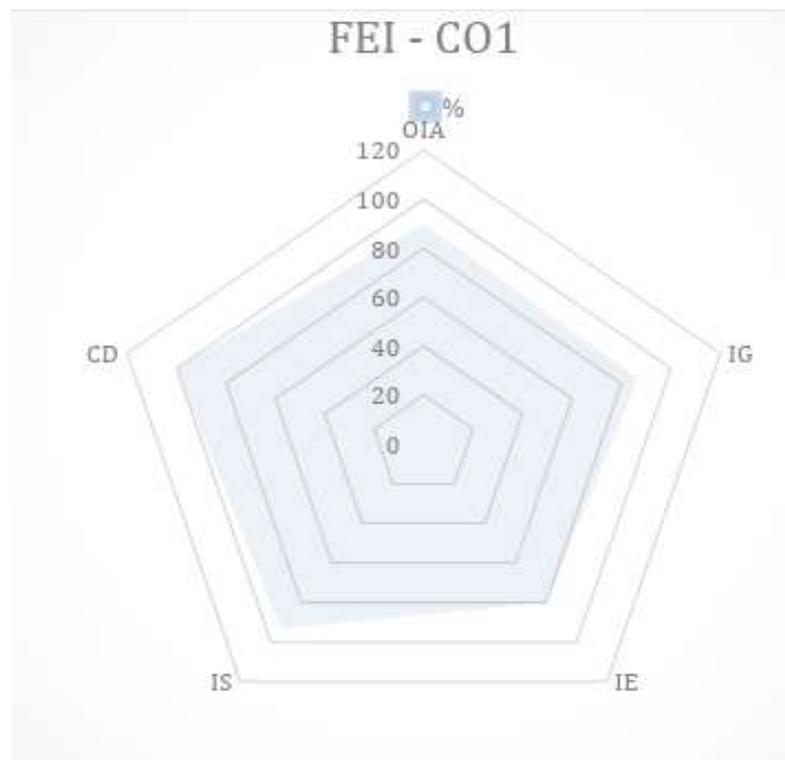
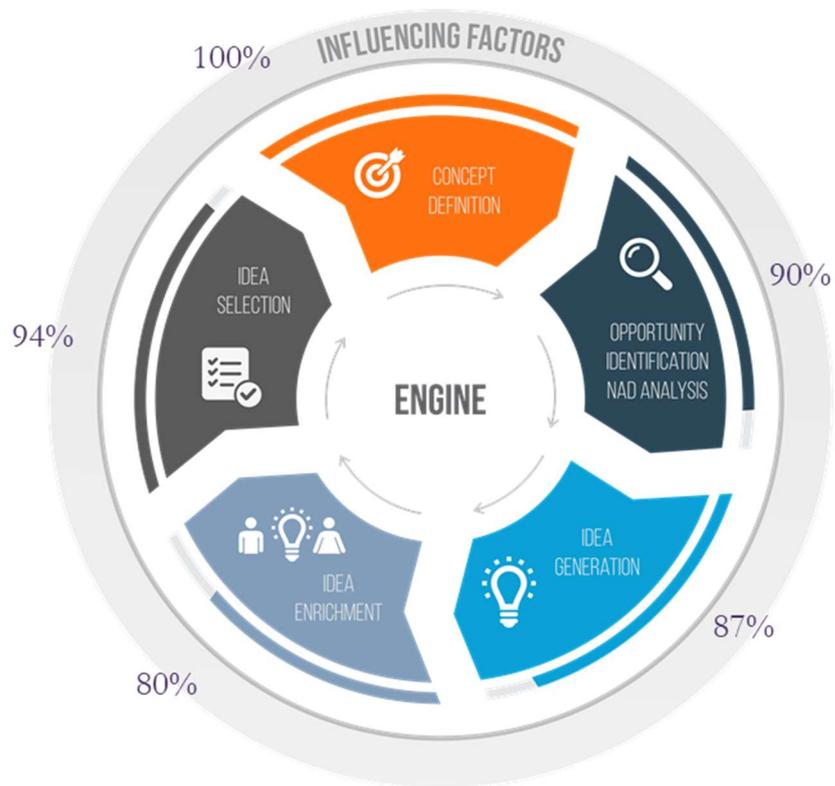


Figure 21: Results - Roles - CO1

6.3.3 Integration Mechanisms

The company continually promotes job rotation. Employees change categories,

for example, a collaborator who worked with perfumes in a year, he or she works with makeup in another year. The company's goal is to build shared knowledge and avoid design flaws. Sometimes the market takes another direction, so the teams are undone and rebuilt, but the built-in know-how is not lost. All knowledge is registered and accessed for future projects. The management process in the research facilitates the capture and registration of information and influences the development itself.

As already mentioned, the company actively participates in congresses, conferences, workshops, and sponsors many events related to cosmetics, design, packaging, sustainability, etc. The company also understands that by participating in external events, it is promoting the sharing of learning. For example, the company is always involved in discussions about developing sustainable communities, integrating such communities into its production chain. In these events, the company promotes hackathons so that the external public brings ideas of products and packaging that positively impact the environment. The company also has an open channel in which it receives ideas from employees, through open innovation.

The company has a core of innovation in which diverse skills such as engineering, design, sustainability, marketing and commercial work.

The design agency contributes to generating opportunities, bringing trends identified in the external environment, and generating and evaluating ideas. However, the design agency does not assess the feasibility of the concepts regarding technical, economic, production and sales requirements.

The manufacturers/converters participate in the evaluation of the technical, productive and economic feasibility of the concepts.

The company seeks to make lessons learned sessions, aiming to record errors and successes. Learning is often accessed in new projects.

After the creation of the core innovation, the development time of packaging has decreased from one year to eight months, but not all products remain in the market for more than three years. For example, a soap stand pouch, despite the objective of equalizing financial sustainability plus consumption, was rejected by the Brazilian market that was not yet mature to receive a new concept for this packaging. The Brazilian consumer has been bothered by the non-traditional form of packaging for soap.

The last stage of the platform is dedicated to the task of lessons learned, which is shared by whole value chain for people who are involved in the innovation process, not only for innovation functions, but also for logistics functions, supplies, and sales. The company understands the suppliers need to know, for example, what particular material is going to be consumed in a specific plant.

Figure 22 shows the integration of suppliers by CO1 in each of the five FEI activities: Design Agency is integrated fully into the Opportunity Identification and Evaluation – OIA and partially into Ideas Selection– IS phase. Design Agency and Converters are integrated into the Ideas Generation – IG phase. No supplier is incorporated into the Ideas Enrichment - IE phase. The converters are integrated into Concept Development.

CO1 seems to be very close to suppliers because it understands that they have the sources of knowledge for the development of better packaging, aiming to improve the perception and acceptance by consumers. This Brand Owner always integrates the Opportunity Identification and Evaluation stage design agencies, inviting them to participate in external events such as conferences and exhibitions. In the Ideas Selection phase, CO1 integrates the design agency into the creation of the selection criteria and the

selection activity in it but does not incorporate the design agency to participate in the review board, which is formed by the committee. In the Concept Development phase, which requires technical, productive and commercial viability, Brand Owner integrates the manufacturers/converters as it understands that these suppliers know the state-of-the-art technology and market trends for such techniques.

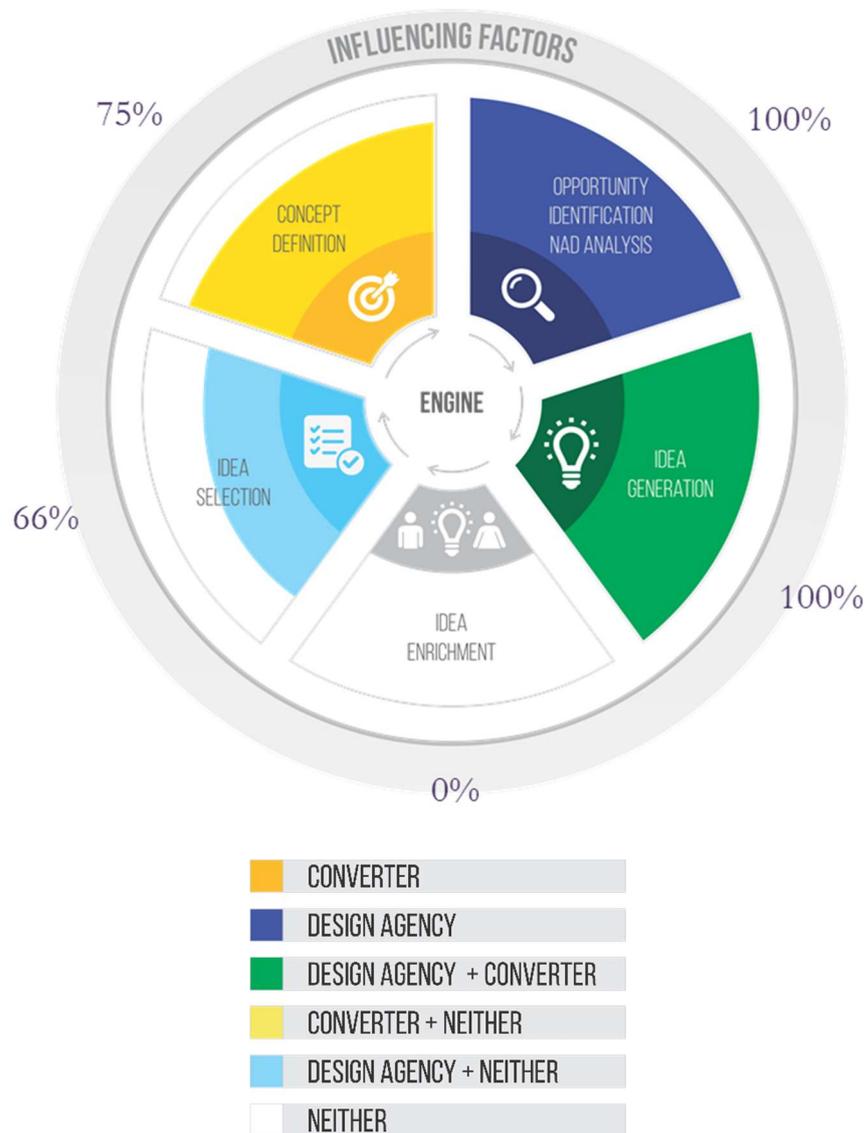


Figure 22: Results - Integration Mechanisms - CO1

6.4 CASE FB1

6.4.1 Description

FB1 is a Swiss transnational food and beverage company. Its history began in 1866. It operates in twelve market segments: milks, coffees, culinary, chocolate powder, cereals, cookies, nutrition, chocolates, refrigerated, ice cream, food services and pet care. FB1 has 447 factories, operates in 194 countries, employs about 281,000 people, its revenues (increase) of United States \$ 89.27 billion (2011). Sales by activity breakdown:

- 27% of beverages;
- 26% dairy products and foodstuffs;
- 18% pre-prepared dishes and ready-to-eat dishes;
- 12% of chocolate;
- 11% of products for animals;
- 6% of pharmaceutical products;
- 2% infant milk;

Sales by geographical area breakdown:

- 20% of Europe;
- 61% of the Americas (26% from the USA);
- 16% from Asia;
- 21% of the rest of the world.

6.4.2 Roles

FB1 has one of the most extensive R&D network of any food company in the world, with 34 R&D facilities (3 Science & Research centers and 31 Product Technology Centers – PTC and R&D centers worldwide), and over 5,000 people involved in R&D. The PTC does not produce. It is responsible for the innovation and renovation of culinary

products, and it is the home of food, bringing culinary art to a level that can be practiced at home or used in a professional kitchen.

