

Market Research and the New Product Development Process

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Abstract

Market research is an important tool throughout all the steps that involve developing new products. Nevertheless, the inadequate use of the available research methodologies raises the probability of failure within innovation to be negotiated in the markets. Based on the stated, this article systematizes the main types of market research to be carried out along the stages of the product development process, as well as its stages and data analysis procedures. Initially, regarding the bibliographic research, it was possible to identify five market research problems throughout the NPD stages: (i) identification of latent demands, (ii) identification of requirements valued by customers, (iii) concept testing, (iv) prototype testing and (v) evaluation of product performance with consumers. Therefore, to establish the appropriate research processes for each of the listed problems, a focus group was conducted with specialists. The proposed classification constitutes a framework that can be adopted for validation in further studies, because of the chosen research approach, the research results may lack generalisability. The synthesis proposed in this work contributes to guiding the managers who act directly in the processes of product innovation.

1 Introduction

Products made available for consumption on the market are highly vulnerable to changes in consumer needs and preferences, new technologies, and increased domestic and foreign competition. This context indicates that the practice of innovation must be a constant (Hauser et al., 2006; Lundvall, 2007; Edquist, 2011). However, the high risk associated with the process of launching innovations makes the number of organizations that develop new products, especially in emerging countries, a small percentage (Tellis et al., 2009; Story et al., 2015; Chang and Taylor, 2016). As described in a study by Evanschitzky et al. (2012), despite the high investment expended by companies that focus on differentiation via product innovation, only 25% of total launches are successful.

New products continue to fail due to recurring errors, such as an overestimated market, misleading design, confusing positioning, and ineffective communication (Castellot and Markham, 2013; Kotler and Keller, 2016). In addition, other factors undermine the process of developing new products such as scarcity of innovative ideas, highly fragmented markets, societal and governmental restrictions, shorter development times, and shorter product life cycles (Jain, 2001; Cankurtaran et al., 2013; Eling et al., 2013; Eppinger and Ulrich, 2015). To change this situation, organizations should seek to develop products that are superior and unique, that must have a product concept clearly defined and valued by their target market before development, and must have teams with a high capacity for cooperation and performance of cross-functional work (Sethi et al., 2001; Cooper et al., 2004; Troy et al., 2008; Barczak et al., 2009; Evanschitzky et al., 2012).

Market intelligence and marketing knowledge, besides the ability to work together among teams, is a strong driving of success in product development (Suwannaporn and Speece, 2003; De Luca and Atuahene-Gima, 2007; Barczak and Kahn, 2012; Trainor, et al., 2013; vom Brocke and Lippe, 2015). Specifically, Henard and Szymanski (2001), through a detailed literature review, have identified that

among 24 drivers mapped to the success of new products, potential market and knowledge of the consumers' needs have a greater impact on post-launch performance along with differentiation, the capacity of resources and pre-development phase.

In this context, marketing research is an important tool throughout all the steps involved in new product development, since it can be used to respond to a wide range of problems that organizations face (Cova and Salle, 2005; Drechsler et al., 2013). However, the misuse of the available research methodologies reinforces the probability of innovation failure to be negotiated in the markets (Ray and Tabor, 2003; Ogawa and Piller, 2006; Veldhuizen et al., 2006; Slater et al., 2014). Therefore, more than using the tool, companies need to know which approaches, collection instruments, and analysis procedures are best suited to the recurring problems that need investigation (Malcolm et al. Malhotra, 2014).

Considering the exposed problem, this article aims to develop an exploratory study to make a script of the main types of market research to be carried out along the stages of the innovative products development process, as well as their steps and data analysis procedures. For this purpose, it is first described the market research process, and later, a referential model of the new product development process (NPD). Thereafter, the method used to reach the objectives of the article is specified. Finally, considering the results of the bibliographic research and the focus group with specialists, the market research processes to be developed in the NPD phases are proposed.

2 Market Research Process

According to Kotler and Keller (2016), effective market research involves six steps: (i) definition of the problem and research objectives; (ii) development of the research plan; (iii) data collection; (iv) data analysis; (v) results' presentation; and (vi) decision making.

When researchers perform step (i) definition of problem and research objectives, that is, when the reasons that support the need for the development of field research and what is intended to obtain from the answers to the research are elucidated, it is possible to distinguish between three types of projects: exploratory, descriptive or causal (Hair, et al., 2008). Furthermore, during the definition of the problem and the objectives, the researcher defines the conception of the study, that is, whether it will be qualitative or quantitative (Malhotra, 2014).