They provide the broad span of product-specific R&D and technical expertise from a single source required to develop cost-competitive and - as far as possible - protectable products. They create technological leadership for significant product groups.

They contribute to long-term growth by:

- Product and process development
- Industrialisation of new techniques
- Technical support
- Quality and safety

Their product groups do research all over the world, which means that they have to focus on the local needs of their markets with regard to cooking culture, taste, climatic conditions, hygiene and product requirements as well as legal aspects.

The primary sources for identifying opportunities at FB1 are:

1. Trend research at PTC. The Brazilian market applied some trends;
2. Magazines and research institutes on the market and trends of the Brazilian market;

For example, the institute indicates that yogurt could be higher or lower, with less sugar, and marketing will analyze whether such a suggestion makes sense with the brand.

3. Congresses, fairs, expositions, conferences;
4. Events with design agencies, doing stimulus exploration.

For example: identify, through sessions of explorations with users, feelings, and

perceptions about brands, verifying the one that refers to a name, etc.

FB1 uses the stage-gates process to make go-no-go decisions.

With regard to the flow of ideation, demand may come from marketing or product development at FB1. There is a weekly conversation between development and marketing. There are also occasional workshops to share information. There is no information sharing platform.

Usually, marketing defines the briefing and development creates technical and layout solutions. Development and marketing can also happen, for example, a more creamy and scalding product, and PTC develops the solution or performs a search on its portfolio of solutions.

When demand comes from marketing, through market research, marketing defines the briefing, and the product development team creates the first ideas, opening up opportunities for the projects.

The responsibility of FB1 marketing is much more to make contact with users and vendors at points of sale, in the field, than to be advertising.

From the field, there come no breakthrough suggestions, but incremental innovations.

The conceptualization and subsequent applicability may also come from the PTC. This is the case of frozen product, whose concept was developed by the PTC, launched in Europe, and later in Brazil.

In the case of an yogurt, the briefing came from marketing that indicated a child's yogurt that could stay out of the refrigerator for 6 hours. The packaging development team suggested the idea of pouch, which was approved by marketing at a gate, and then, developed the pouch prototype, which in turn was passed by marketing at another gate. And so on.

The pouch extends the portability and convenience features of the stand-up pouch (SUP) with nozzle, which are made to be positioned vertically (standing) and has been increasingly accepted by the Brazilian market, for several reasons such as: easy to consume "on the go"; easy to carry in the pocket without problems (as opposed to bottles, which take up more space); by the smaller and lighter format, make logistics cheaper; support various types of materials (solids, powders, granulates, chunks, liquids, gels and pastes), making applicability easier and production cheaper; work better the graphic design and, consequently, the highlight in the point of sale (PoS).

The design of the packaging is customized and presents in addition to an enlarged facing, curvature that assists the "handle" in the hands of children. The caps are of the standard "Baby Cap" model that preserve the characteristics anti-glue and anti-foaming, fundamental for the target audience. This technology enables the versatility of the line, the rapid set up of the technology allows the efficient packaging of two flavors, in which each one has different packages and covers in specific colors, also made possible by the technological system that includes machinery and packaging.

For ideas recording: FB1 uses Three-Year Plan, in which it defines actions for the brand in the following three years. Ideas are recorded in the briefing - which goes to the first approval process (stage 1) and submitted to the committee, which is made up of four directors: technical, sales, marketing, and finance. While the approval is carried out at the board level, the analyzes are performed at managerial level.

Unapproved ideas, or dead ideas, are not indeed discarded. The employees can access them just as they can retrieve discontinued product information. For example, one idea did not serve a market, it could help two years later for other reasons (different countries, different regions). Sometimes the unapproved approach may make sense again

because the habit of consumption has changed.

Currently, the Brazilian consumer has been migrating to family size products, which are cheaper. It can be a consequence of the crisis, because the economy makes the migration of segments change, provoking downgrade. It is possible that in 1 or 2 years, the Brazilian consumer will again consume individual packages. For example, between 2016 and 2017, there was a change in the consumption of yogurt pot to yogurt tray.

Another example was lactose-free products, which increased the percentage of total sales by 4% in 2015, but - after a report stating that lactose-free products do not have results that make sense to health improvement - today is an unimpressive market.

The PTC usually shares their research and findings through workshops, which are held annually or biannually. In these seminars, the concepts that have been worked out and what were recently launched are presented.

On the other hand, if Packaging Development has a demand, you can consult, by telephone and /or email, the PTC, checking for solutions to a problem. The PTC, in turn, may respond that it does not have or are developing or have already launched in another country. There is a consultation of Packaging Development to the PTC is always punctual, doing case by case.

To approval gates, for each gate, management must carry documented points that will be evaluated. That is, each gate has specific approval criteria that must be translated into documents.

For example: in the ideation phase, management does not present production volume numbers, but only concepts. Already in the test phase, it presents numbers of the time of production, costs etc.

Behind every one of company's products there is a team of scientists, engineers, nutritionists, designers, food technology, packaging technology, process engineering,

electrical engineering, biotechnology, chemistry, microbiology, nutritional science, sensory specialists, regulatory specialists and consumer care representatives dedicated to work their consumers' trust, through safety and quality.

There is little job rotation in FB1, and one of the justifications for this is that the know-how built in a business unit takes time to development. Migrating to another business unit is therefore complicated.

It is more common to change the responsibility for the product within the same segment or to work with different suppliers but within the same category. The competencies developed in each area do not resemble each other. For example, formula staff knows little of the packaging area and vice versa.

There is internal and external recognition in each category and products, such as prizes, materials in technical magazines, etc., as well as the obligation of each class to follow the development and launching goals of the company.

Figure 23 shows the radar plot for the FB1 stage in FEI. The company works very well into the Ideas Generation – IG, Ideas Selection – IS, and Concept Development – CD. it works more or less into the Opportunity Identification and Evaluation – OIA phase. In addition, the worst action is Idea Enrichment – IE.

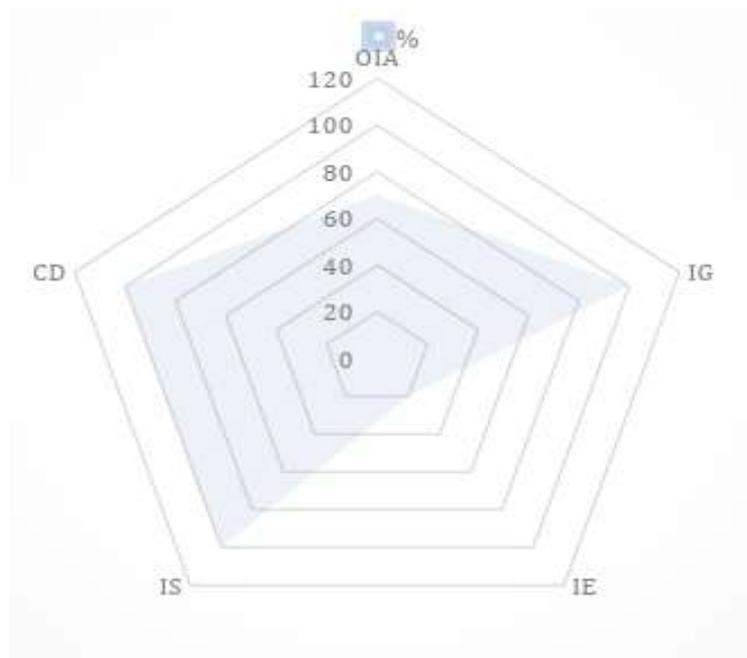
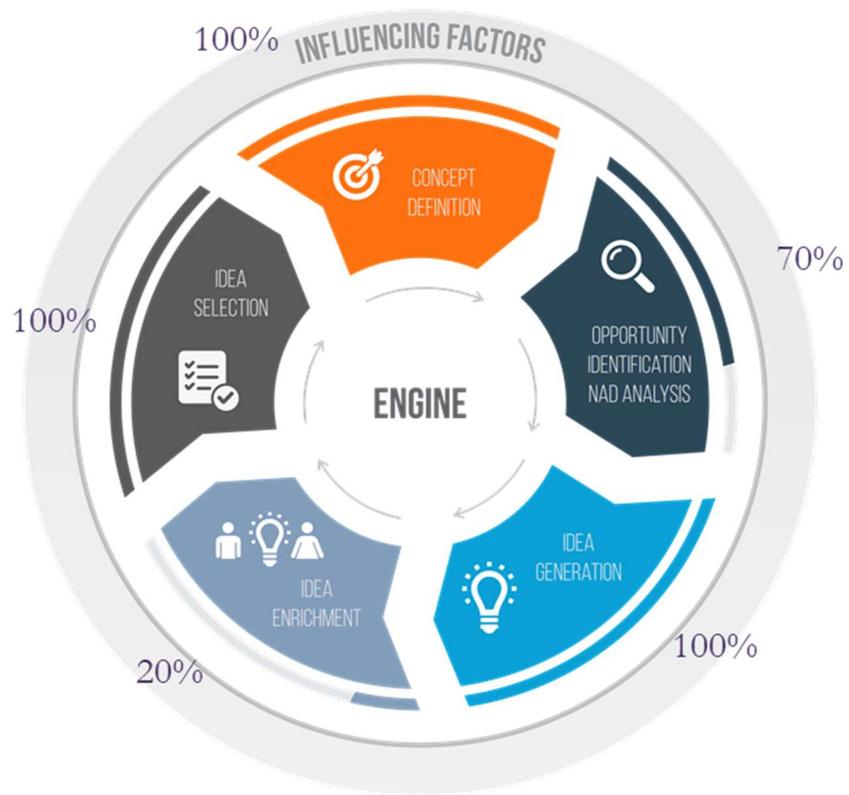


Figure 23: Results -Roles - FB1

6.4.3 Integration Mechanisms

FB1 integrates partners to some extent, in some activities. For example, the design agency focuses on package design (structural or graphics), does not track production, or provides information on productive viability. Marketing works alongside the Design Agency much more in the Conceptualization phase.

Packaging Development gets more involved with manufacturers /converters, but only after they receive the marketing briefing. Packaging Development and manufacturers /converters act together in the activities of Generation and Enrichment of Ideas, and Conceptualization. For example, when the briefing indicates a new flavor, for example, banana flavor for yogurt; Packaging Development comes into contact with the aroma houses to work together on the development of the new character, performing tests and adjustments, in an iterative activity. This activity occurs in parallel with the packaging creation activities.

The demand always comes from FB1 to suppliers. Formalized external suggestions are not part of company's routine. Sometimes in design meetings, recommendations come from suppliers, manufacturers and/or design agencies, but informally. But there is no process for suppliers to seek FB1 to come up with a solution.

As already written, FB1 usually recovers dead ideas or discontinued products, working on learning, and using a part of the concept of the unapproved idea or the discontinued product to apply to the concept of the current idea or the current project.

FB1 monitors sales performance if it is reaching the expected volume and takes action to correct sales.

What happened to a nutritional energy drink (healthcare nutrition product), which was developed for cholesterol-restricted people and was considered, in other countries, a

product with excellent benefits. However, there may have been a lack of applicability study in Brazil. Although the Brazilian has better eating habits, with the increasing consumption of natural products, he still does not want a food product, which usually refers to pleasure, as a medicine. He or she may even want a sugar-free product, but not one that reminds him of his disability/illness and makes consumption a medical necessity.

This brand launched in the Brazilian market in 2009 through a line of functional products with vegetable phytosterols - natural components also found in soy, oilseeds and vegetable oils in general - that help in reducing the absorption of cholesterol by the body and, together with a balanced diet, help maintain healthy cholesterol levels.

About 40% of the Brazilian population has high cholesterol level, and there is growing concern about controlling the problem, which is considered one of the leading risk factors for the development of cardiovascular diseases. Several scientific studies prove the effectiveness of phytosterols in lowering cholesterol levels, but their intake in a typical diet does not reach the recommended levels.

According to PTC, Ph.D. in Applied Medical Biology and responsible for the scientific studies conducted with this brand, regular consumption of the products provides a reduction of LDL-cholesterol after four weeks of daily use .

The daily intake of phytosterols ranges from 78 mg in the general population to 344 mg in vegetarians. An unpublished study in Brazil published in February 2003, carried out with 1,609 residents of the city of São Paulo (SP), showed that the average intake of phytosterols in the population is about 0.1g. For a significant reduction in cholesterol absorption, it is recommended to ingest 1 g to 3 g4.

According to the PTC, the amount present in a unit of yogurt of 75 g of this brand is 1.1 g, and in 2 glasses (400 ml) of the milk compound is 1.2 g. In this way, the consumption of the products in the recommended amounts allows the intake of a quantity

highly superior to that obtained in a traditional diet. Therefore, it is an vital aid to reach the recommendations.

Such a product was already marketed and accepted on the European market. For the launch of the same in Brazil, marketing investments and information on launches, images and scientific studies were available at www.acticol-imprensa.com.br. The site is down.

The product did not have proper acceptance in the Brazilian market. According to the Department of Frozen Packaging Development, the Brazilian consumer associated the product with the drug and refused to consume this brand as a medication, preferring to consume the brand of the traditional form.

It is quite common to find this habit in Brazilian consumers: to prefer whole milk to skim, and so on. Consumers who avoid light or healthier versions claim that if they need a supplement or supplement, they will look for medicines, not food products.

From this case, FB1 began to act more intensely in the applicability research phase. It hired a research institute to conduct a blind tasting, in which he makes a product available to consumers, questioning their feelings and perceptions, to identify the one that refers to that product.

This activity implies an increase in the time of the packaging development process, whose average time is one year. Each case is a case, but usually the FEI takes six months, and after conceptualization, it takes two months for development itself. There are cases, which takes six months or a year, when it involves criticality, as machinery that needs to come from countries like Japan.

Figure 24 shows the integration of suppliers by FB1 in each of the five FEI activities: No supplier is incorporated into the Opportunity Identification and Evaluation

– OIA, Ideas Enrichment - IE and Ideas Selection– IS phase. The converters are integrated partially into Ideas Generation - IG and in the Concept Development - CD phase.

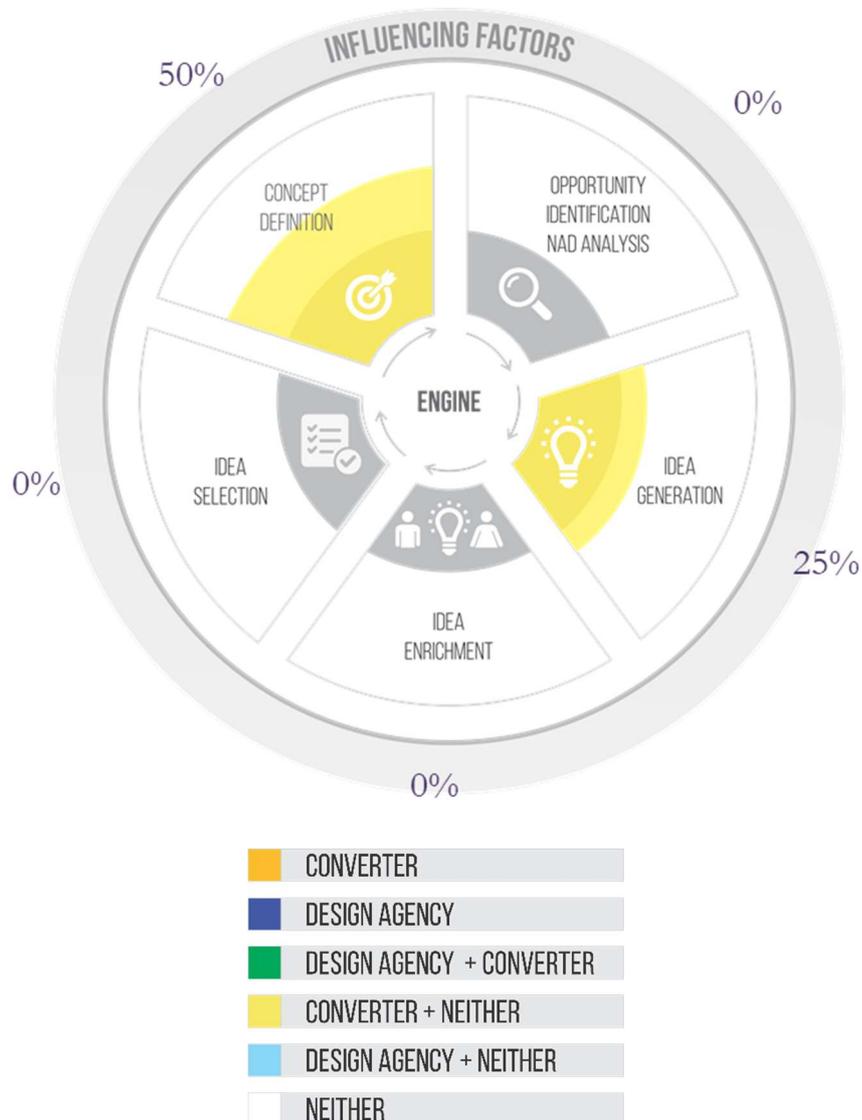


Figure 24: Results - Integration Mechanisms - FB1

6.5 CASE FB2

6.5.1 Description

FB2 was formed in 1965 with the merger of the two companies. An American pharmacist and industrialist first developed it in the 1880s. Approximately 274,000 employees generated \$66.415 billion in revenue in 2016. As the most abundant food and beverage company in North America, and one of the biggest in the world, has a portfolio

with 22 brands, and its significant products of the new companies are soft drinks, corn chips, potato chips, snacks, biscuit; and pretzels.

FB2 offers products to over 200 countries and territories. Based on net revenue, B2 is the second largest food and beverage business in the world. Within North America, FB2 is the largest food and beverage company by net revenue.

6.5.2 Roles

Since 2007, the company evolved from a “Go-do” R&D function that simply executes product line extensions to a “Go-to” global R&D function that, with exacting precision, delivers new innovative products and new categories.

Opened in 2012, and since then, FB2 has increased its investment in Research & Development by 45%, with experts in disciplines such as agronomy, computational biology, computer modeling, exercise physiology, endocrinology, fluidics, metabolomics, and rheology, among others. An R&D function that was for decades focused almost exclusively on the consumer’s taste experience began to focus on the consumer’s entire body (i.e., overall biology) and preference drivers (i.e., taste, aroma, texture, convenience) to deliver the right product offerings. It created a new structure, evolving from a decentralized organization to a globally aligned, flexible, responsive one. This meant expanding from a North America-focused R&D operation to a geographically diverse organization with R&D centers of excellence in Asia, Europe, and Latin America, in addition to North America. For a company that had for decades innovated almost exclusively from America and exported abroad, this marked a new era of creativity and collaboration with its colleagues on a global scale. This new structure helped it migrate

from “products” to “platforms.” In other words, it could now build a “new global chassis” at any R&D facility and then quickly export it, supporting operations worldwide to customize a food or beverage innovation to satisfy local tastes market-by-market. This combination of global offerings made locally relevant it call its “Glo-Cal” strategy.

Today Global R&D has 22 billion-dollar brands in its portfolio. Many of these 22 billion-dollar brands are iconic, category-leading brands that have been consumer favorites in the marketplace for years— and that is by design. Innovation is now generating 9% of net revenue at FB2 (up from 7% in 2012). R&D’s science-based and led innovation creates an unrivaled advantage gap for the company vis-à-vis other food and beverage companies.

The company participates in external events such as fairs and exhibitions and conducts many actions to share trends to its employees through as workshops, e-mails, and meetings between employees. In these meetings, the trends and needs encountered by consumers are presented. The company also participates in workshops and meetings with research institutes to collect such information. The R&D team records this information in a form with categories such as “market trends”, “consumer needs”, “new technologies”, “design agencies”, “image banks”, etc. The purpose of these categories is to organize the information separately, improving the search. For example, when the company needs different images for packaging, it can search, in these documents, news of manipulation of images coming from design agencies or endings images found in banks of images.

Despite the ability to exploit trends in the outside world and register information and ideas, the company does not have a systematic method for capturing and sharing ideas among its employees. Sometimes the company uses meetings to conduct brainstorm and focus group sessions and generates punctual feedback over the sessions. The company

says it should put more brainstorming sessions into its routine. Most of the time, the leader of the category and a small part of the team quickly generate ideas that will be approved at the next gate. But there is not much discussion in this activity, nor do those responsible shares the results with other collaborators. FB2 has a culture of launching many products quickly on the market, which reduces time in the FEI, especially in the generation and enrichment of ideas. Teams do not spend at most a week testing or maturing ideas. The most critical point in the FEI is in ideas enrichment phase, because the company does not have a technology platform with information from R&D surveys.

The company does not have a well-defined method for selecting the ideas that will become projects. The company has a board of directors that approves the ideas that will become projects. Most of the packaging launched in the market is incremental because as the test and feedback phase does not last very long, radical ideas are not well evaluated in the FEI and not approved by the directors. On the other hand, incremental innovations are not fully assessed in the FEI, and many of them are re-worked in the development phase. For example, during the development of packaging of a snack, the images were redone five times by the design agency because it was not clear at the briefing the position of the pictures on the packaging and every time the design agency presented a layout, the Brand Owner asked for a change in the positioning of images. Another project of other snacks indicated the development of pictures with people in a yoga position. At the briefing, the creation of pictures with people performing yoga was mentioned, but did not indicate quantity, preferred positions, color palette, types of clothes, physiognomy. That is, it did not state what feeling the company wanted to pass through the packaging. The design agency has twelve times resized sets of images.

The re-work creates a cost for the Brand Owner because, when hiring the agency

that will develop the images, it pays for the development time. The company could spend more time on the FEI, testing images and their acceptance by the consumer, conducting feedback sessions among collaborators, sharing the lessons learned between the teams so that those insights could come from other projects. Only after the ideas were better defined, would it be on the evaluation board and, if approved, would the briefings be developed.

On the other hand, recently, the company did something different: the company has created prototypes to test ideas before moving on to the next phase and the board has a list of criteria for evaluating ideas and making them concepts. For example, a French fries brand: instead of using the french fry slicer to create chips for consumer design testing, the team first computer modeled the chip. Then 3-D printing technology was used to create more than two-dozen optimal potato chip prototypes – with varying degrees of waviness and thickness. These chips were then tested for their design, look and feel with focus groups. Based on that feedback, the team then produced nine different prototypes using a vegetable slicer with specially designed cutting blades, and tested them with consumers.

Employees at FB2 have taken Design Thinking techniques but are in a stage where they are looking for an applicability of this model to the company, as well as lean startup (the launch of fast products). It is a mindset they are still trying to find.

Figure 25 shows the radar plot for the FB2 stage in FEI. The only activity that the company entirely is the Opportunity Identification and Evaluation - OIA. In addition, the worst action is Ideas Enrichment - IE.