For previously referenced authors, exploratory type surveys should be conducted when the objective involves gathering preliminary data to clarify the nature of the problem and suggest possible hypotheses or new ideas. Descriptive research should be used when describing market characteristics or functions, while causal studies are necessary when the objective is to test cause-effect relationships.

Having defined the type of research to be executed, it is possible to (ii) develop the research plan. This step establishes the approach and the sampling plan to be used, as well as the instrument and the most appropriate procedure for data collection (see item 2.1). After that, the (iii) data collection stage is characterized by requiring more time, as well as by the greater probability of errors, especially when the

approach that is being used is the survey. In order to minimize the possibility of deviation in the results due to biased data collection, it is suggested to detail the collection procedure plan (Ray and Tabor, 2003).

Step (iv) data analysis involves the interpretation of the data collected. The methodology of data analysis to be performed depends on the initial objective of the research, as well as the type of project (Malhotra, 2014). In the presentation of the results (v), Kotler and Keller (2016) emphasize that it is the responsibility of the researcher to select the results that respond more specifically to the problem that led to the study, using appropriate communication techniques and describing conclusions relevant to the decision making. Regarding decision making (vi), when receiving the results of a market survey, managers should question whether the research carried out was based on an adequate scientific method (Clancy and Krieg, 2000) and should also reconcile the process of decision making with other data that has relevant business and environmental information, complementing the information generated in field research (Little, 1979).

2.1 Research Plan Development

According to Malhotra (2014), the research approach may be indirect or direct. In the indirect approach, the objectives of the project are masked for the respondents, while in the direct approach they are obvious to the participants considering the nature of the instrument. In other words, in the indirect approach techniques, the respondents provide a response that would not clarify the researcher if they were being directly questioned about a subject, whereas in direct approach techniques it becomes easier to obtain complete and detailed information. Regarding the means to be used, there are projective techniques and observation for the indirect approach (Anzieu and Chabert 2004; Underhill, 2008); and focus groups, individual interviews, surveys, and experimentation for the direct approach (Kuhfeld et al., 1994; Greenbaum, 1998; Bradburn et al., 2004; Giannarou and Zervas, 2014) as shown in Table 1.

The step called sampling plan requires three decisions to be made by the researcher: sampling unit, sample size, and sampling procedure. The sampling unit contemplates the definition of who will be researched, which is the target population that must be sampled. The decision on sample size signals how many subjects should be surveyed, and often samples with less than 1% of the population can provide results with a good level of credibility, once the sampling procedure chosen is reliable (Churchill and Iacobucci, 2006; Kotler and Keller, 2016). The sampling procedure indicates how the participants of the collection will be chosen. Representative samples should be taken from probabilistic samples of the population since in these samplings the calculation of confidence limits for the error is performed. However, when the monetary cost or time required to perform the collection is excessive, it is possible to use non-probabilistic samplings, although these do not allow measurement of the error (Hair, et al., 2008), as shown in Table 2.

Concerning the data collection instrument, it has a direct relationship with the design and the approach that will be used in the research. This means that in designing the data collection instrument, in addition to the main objective of the study, it should be considered whether it is qualitative or quantitative, as well

as whether in-depth interviews focus groups, surveys, or other approaches (Churchill and Iacobucci, 2006; Hair et al., 2008; Malhotra, 2014), as summarized in Table 3.

Important care concerning data collection instruments is validation. The literature recommends that the instrument should be validated by specialists or that pre-tests are performed with a group of subjects with characteristics similar to those of the target population. Besides regard to structured questionnaires, it should also be considered the measurement and scheduling mechanisms that will be used (Bearden and Netemeyer, 1999), presented in Table 4.

Finally, the research plan should detail the methods of contact, that is, which will be the data collection procedures used with the elements of the sample. Given the type of approach, researchers may choose to collect data in person (projective techniques, focus groups, individual interviews, observation, survey, and experimentation) through postal methods (survey) or electronic methods (survey and observation). All methods have advantages and disadvantages depending on variables such as flexibility of the instrument, diversity of the questions, use of physical stimuli, subjects' anonymity, available time, and rate of return, among others (Churchill and Iacobucci, 2006; Malhotra, 2014).

2.2 Data Analysis

The form of data analysis that will be used stems from the research objective, the type of project that was carried out, and its design. Thus, qualitative exploratory research will have the results submitted to content analysis (Bardin, 2013), while quantitative descriptive and causal surveys will have the data obtained from the collection submitted to statistical analysis (Hair, Et al., 2010).