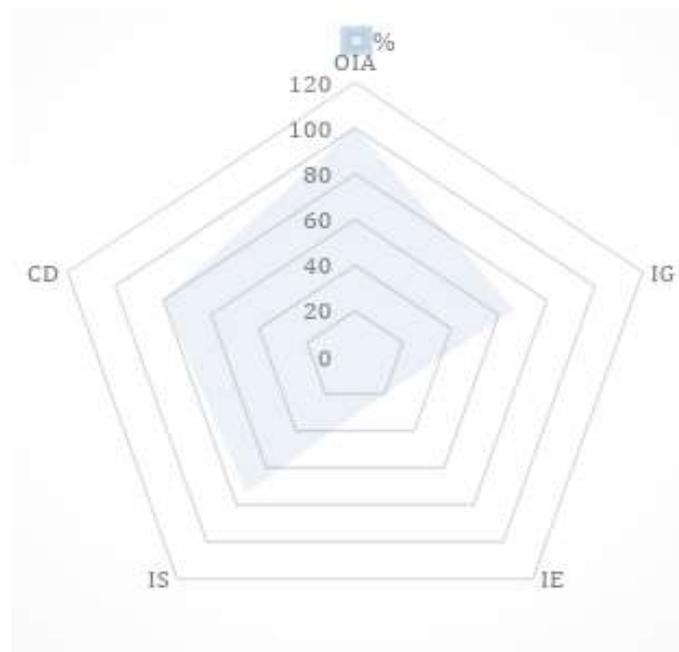
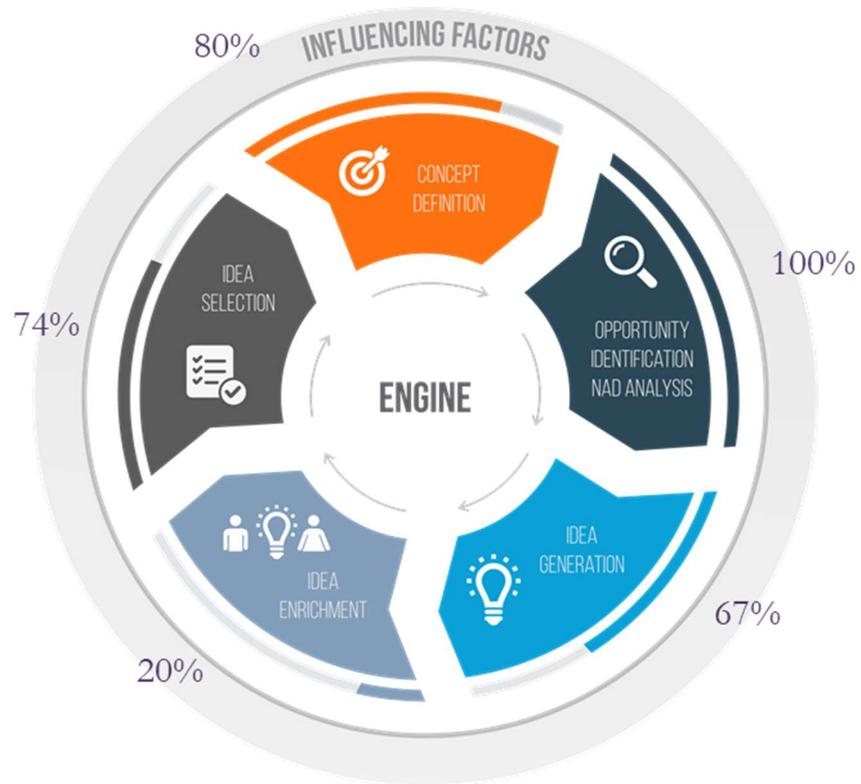


Figure 25: Results - Roles - FB2

6.5.3 Integration Mechanism

The company promotes job rotation. In the unified office with headquarters in São Paulo, Brazil, the worktables are the same and rotating, which leaves the work environment more dynamic and promotes the sharing of projects and ideas among different teams. The company supports internal incentives through awards, but it does not help through financial payments.

FB2 integrates its suppliers in almost all FEI activities. However, as the company does not have a platform to access project information, suppliers do not know how to evaluate, formally, with the projects are conducted. The Design Agency knows which manufacturers are being involved since the FEI and has the autonomy to talk to them about the project they are working on together and may suggest adjustments in production and marketing. For example, during the concept development of a light version of a ready-to-drink (RTD) chocolate, DA1 and the converter work together with FB2 for testing the layout with the consumer. DA1 suggested some color combinations and, according to this color palette, the converter creates some prototypes, which were tested by the agency in focus group with consumers. After a focus group session, DA1 made adjustments to the packaging layout and directed it to convert it to produce new prototypes and DA1 started the test again. During this phase, design agency and converting were deliberately related, without the control of the Brand Owner. The goal was for suppliers to conduct the testing phase more freely and quickly, without waiting for the various instances of Brand Owner's approval. It may be good to give suppliers freedom to relate to more freedom in the FEI. However, just as FB2 does not have the culture to conduct feedback sessions internally, it also does not promote discussions with suppliers. Figure 26 shows that the idea enrichment phase is weak, in which the suppliers can suggest insights from the tests. FB2 allows your suppliers to conduct much of the concept but still would like to develop

further their list of criteria for evaluating ideas and concepts.

The company spends little time driving lessons-learned sessions, both with their internal teams and externally with their partners. In this way, the company does not build knowledge and does not use prior project knowledge in new projects. Some products launched are not well accepted by the Brazilian market. Many had re-work that could have been avoided had the sharing of information in the FEI been better documented.

FB2 promotes the integration inter-firms in the FEI, but it still does not have well-defined criteria for selecting ideas and concepts. Many of its products remain short of time in the market. Some stay for two months because the market has not well accepted them. The company could use its very close relationship with its suppliers to create a better defined and detailed checklist for assessing ideas and concepts, accessing knowledge from previous projects, and recombining knowledge into new ideas and concepts.

Figure 26 shows the integration of suppliers by FB2 in each of the five FEI activities: Design Agency and Converters are integrated into the Opportunity Identification and Evaluation - OIA, Ideas Generation - IG, and in the Concept Development - CD phase. No supplier is incorporated into the Ideas Enrichment - IE phase. And Design agencies are integrated into the Ideas Selection - IS phase.

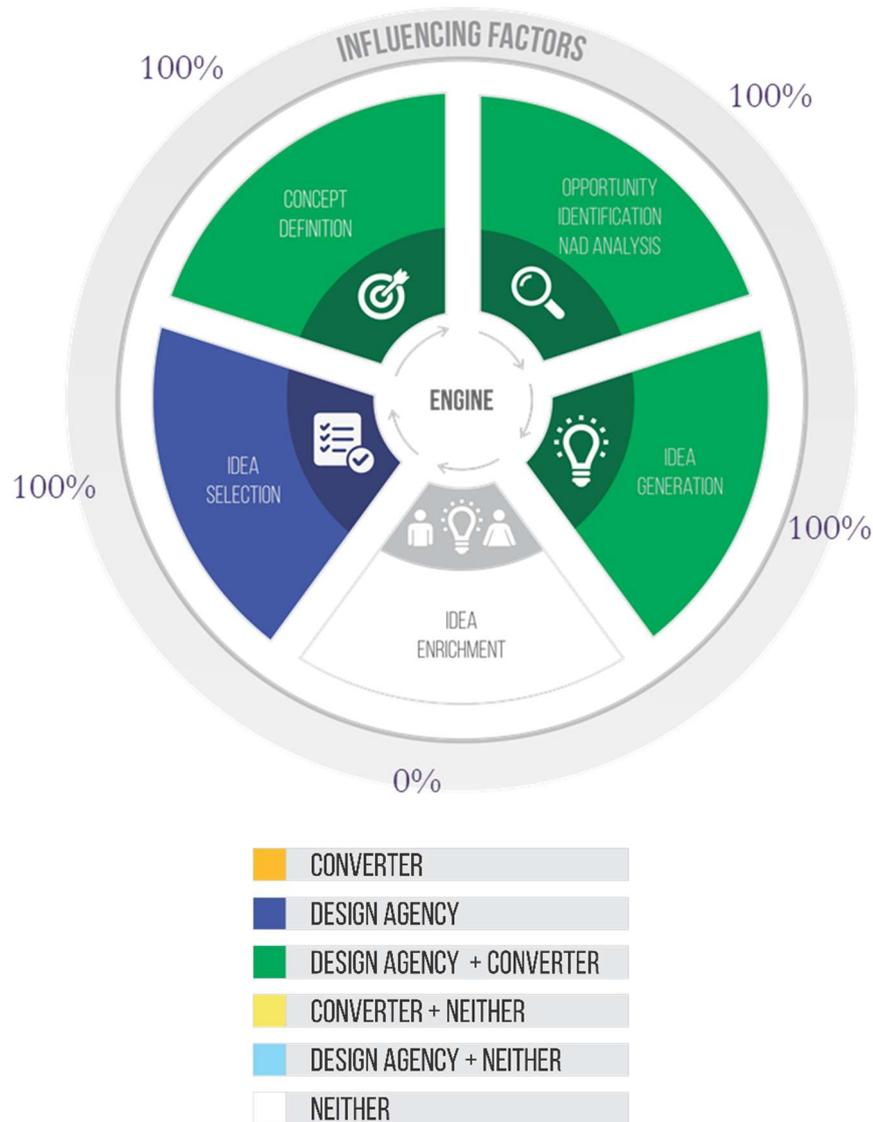


Figure 26: Results - Integration Mechanisms - FB2

Figure 27 and Table 18 show the total score for each activity: the most executed operations are Opportunity Identification and Evaluation – OIA (with 92% of their tasks performed by the 5 Brand Owners) and Concept Development – CD (with 96% of their functions shown by the 5 Brand Owners). This is due to two reasons:

1. OIA: because it is the initial phase, quite uncertain, the Brand Owners seek to perform the maximum tasks such as participation in fairs, congresses, a formation of research groups and agreements, to identify opportunities and partnerships;

2. CD: because it is the final phase of the FEI, a step before the development

process itself, the project is already matured, making it more natural to perform tasks such as the feasibility of projects with regards to manufacturing, marketing and sales, technical requirements; and economics.

Table 22 and figures 30 and 31 present the results for the integration of the partners - design agency and manufacturers/converters - in FEI activities by the Brand Owners. The phase that had the most integration of partners is the OIA, and the stage that had the least integration of partners is that of Idea Enrichment. The Opportunity Identification and Idea Generation are activities that most require the collaboration of the partners because the Brand Owner alone cannot be in all events, not being able, therefore, to identify and create all possible ideas.

Concerning Idea Enrichment being the phase with less collaboration of partners, the justification is due to the constructs defined in this research, which measure this activity through the use of IT systems. It is suggested that in future research, other variables be set to measure the Idea Enrichment phase.

The results on Roles and Integration mechanisms will be better discussed in the next section.

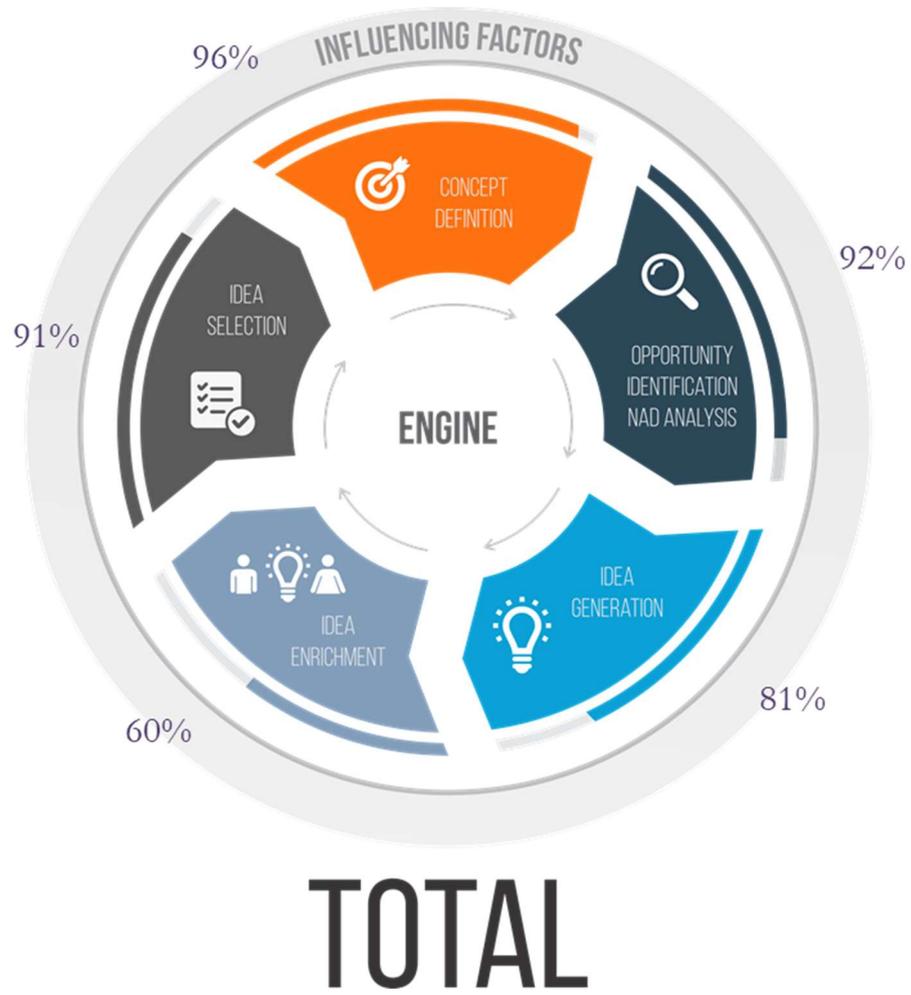


Figure 27: Results - Roles - TOTAL 1

7. PRESENTATION AND DISCUSSION OF RESULTS

In this chapter, we aimed to verify the dynamics into the FEI, which activities are executed and which suppliers are integrated by the Brand Owner. We also assessed the influence of design brokering on the performance into the FEI. Five Brand Owners were interviewed, and the FEI has been divided into five activities: Opportunity Identifications and Analysis, Idea Generation, Idea Enrichment, Idea Selection, and Concept Development.

7.1 Roles

Figure 26 and Tables 16, 17 and 18 present the answers about the company's performance into the FEI. Results showed the five Brand Owners have worked positively in the FEI. SW1 is the most active company in the FEI, working in 95.71% of the activities, and scoring maximum note (5) for all activities, except: feedback on ideas received, comprehensive idea selection and evaluation method, defined set of selection criteria for idea selection. FB2 is the company that operates least in FEI, working in 70% of activities. Still, it is a good score,

According to table 18, the activity that most is performed by the Brand Owners is that of Concept Development, being worked entirely by four of the five companies interviewed; followed by Opportunity Identification and Analysis. The activity that is least worked on by the Brand Owners is that of Idea Enrichment, with two companies working only 20% of what is accomplished on the other three companies.

The most executed activities are Opportunity Identification and Evaluation – OIA (with 92% of their tasks performed by the 5 Brand Owners) and Concept Development –

CD (with 96% of their tasks performed by the 5 Brand Owners). This is due to two reasons: because the OIA is the initial phase, quite uncertain, the Brand Owners seek to perform the maximum tasks such as participation in fairs, congresses, formation of research groups and agreements, to identify opportunities and partnerships; and because the CD is the final phase of the FEI, a step prior to the development process itself, the project is already matured, making it more natural to perform tasks such as feasibility of projects with regards to manufacturing, marketing and sales, technical requirements; and economics.

According to previous studies, see Chapter 3, the companies should manage the front end as a part of a normative model of the process, highlights best practices based on assessment of critical activities, shortening development time dramatically (Khurana & Rosenthal, 1997).

7.1.1 Opportunity Identification and Analysis

This phase measures the degree to which the company spends time evaluating the external environment with a formal process.

One Brand Owner, FB1, is not yet fully engaged in Opportunity Identification and Analysis phase, because it uses little formal documented process review of the external environment.

All Brand Owners interviewed are members of ABRE - Brazilian Packaging Association, which, in turn, promotes, almost monthly, meetings and workshops on trends in the packaging market, promoting the sharing of information by its associates. There are also annual congresses, so that more in-depth discussions about trends and critical points in this market can be carried out in order to reduce uncertainties and promote knowledge sharing among companies.

7.1.2 Idea Generation

Only one Brand Owner, FB1, acts 100% in the events of Idea Generation.

A critical activity answered by the interviewees is the use of a systematic method to capture and share ideas by FB2 and BV1. They are also neutral for activity of providing feedback on ideas received.

7.1.3 Idea Enrichment

Two Brand Owners do not work in any of the activities of Idea Enrichment: FB1 and FB2 pointed out with note 1, which means that the interviewee states that the company does not have an IT-based system for sharing, capturing, and assessing ideas as well as the ability to identify R&D people and find what they are doing.

7.1.4 Idea Selection

Two Brand Owners, VB1 and FB1, move 100% in the activities of Idea Selection.

7.1.5 Concept Development

Four Brand Owners act 100% in the activities of Concept Development, and the company FB2 operates almost all the operations of this stage.

7.2 Cross-functional teams

Tables 19 and 20 present the answers regarding internal integration mechanisms, through cross-functional teams. Identifying if the company has cross-divisional teams,

the integration mechanisms and rewards systems for collaboration have been measured. All companies have cross-divisional teams, with two Brand Owners using all the integration mechanisms and rewards systems for collaboration.

BV1 and CO1 claim to have all cross-functional team competencies working in the FEI. FB1 was the one that indicated fewer skills of cross-functional teams, indicating 70% of the competences, not realizing reward system based on corporate performance and having little job rotation.

The Brand Owners have been integrating the skills of Design Brokering: integrating past experiences with current problems, translating knowledge, integrating players and making analogies with other sectors.

The three companies that have the most cross-functional teams are also the ones that work the most in the FEI, or that have more clearly defined EIF activities.

7.3 Inter-firms integration

Table 22 and figures 30 and 31 present the results for the integration of the design agency and manufacturers/converters in FEI activities by the Brand Owners. SW1 and FB2 involves suppliers in 85.71% of activities, but in different ways: SW1 involves the Design Agency at 50% and manufacturers / converters are involved at 78.52%. FB2 involves the Design Agency at 85.71% and manufacturers/converters are involved in 57.14%. That is, FB2 involves more design; while SW1 does the reverse, integrating more manufacturers/converters. In no FEI activity, all companies have integrated their partners. The tasks that had the most integration of partners are: Analysis of the external environment, Review with a formal documented process, Record ideas, Providing feedback on ideas, Seeks to understand the feasibility of projects with regard to manufacturing, Seeks to understand the feasibility of projects with regard to technical

requirements, being integrated into one of the five companies. The phase that had the least integration of partners is that of Idea Enrichment; being that only BV1 affirms Sharing, capturing, and assessing R&D project information through IT based; and no company claims Allow people to find R&D people and what they are doing through IT-based systems.

FB2 promotes the integration inter-firms in the FEI, but it still does not have well-defined criteria for selecting ideas and concepts. Many of its products remain short of time in the market. Some stay for two months because the market has not well accepted them. The company could use its very close relationship with its suppliers to create a better defined and detailed checklist for assessing ideas and concepts, accessing knowledge from previous projects, and recombining knowledge into new ideas and concepts.

Companies that integrate SW1 and FB2, work inversely in the FEI: SW1 is the company that most operates in the FEI, working in 95.71% of the activities listed in the FEI in this study; while FB2 is the company that works least on the FEI, defining 70% of the activities. For example, FB2 claims to work little on capture and share ideas, but says it involves both suppliers in this activity. That is, the company acts little in this activity, but in the little that acts, integrates the suppliers. The company can look for other forms of capture and share ideas with its suppliers, enriching the stage of Idea Generation.

Table 21 and figure 2 show that companies that integrate design and converters in the Opportunity Identification and Analysis phase perform 100% of the activities at this stage. This scenario is what happens with BV1, SW1, and FB2. The CO1 company, which integrates design agencies, performs 90% of the activities in the OIA phase, while the

FB1 company, which does not include any supplier, carries out 70% of the events at this stage. In the Opportunity Identification and Analysis phase, trends on the market, consumption, design, and technology are identified.

CO1 is a company that dedicates the investment of innovation in packaging, either creating new formats to improve the ergonomics, or with new covers that enhance the opening and closing, or changing form by reducing the use of raw material. Due to this competence, CO1 is always close to the design agencies, seeking to know novelties about formats, materials, consumer needs.

If Brand Owners bring their suppliers together to analyze these tasks, and if Brand Owners can access information that is known to their suppliers, for example, state-of-the-art technology, Brand Owners will be able to play the Opportunity Identification and Analysis more satisfactorily.

The ideation phase is divided into three sub-phases: Idea Generation, Idea Enrichment, and Idea Selection. Brand Owners accept ideas from their suppliers but do not integrate them to develop them (enrichment). BV1, SW1, and CO1 perform the enrichment activity on their own. BV1 and CO1 say they prefer to develop ideas only with their internal teams to accelerate the evaluation process. SW1 justifies the opposite way: it prefers to detail the idea generated as much as possible according to the company strategy, avoiding an influence of the suppliers. After developed, the idea will be directed to go / no-go phase and three Brand Owners call their suppliers to help them in the selection: SW1 integrates the converters, CO1 partially incorporates the design agency, and FB2 integrates full the design agency. BV1 and FB1 do not receive collaboration from their suppliers in the selection of ideas. As already mentioned, CO1 is interested in the opinion of the design agencies because it understands that they have knowledge about raw material, ergonomics and consumer behavior for packaging.

The Concept Development phase had the most diverse responses. SW1 and FB2 incorporate their suppliers in this activity, but FB2 claims not to perform 100% of the evaluation of technical, productive, market and economic feasibility. As already mentioned, FB2 seeks to launch products quickly, and for the task of evaluating the feasibility of marketing and sales, FB2 integrates only the design agency, because it understands that incorporating other suppliers would increase the time in this activity. BV1, CO1, and FB1 perform 100% of the Concept Development phase, but do not integrate 100% of their suppliers in this event: BV1 does not incorporate any, CO1 combines only the converters, and FB1 partially integrates the converters.

The consumers of the interviewed companies buy the product by the performance of the same and also by the packaging. Packaging is considered a second product at the point of sale and a vital buying decision factor. Brand Owners understand that they need to integrate suppliers into the FEI to assist them in identifying opportunities, ideation, and conceptualization.

The company CO1 dedicates its investment of innovation in the development of packaging, especially in the concept and ergonomics of the packaging. For this, CO1 integrates the design agencies in the FEI, since these have the vital competencies for activities of ideation and conceptualization.

Companies SW1, CO1, and FB1 are concerned with the raw material of the packaging, looking for raw material that provides better product benefits, such as non-contamination of the raw material by misuse by the consumer, or increases the shelf-life of the product. For this, SW1, CO1, and FB1 integrate the converters in the FEI, since they know the state-of-the-art of technology and materials.