As qualitative research generates a significant amount of research notes or testimonials, content analysis suggests that the frequency of phenomena is counted, seeking to identify relationships among them, and the interpretation of the data is systematized according to conceptual models previously defined by the researcher. In addition to content analysis, qualitative research data can also be submitted to conversation analysis and semiotic analysis (Pierce, 1991; Goulding, 2005), as suggested by the information in Table 5.

On the other hand, the statistical analysis of the data coming from quantitative research usually goes through the following stages: univariate analysis, bivariate analysis, and multivariate analysis. In the univariate analysis, frequencies are established for each question researched. In the bivariate analysis, cross-tabulations are performed, and it is possible to calculate different measures of associations between the variables. Finally, a multivariate analysis should be applied when researchers wish to simultaneously analyze multiple measures on each subject or object being investigated (Hair, et al., 2010). Considering the strong use of multivariate analysis techniques in marketing research, Table 6 briefly seeks to describe them.

3 Npd And Market Research Reference Model

The new product development process is a sequence of activities that are undertaken by a company to create, design, and sell a product (Eppinger and Ulrich, 2015). Since product development implies a difficult and interactive decision-making process, with several stages and filters between them (Krishnan and Ulrich, 2001), a series of process models for the development of new products were developed, diverging in the number and the definition of the stages that involve it (Amaral et al., 2007).

Nonetheless, analyzing most of the proposed reference models, it is possible to see that there are common phases to all models. First, the models contemplate a phase to create the concept of the product (conception), another one for the planning, another one for the detailing, and one last of review and tests (Cooper, 1983; Clark and Wheelwright, 1995; Roozenburg and Eekels, 1996. Peters et al., 1999; Rozenfeld et al., 2006; Amaral and Rozenfeld, 2007; Crawford and Benedetto, 2008; Pahl and Beitz, 2013; Eppinger and Uirich, 2015; Kotler and Keller, 2016).

Thus, the present study chose to describe the process model of new product development described by Rozenfeld et al. (2006) and Amaral and Rozenfeld (2007). This choice is justified because, along with the model proposed by Peters et al (1999), it is one of the most complete described in the literature, encompassing greater detailing of the phases and integrating marketing activities along the same lines (Ribeiro, 2011). In addition, the reference model described by Rozenfeld et al. (2006) and Amaral and Rozenfeld (2007) assists in the identification and visualization of NPD activities within the general context of development management, including, in addition to the model, the process management, methods, and support tools.

In the reference model of Rozenfeld et al. (2006) and Amaral and Rozenfeld (2007), the development of a new product includes (i) pre-development, (ii) development, and (iii) post-development. In (i) pre-development, the main objective is the evaluation of opportunities and evaluation of market demand. At this stage, the steps of strategic product planning and project planning should be considered. In strategic product planning, the objective is to obtain a plan that can align the company's portfolio with the strategic planning of the business unit, that is to say, this step delivers a list of new products to be launched according to the strategic opportunities. With regard to project planning, this should address a brief description of the product, key business goals, the target market for the product, constraints, and assumptions, and product stakeholders.

In (ii) development, the activities concerning to evaluation of the product under development begin with the concept test, the prototype test, and the pilot batch test. The authors have listed as stages of development: the informational project, the concept design, the detailed design, the preparation of the product's production, and its launch in the market. Finally, in (iii) post-development, the product is tested on the market. At this stage, the phases are related to the monitoring and improvement of the product or its discontinuity. Figure 1 shows a table summarizing the NPD stages proposed by Rozenfeld et al. (2006) and Amaral and Rozenfeld (2007), associating the macro steps with each of the stages of development

Since the cost involved in developing new products is high, as well as the probability of failure, at the end of each step it must be decided whether or not the project will continue. Thus, each step has a "gate", or a control point on which evaluation criteria are established. This means that, at each stage, it is possible for the managers involved to judge whether the project deserves to be conducted for the next stage through the analysis of indicators (Cooper, 1998; Durmuşoğlu and Barczak, 2011).

In this context, market research is one of the monitoring tools for the transposition of phases and stages in the NPD (Suwannaporn and Speece, 2003; Sethi and Iqbal, 2008; Drechsler et al., 2013). However, since the cost of market research is generally high (Crowley, 1977; Lehmann et al., 1997; Hess and Lucas, 2004; Sandberg and Aarikka-Stenroos, 2014; Seifert et al., 2016), medium and small-sized companies cannot handle all the necessary projects and collections (Freel, 2000; Madrid-Guijarro et al., 2009), a synthesis of the main marketing researches to be carried out along the process of new product development is following, according to the bibliographic research carried out by the authors.