The companies FB1 and FB2, which are food and beverage companies and have large portfolios of products, rapid product launches because its market is much more dynamic than the others. Therefore, FB1 and FB2 perform fewer tasks in the FEI, compared to those that do not need to launch products quickly. FB1 and FB2 claim to spend less time on the FEI to launch products quickly and test them in the market. Many of these products are reworked or are discontinued due to lack of research and testing in the FEI.

7.4 Design Brokering

Tables 21 presents the answers to the skills of Design Brokering. Only BV1 claimed to have all the skills of Design Brokering. The companies with the lowest competences are the FB2, with 68% of the competences; and SW1 with 72%. The FB2 did not indicate a maximum grade for any competence, indicating note three for access to distributed knowledge in its network; assimilate the distributed knowledge; and construct new networks around those combinations in order to ensure their success. SW1 indicated note 3 for access to distributed knowledge in its network; and assimilate the distributed knowledge.

In a packaging project, the start is usually given by marketing, which, in turn, hires the design. The design is the integrating component of the process. For example, to make a shampoo packaging, the bottle is blown in one factory, another factory manufactures the injected lid, the label and the carton are produced with different technologies and materials. For these four items to fit neatly into each other and fit into the packaging line productions, four files are needed with the drawings of each of them and information from four companies is required. The design will integrate the parts into a single project. Few Design Agencies act on the process and few Brand Owners realize that design is the integrating component of the process and that it must be present at the zero project time.

Brand Owner, Design Agency, and Converters should collaborate in the FEI, but this is not the case most of the time. The integration of Design and the other Suppliers with the Brand Owner not only reduces errors in the process and execution times but also improves the quality of the project realized when the members of the chain collaborate from the first moment.

Design can act as a broker in the packaging development process, combining innovations and existing ideas, exploring small knowledge, using past expertise to solve current problems, to increase product success, proposing solutions that bring together manufacturers and products. The primary skill is being willing to learn different things, dealing with design, technology, marketing, techniques and industrial processes, for example.

7.5 Propositions

From the interviews, some propositions can be tested in future works:

P1: Companies that make quick product launches perform fewer EIF activities.

P2: Companies that develop products whose packaging formats are a buying decision factor are part of design agencies within the FEI.

P3: Companies that develop products whose opening systems and packaging raw materials are purchasing decision factors integrate converters into the FEI.

Table 16: Results: FEI roles and activities (1)

Activities/Roles	Constructs	Variables (Questions)	BV1	SW1	CO1	FB1	FB2
Opportunity Identification and Analysis	The degree to which the company spends time evaluating the external environment with a formal process.	The degree to which the company performs a through analysis of the external environment.	5	5	5	5	5
		The degree to which the company uses a formal documented process review of the external environment.	5	5	4	2	5
Idea Generation	The degree to which the business unit has a systematic way to capture, share, record and provide feedback on ideas.	The degree to which the company has a systematic method to capture and share ideas.	1	5	5	5	2
		The degree to which the company records ideas.	5	5	4	5	5
		The degree to which the company provides feedback on ideas received.	3	4	4	5	3
Idea Enrichment	The degree to which the business has an IT-based system for sharing, capturing, and assessing ideas as well as the ability to identify R&D people and find what they are	The degree to which the company has IT-based systems for sharing, capturing, and assessing R&D project information.	4	5	4	1	1
		The degree to which the company has IT-based systems for allow people to find R&D people and what they are doing.	4	5	4	1	1
Idea Selection	The degree to which the business unit has an idea review board, a comprehensive method for idea evaluation, and a defined set of selection criteria.	The degree to which the company has an idea review board.	5	5	5	5	4
		The degree to which the he company has a comprehensive idea selection and evaluation method .	5	4	4	5	3
		The degree to which the company has a defined set of selection criteria for idea selection.	5	4	5	5	4
Concept Development	The degree to which the company assess the feasibility of manufacturing process, the , marketing and sale effort, technical requirements, and economic factors connected with a project.	The degree to which the company seeks to understand the feasibility of projects with regards to manufacturing.	5	5	5	5	4
		The degree to which the company seeks to understand the feasibility of projects with regards to marketing and sales.	5	5	5	5	4
		The degree to which the company seeks to understand the feasibility of projects with regards to technical requirements.	5	5	5	5	4
		The degree to which the company seeks to understand the feasibility of projects with regards to economics	5	5	5	5	4
Total			62	67	64	59	49
			88,57%	95,71%	91,43%	84,29%	70,00%

Table 17: Results: FEI roles and activities (II)

Activities/Roles	Constructs	BV1	SW1	CO1	FB1	FB2
Opportunity Identification and Analysis	The degree to which the company spends time evaluating the external environment with a formal process.	10	10	9	7	10
Idea Generation	The degree to which the business unit has a systematic way to capture, share, record and provide feedback on ideas.	9	14	13	15	10
Idea Enrichment	The degree to which the business has an IT-based system for sharing, capturing, and assessing ideas as well as the ability to identify R&D people and find what they are doing.	8	10	8	2	2
Idea Selection	The degree to which the business unit has an idea review board, a comprehensive method for idea evaluation, and a defined set of selection criteria.	15	13	14	15	11
Concept Development	The degree to which the company assess the feasibility of manufacturing process, the , marketing and sale effort, technical requirements, and economic factors connected with a project.	20	20	20	20	16
Total		62	67	64	59	49
		88,57%	95,71%	91,43%	84,29%	70,00%

Table 18: Results: FEI roles and activities (III)

Activities/Roles	BV1	SW1	CO1	FB1	FB2	Total
Opportunity Identification and Analysis	100,00%	100,00%	90,00%	70,00%	100,00%	92,00%
Idea Generation	60,00%	93,33%	86,67%	100,00%	66,67%	81,33%
Idea Enrichment	80,00%	100,00%	80,00%	20,00%	20,00%	60,00%
Idea Selection	100,00%	86,67%	93,33%	100,00%	73,33%	90,67%
Concept Development	100,00%	100,00%	100,00%	100,00%	80,00%	96,00%
Total	88,00%	96,00%	90,00%	78,00%	68,00%	

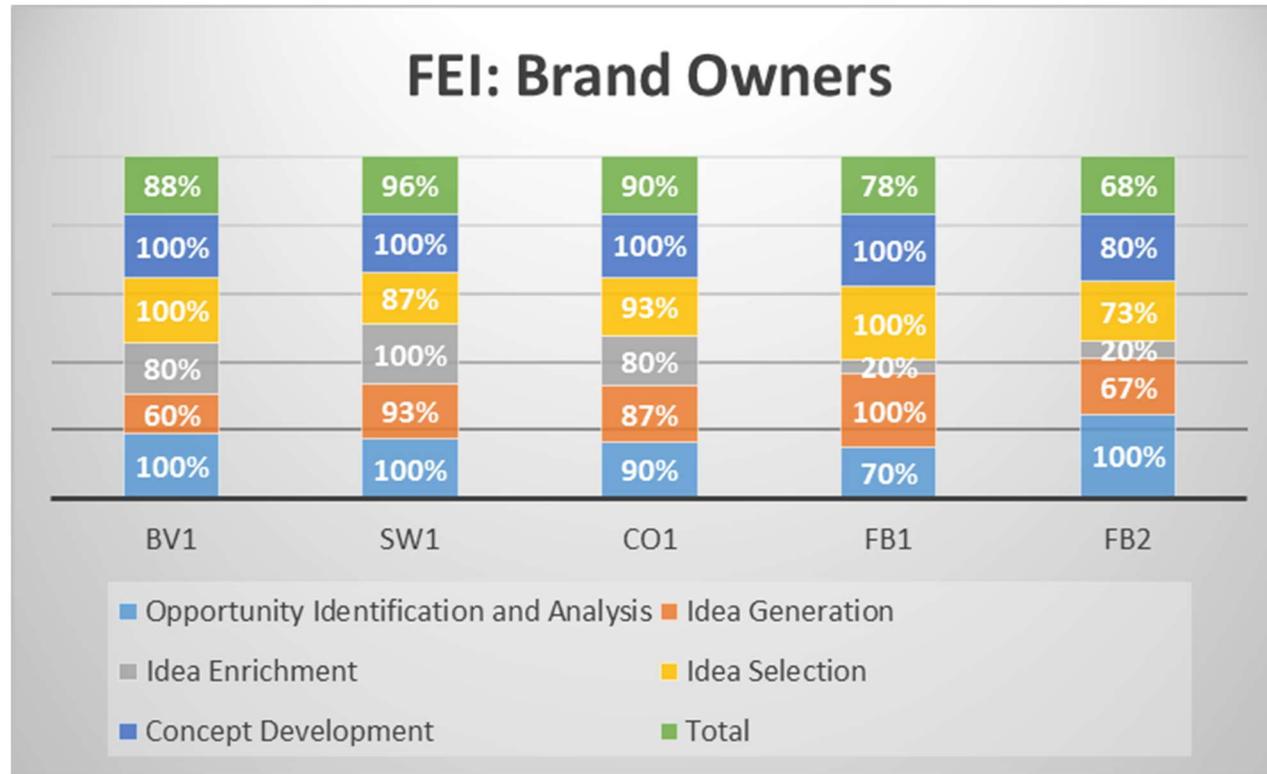


Figure 28: Results - Roles - Brand Owner 1

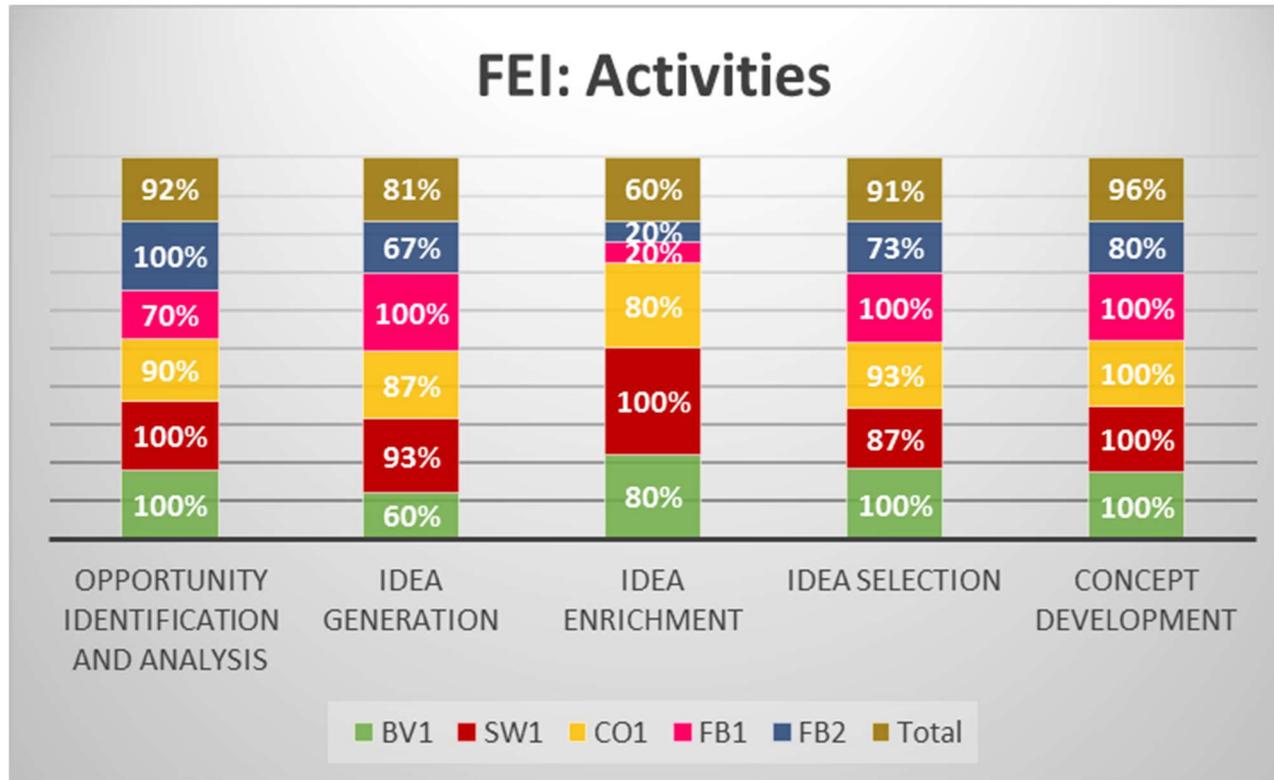


Figure 29: Results - Roles - Activities 1

Table 19: Results: Cross-functional teams (1)

Integration Mechanisms	Constructs	Variables (Questions)	BV1	SW1	CO1	FB1	FB2
Cross-functional team	The degree to which the company promote cross-divisional collaboration through integration mechanisms	The degree to which the company promote informational exchange by the use of information technology.	5	5	5	3	4
		The degree to which the company foster job rotation between its division	5	4	5	2	3
		The degree to which the company sustain permanent committees for cross-divisional R&D topics.	5	5	5	5	4
		The degree to which the company create specific cross-divisional units for cross-divisional R&D topics.	5	5	5	5	4
	The degree to which the company promote cross-divisional collaboration through rewards system.	The degree to which the company reward its employees based on corporate performance.	5	5	5	1	4
		The degree to which the company promote non-monetary incentives cross-divisional collaborations.	5	4	5	5	3
Total			30	28	30	21	22
			100%	93%	100%	70%	73%

Table 20: Results: Cross-functional teams (II)

Integration Mechanisms	Constructs	BV1	SW1	CO1	FB1	FB2
Cross-functional team	The degree to which the company promote cross-divisional collaboration through integration mechanisms	20	19	20	15	15
	The degree to which the company promote cross-divisional collaboration through rewards system.	10	9	10	6	7
Total		30	28	30	21	22
		100%	93%	100%	70%	73%

Table 21: Results: Brokering

Integration Mechanisms	Constructs	Variables (Questions)	BV1	SW1	CO1	FB1	FB2
Design Brokering	The degree to which the company creates and manages social networks.	The degree to which the company recombine innovations, existing ideas, artifacts, and people in new ways.	5	4	5	4	4
	The degree to which the company access to distributed knowledge in its network.	The degree to which the company exploit small worlds in the pursuit of innovation.	5	3	4	5	3
	The degree to which the company assimilate the distributed knowledge.	The degree to which the company convert experience into knowledge.	5	3	4	5	3
	The degree to which the company recombines learned knowledge through analogical reasoning.	The degree to which the company use past knowledge to solve current problems.	5	4	5	5	4
	The degree to which the company move from innovative ideas to accepted innovations by building new network ties, embedding the emerging recombination within a new domain networks.	The degree to which the company construct new networks around those combinations in order to ensure its success.	5	4	4	5	3
Total			25	18	22	24	17
			100%	72%	88%	96%	68%

Table 22: Results: Inter-firm integration

Integration Mechanisms	Constructs	Variables (Questions)	BVI			SWI			COI			FBI			FB2			Total de atividades integradas	
			Design Agency	Converter/ Raw material for packaging suppliers	Neither	Design Agency	Converter/ Raw material for packaging suppliers	Neither	Design Agency	Converter/ Raw material for packaging suppliers	Neither	Design Agency	Converter/ Raw material for packaging suppliers	Neither	Design Agency	Converter/ Raw material for packaging suppliers	Neither		
Inter-firms	Opportunity Identification and Analysis	Analysis of the external environment.															4		
		Review with a formal documented process.																4	
	Idea Generation	Capturing and sharing ideas.																3	
		Record ideas.																4	
		Providing feedback on ideas.																4	
		Sharing, capturing, and assessing R&D project information through IT based																1	
	Idea Enrichment	Allowing people to find R&D people and what they are doing through IT-based systems																0	
		Participating in the Idea review board.																3	
	Idea Selection	Participating in the idea selection and evaluation.																3	
		Define or help to define a defined set of selection.																3	
	Concept Development	Seeks to understand the feasibility of projects with regard to manufacturing.																4	
		Seeks to understand the feasibility of projects with regard to marketing and sales.																3	
		Seeks to understand the feasibility of projects with regard to technical requirements.																4	
		Seeks to understand the feasibility of projects with regard to economics.																3	
	Total de atividades nas quais agência de design e convertedores são			7	5	7	7	11	2	7	6	4	1	3	11	12	8	2	
				50,00%	35,71%	50,00%	50,00%	78,57%	14,29%	50,00%	42,86%	28,57%	7,14%	21,43%	78,57%	85,71%	57,14%	14,29%	
Total de atividades nas quais todos os fornecedores são integrados			7			12			10			3			12				
			50,00%			85,71%			71,43%			21,43%			85,71%				

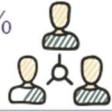
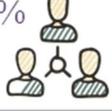
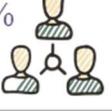
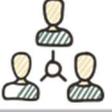
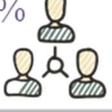
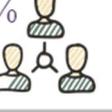
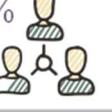
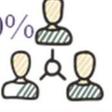
	BV1	SW1	CO1	FB1	FB2	
OPPORTUNITY IDENTIFICATION AND ANALYSIS	100% 	100% 	100% 		100% 	80%
IDEA GENERATION	66% 	100% 	100% 	25% 	100% 	78%
IDEA ENRICHMENT	50% 					10%
IDEA SELECTION		100% 	66% 		100% 	53%
CONCEPT DEVELOPMENT		100% 	75% 	50% 	100% 	65%
TOTAL	50%	86%	71%	21%	86%	

Figure 30: Results Interfirm integration 1

	BV1	SW1	C01	FB1	FB2
OPPORTUNITY IDENTIFICATION AND ANALYSIS					
IDEA GENERATION					
IDEA ENRICHMENT					
IDEA SELECTION					
CONCEPT DEVELOPMENT					
TOTAL	50%	86%	71%	21%	86%

Figure 31: Results Interfirm integration 1

Legend	
	Converter
	Design Agency
	Design Agency + Converter
	Converter + Neither
	Design Agency + Neither
	Neither

Table 23: Results - Brand Owners Summary

Brand Owner	Founded	Headquarters	Revenue	Employees	Countries	Brands	R&D
BV1	1999	Brazil	45 billion	46K	19	30	
SW1	1923	USA	30 billion	99K	165	51	Yes
CO1	1969	Brazil	4.3 billion	7K	70	36	
FB1	1866	Switzerland	89 billion	281K	194	20	Yes
FB2	1965	USA	66B	274k	200	22	Yes

8. FINAL CONSIDERATIONS

8.1 Theoretical implications

The Front End of Innovation process – FEI, also called the Fuzzy Front-End – FFE, is the predevelopment phase (Cooper, 1988) which refers to the early stages of the New Product Development – NPD process (Smith & Reinertsen, 1991; Koen et al; 2001), in which is developed the concept of the project, and whether or not funds should be invested in order to produce the idea (Moenart, de Meyer, Souder & Deschoolmeester; 1995).

Due the uncertainty and ambiguity that surround the Front End of Innovation (FEI), this phase has difficulties such as its dynamism and the low levels of formalization, but it is responsible for the idea generation and an essential driver of innovation success. At the beginning of the study, the researcher used the term Fuzzy Front-End – FFE, considering that the phase was fuzzy, ambiguous and full of uncertainties, without activities and well-defined roles. But insofar as the researcher read the most current references, and insofar as she conducted the interviews in the first phase, the researcher changed her perception regarding the stage of the pre-development, which has become more explicit to the Brand-Owners and more strategically explored by the company. It is still a fuzzy phase, it still has uncertainties, but ambiguity is giving way to more clearly defined tasks, through gates and the definition of roles responsible for such functions. According nature, strategy of the project, and structure of Brand Owner, the activities the integration occurs in different ways.

Despite the growing research about the FEI in recent years, there is a need for

further research on the theme to understand the dynamics better and help to reduce the uncertainty in the critical concept phase. The formal processes designed for the front end are insufficient, the rules and roles are not adequately described, and it is necessary to balance the interactions between the activities in the FEI to get a better-structured New Product Development – NPD – later. The main FEI models developed at the literature have discussed some key roles such marketing, engineering, customers, but they do not address the role of design, which is critical in creative activities which, in turn, are the nature of the new product development process. The literature also has not discussed the external integration in the FEI, that is, how the Brand Owners integrate the partners, especially the suppliers and design agencies, in this critical and uncertain phase.

To tackle this issue, this research examined the FEI in the packaging industry, a dynamic industry, exploring the integration of roles in an iterative process. This study identified the roles that play in the Front End of Innovation and the mechanisms of integration, whether internal through cross-functional teams; or external through inter-firms collaboration.

The central question that guided this research was “What roles are involved in each FEI activity and what is the mechanism that integrates these roles in the FEI?”.

The packaging sector was selected because of its value chain in the concept creation phase: there is a dynamic relationship among its parties and, as in other industries involving many players, the interaction among different companies is problematic. In this study, five brand owners were interviewed, and the FEI has been divided into five activities: Opportunity Identifications and Analysis, Idea Generation, Idea Enrichment, Idea Selection, and Concept Development. The consumers of the interviewed companies buy the product by the performance of the same and also by the packaging. Packaging is considered a second product at the point of sale and a vital buying decision factor. Brand

Owners understand that they need to integrate suppliers into the FEI to assist them in identifying opportunities, ideation, and conceptualization.

The packaging that we find in the market is the result of the action of a complex and multidisciplinary chain. Diverse skills like Design, Marketing, Industrial Production, Technologies and Logistics, for example, are desirable at some level in this work. But none of the parts of the value chain can completely ignore the others, and what is still lacking is the understanding of the whole, because people and companies are focused on their activity without having the holistic view of the value chain.

Brand Owner, Design Agency, and Converters should collaborate in the FEI, but this is not the case most of the time. The integration of Design and the other Suppliers with the Brand Owner not only reduces errors in the process and execution times but also improves the quality of the project realized when the members of the chain collaborate from the first moment.

The central theoretical contribution of this work is the description of the division of labor, and the description of integration mechanisms in the Front End of Innovation of the New Product Development Process of a Complex Industry. A well structured FEI results in better NPD.

The companies that dedicate investment of innovation in the development of packaging, especially in the concept and ergonomics of the packaging integrate the design agencies in the FEI since these have the vital competencies for activities of ideation and conceptualization.

Companies that are concerned with the raw material of the packaging, looking for raw material that provides better product benefits, such as non-contamination of the raw material by misuse by the consumer, or increases the shelf-life of the product, integrate

the converters in the FEI, since they know the state-of-the-art of technology and materials.

The companies which are food and beverage companies and have large portfolios of products, launch rapid product because its market is much more dynamic than the others. Therefore, these companies perform fewer tasks in the FEI, compared to those that do not need to launch products quickly. These companies claim to spend less time on the FEI to launch products quickly and test them in the market. Many of these products are re-worked or are discontinued due to lack of research and testing in the FEI.

The Brand Owners have been integrating the skills of Design Brokering: incorporating past experiences with current problems, translating knowledge, integrating players and making analogies with other sectors.

The roles of the assessed three vital players – Brand Owners, Design Agencies, and Converters - emerge clearly because commercial borders mediate their relationships within the FEI. One of the difficulties for innovation in this industry happens in the Front End, due to the withholding information among the constituent parties. The Brand Owner does not share market data and consumer surveys. The packaging producers do not share technology state of the art. Mediating and aligning the information to reduce the obstacles, are the design agencies, working as a broker.

8.2 Management implications

The managerial contribution of this work is the description and the organization of the roles in the FEI, explaining how different players work in each activity of the FEI. Choosing the correct relationship among players, it will be possible reduce fuzziness and uncertainty, changing from a fuzzing phase to a more formalized phase.

Companies should devote more time to carrying out activities at the FEI, avoiding rework and discontinuation of products on the market because consumers did not accept

them. Many products are reworked or are not approved by the consumers because the Brand Owner has not tested ideas and concepts in the FEI.

Companies should further integrate suppliers into the FEI to assist them in carrying out more EIF activities.

Companies that develop products whose packaging formats are a buying decision factor should integrate design agencies in the FEI, since they have the vital competencies for the ideation and conceptualization activities, as well as acting as brokers, articulating concepts, consumer needs, suppliers, technologies, solutions, etc.

Companies that develop products whose opening systems and packaging raw materials are purchasing decision factors must integrate the converters into the FEI as they know the state of the art of the technologies.

Design can act as a broker in the packaging development process, combining innovations and existing ideas, exploring small knowledge, using past expertise to solve current problems, to increase product success, proposing solutions that bring together manufacturers and products. The primary skill is being willing to learn different things, dealing with design, technology, marketing, techniques and industrial processes, for example.

8.3 Future Research

There are some limitations in this work that can be corrected through other research in the future: deepen the literature of integration and contingencies to extract more dimensions to be explored in other empirical research. Second, increasing the

sample. Third, comparing more success and failure projects to identify the influences of the division of labor causes in the success of the projects.

From the interviews, some propositions can be tested in future works:

P1: Companies that make quick product launches perform fewer EIF activities.

P2: Companies that develop products whose packaging formats are a buying decision factor are part of design agencies within the FEI.

P3: Companies that develop products whose opening systems and packaging raw materials are purchasing decision factors integrate converters into the FEI.

P4: The companies that have

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APPENDIX

APPENDIX 1: INTERVIEW GUIDE (Phase 1)

Company:	Email:
Name:	Telephone:
Function:	Agree to follow up?
1.Opportunity Identification Stage:	<ul style="list-style-type: none"> ● What do you have in your internal discovery pipeline and what needs to be acquired externally according to your strategic direction and research projects (bought or brought in-house)? ● From an information processing perspective, what role does information transfer play in integrating R&D and marketing functions during the planning stage? ● From an information processing perspective, what effects do project formalizations and project centralization of R&D and marketing planning activities have on the efficiency of marketing and technological uncertainty reduction? ● How does your company process the information? How do you integrate information into their reasoning? ● How control mechanism can managers use in managing the front end of innovation projects? ● How can the project management office (PMO) or related organizational arrangements be used for the management control in managing the front end of innovation projects? ● What are the contingency factors that affect the choice and/or performance of such mechanisms? (in terms of interactive systems and belief sustems)
2. Consumer (target) Evaluation	<ul style="list-style-type: none"> ● What are the structural relationships among market orientation? ● What is the type of customer contribution? ● What is the timing of major customer participation during the product innovation

Stage:	<p>process?</p> <ul style="list-style-type: none"> ● What is the impact of different types of customer contributions on the degree of product newness? ● What is the impact of the timing of customer participation on the degree of product newness? ● How new product and market program creativity affect product competition advantage as a strategic innovation outcome? ● Does your team use market research techniques such as focus groups, interviews, and observation? If yes, why?
3. Technology Feasibility Stage:	<ul style="list-style-type: none"> ● What are requirements for individuals serving as manufacturing's liaison to the front-end? ● Is there a practicable way to combine technology-oriented and market-oriented views or even extend them to other related factors?
4. Concept Generation Stage:	<ul style="list-style-type: none"> ● Why are ideas generated? What sorts of issues, perceptions, predictions, or needs prompt them? ● Is there somebody that inform the idea generator of the specificity, depth, and detail of the information required to create the ideas? ● Under what circumstances do different forms of rationalization become dominant? Are there patterns of rationalizing that managers fall into when generating ideas? ● Where do managers obtain information in their efforts to generate and evaluate ideas? What kinds and how much information do they look for? ● How team cognitive characteristics enhance/ inhibit the ideation task? ● And the mediating role of goal constraint on the relationship between an ideation team's cognitive characteristics and the ideation task outcomes?
5. Concept Screening Stage:	<ul style="list-style-type: none"> ● How do you qualify an idea? ● How do you identify ideas that are most viable candidates do move to subsequent of development, in terms of the degree of perceived market and technological readiness, maturity? ● Do you rate the ideas quantitatively? If yes, what framework? ● How do you reduce the subjectivity and lack of information that typically are

	<p>associated with idea evaluation and selection decisions in the fuzzy front end of the NPD process?</p> <ul style="list-style-type: none"> ● How do you evaluate and subsequently approve or reject a new product or service concept for further development? ● How the ideation capabilities are manifested and in firms? ● What extent the ideation should be influenced in terms of direction? ● What is the role of the horizontal/lateral between-ideas and between-projects integration? (with relation to information processing and behavioral perspectives)
<p>6. Project</p> <p>Definition:</p>	<ul style="list-style-type: none"> ● Do you prioritize projects according to the capabilities that have internally? ● How can your company improve its front-end practices to achieve success in new product development? ● How does the structures of the network affect how new relationships are established? ● How does the structure of your network offer an approach to evaluate the potential of teams? ● What is the impact of the individual level, team level, and organizational level on Product Development project performance, such as glitches in PD? ● What is the role of the early stages of innovation in cross-divisional ventures? ● How can corporate managers stimulate cross-divisional collaboration in the front end of innovation? ● How the choice of specific learning strategies can reduce fuzziness in the front end?

APPENDIX 2: Questionnaire for projects NCD activities (Phase 2/Step 2)

Managing the Front End of Innovation

The Front End of Innovation is the early phase of the Product Development Process. It is characterized by the following activities: Opportunity Identification and Analysis, Idea Generation, Idea Enrichment, Idea Selection, Concept Definition. Only after this phase, the product will be developed by the companies such as a Brand Owner, Design Agency and Manufacturers / Raw Materials for packaging suppliers. Based on this definition, this research aims to identify how the activities are performed in the pre-development phase, who does what and what are the integration mechanisms between companies.

Predevelopment activities of innovation

1. My company performs a thorough analysis of the external environment.
2. My company performs using a formal documented process review.
3. My company performs has systematic methods for capturing and sharing ideas.
4. My company records ideas.
5. My company performs has systematic methods for providing feedback on ideas received.
6. My company has IT-based systems for sharing, capturing, and assessing R&D project information.
7. My company has IT-based systems for allowing people to find R&D people and what they are doing.
8. My company has an idea review board.
9. My company has a comprehensive idea selection and evaluation method.
10. My company has a defined set of selection criteria.
11. My company seeks to understand the feasibility of projects with regard to manufacturing.
12. My company seeks to understand the feasibility of projects with regard to marketing and sales.
13. My company seeks to understand the feasibility of projects with regard to technical requirements.
14. My company seeks to understand the feasibility of projects with regard to

economics.

Cross-divisional teams

15. We promote cross-divisional information exchange by the use of information technology.
16. Job rotation between our divisions is fostered.
17. Permanent committees exist for cross-divisional R&D topics.
18. Specific cross-divisional units exist for cross-divisional R&D topics.
19. The reward system for our employees is mostly based on corporate performance.
20. Non-monetary incentives are provided for cross-divisional collaborations.

Inter-firms integration

21. My company involves which suppliers in each of the activities below?

	Design Agency	Converter/ material for packaging suppliers	Raw for	Neither
Analysis of the external environment.				
Review with a formal documented process.				
Capturing and sharing ideas.				
Record ideas.				
Providing feedback on ideas.				
Sharing, capturing, and assessing R&D project information through IT based				
Allowing people to find R&D people and what they are doing through IT-based systems				
Participating in the Idea review board.				
Participating in the idea selection and evaluation.				
Define or help to define a defined set of selection.				
Seeks to understand the feasibility of projects with regard to manufacturing.				

Seeks to understand the feasibility of projects with regard to marketing and sales.			
Seeks to understand the feasibility of projects with regard to technical requirements.			
Seeks to understand the feasibility of projects with regard to economics.			

Brokering

22. My company recombine innovations, existing ideas, artifacts and manage people in new ways.
23. My company explores small worlds, small knowledge, in the pursuit of innovation.
24. My company translates experience into knowledge and assimilates distributed knowledge.
25. My company uses past knowledge to solve current problems.
26. My company builds new networks around these combinations to ensure its success.

Company Performance

27. Today, the Packaging development process in my company is shorter, with regards to the time, compared to the last 3 years.
28. What is the average time of packaging development?
29. The products launched in the last 3 years are still in the market.
30. How much does my company invest in innovation (%)?
-

APPENDIX 3: Questionnaire with Suppliers (phase 2/step 4)

Predevelopment activities of innovation

31. My company performs a thorough analysis of the external environment.
32. My company performs using a formal documented process review.
33. My company performs has systematic methods for capturing and sharing ideas.
34. My company records ideas.
35. My company performs has systematic methods for providing feedback on ideas received.
36. My company has IT-based systems for sharing, capturing, and assessing R&D project information.
37. My company has IT-based systems for allowing people to find R&D people and what they are doing.
38. My company has an idea review board.
39. My company has a comprehensive idea selection and evaluation method.
40. My company has a defined set of selection criteria.
41. My company seeks to understand the feasibility of projects with regard to manufacturing.
42. My company seeks to understand the feasibility of projects with regard to marketing and sales.
43. My company seeks to understand the feasibility of projects with regard to technical requirements.
44. My company seeks to understand the feasibility of projects with regard to economics.

Cross-divisional teams

45. We promote cross-divisional information exchange by the use of information technology.
46. Job rotation between our divisions is fostered.
47. Permanent committees exist for cross-divisional R&D topics.
48. Specific cross-divisional units exist for cross-divisional R&D topics.
49. The reward system for our employees is mostly based on corporate performance.

50. Non-monetary incentives are provided for cross-divisional collaborations.

Brokering

51. My company recombine innovations, existing ideas, artifacts and manage people in new ways.

52. My company explores small worlds, small knowledge, in the pursuit of innovation.

53. My company translates experience into knowledge and assimilates distributed knowledge.

54. My company uses past knowledge to solve current problems.

55. My company builds new networks around these combinations to ensure its success.

**APPENDIX 4: Questionnaire with support and learning institutions of
the Packaging Industry (phase 2/step 5)**

1. What competencies are required to operate in the Packaging Industry?
2. What activities are carried out in the pre-development phase of the packaging development process?
3. Do the companies involved in the development of the packaging itself, such as the Brand Owner, Design Agency and Suppliers / Converters, collaborate in the activities of the pre-development phase?
4. Can Design act as a broker in the packaging development process, recombining innovations and existing ideas, exploring small knowledge, using past knowledge to solve current problems, in a way that increases product success?
5. If so, have designers been called by the Brand Owner, whether in internal departments or in partnerships with companies, to act as brokers?