Specifically, in pre-development, marketing research can assist in mapping latent demands with consumers, allowing the generation of new ideas (which may correspond to radical or incremental innovations) (Urban, et al., 1996; Troy et al., 1998; Van Hoeffler et al., 2006; Veldhuizen et al., 2006; vom Brocke and Lippe, 2015; Chang and Taylor, 2016; Cui And Wu, 2016). In the development phase, marketing research can provide answers to the organization's doubts about the requirements valued by customers, also about the concept of the product, and the prototype (Matsatsinis and Siskos, 1999; Olson et al., 2001; Hoeffler, (1998); Suwannaporn and Speece, 2003; Cova and Sale, 2005; Veldhuizen et al., 2006; Swink and Song, 2007; Alexander et al., 2008; Zhao et al., 2009; Hofmann et al. Dahl, 2013; Slater et al., 2014; vom Brocke and Lippe, 2015; Chang and Taylor, 2016; Cui and Wu, 2016). Finally, in the post-development phase, the research may contribute to collecting in the market the perceptions that the consumers have of the product that is being sold (Matsatsinis and Siskos, 1999; Moreau et al., 2001; Hoeffler 2003; Shih and Venkatesh, Chang et al., 2006; Chang et al., 2004).

Figure 2 summarizes the main research problems to be investigated throughout the phases of the NPD referential model proposed by Rozenfeld et al. (2006) and Amaral and Rozenfeld (2007):

4 Method

The research can be classified as qualitative research. For all purposes, the study is characterized as an exploratory study. Regarding the means employed, bibliographic research and field research was used. Bibliographical research refers to the study developed together with the existing theoretical reference on the subject in question ("market research and new product development process"), and was carried out mainly in the Web of Science and Scopus databases. The field research, however, refers to the data that was generated by the researchers for the specific purpose of responding to the problem in question.

In this way, through bibliographic research, it was possible to identify five marketing research problems during the NPD stages: (i) mapping of latent demands, (ii) identification of requirements valued by customers, (iii) concept testing, (iv) prototype testing and (v) evaluation of the product performance with

consumers. Then, to define the appropriate research processes for each of the mapped problems, a focus group was conducted with six specialists from the marketing and production engineering areas, focusing on product management.

Focus groups can be defined as small group forums in which a topic of interest is discussed, with a moderator leading the discussion (Ribeiro and Newmann, 2003). To do so, the moderator uses a pre-structured script that, in this case, contained the previously identified problems and questions related to the type of research, approach, sample, instrument, data collection, and analysis procedure. For more reliability of the results, the discussion was recorded in audio and after the transcribed, followed by the codification and categorization (content analysis).

Afterward, the authors' inferences were made from the material, taking into account the knowledge coming from the bibliographical research. For the interpretation stage, the procedure used three blocks for the unit of analysis: definition of the problem, objective and type of research, development of the research plan, and, finally, method of analysis of the information for each one of the researches that should be carried out (Bardin, 2013).

5 Research Processes For Npd Stages

Observing the systematization of the NPD process proposed by Rozenfeld et al. (2006) and Amaral and Rozenfeld (2007), the first research problem is related to the generation of new ideas. To map latent demands with consumers, organizations must conduct exploratory and qualitative research, since in these researches the objective is to understand a certain context, not to generate conclusive data.

The next problems arise in the stages of the development phase. To develop the informational project, it is necessary to know the requirements valued by consumers. Thus, it must be carried out research in two phases, that is, a first exploratory one, to identify the requirements, then a causal one, to weigh their importance. To test the concept of the product, and also to test the prototype, it is suggested to conduct causal research to evaluate cause-effect relationships.

Finally, to evaluate the performance of the product with consumers, it is suggested to carry out descriptive research, since these are valid when the objective focuses on describing certain behaviors. Table 7 shows a summary of the NPD phases, objectives, and types of research to be used.

The development of the research plan involves the next process definitions. Towards this end, the (i) approach, (ii) sample, (iii) instrument, and (iv) collection procedure will be commented on for each of the research that must be performed throughout the NPD process.

The (i) research approach that will map latent demands with consumers should be straightforward, and the use of focus groups is recommended. This decision is justified because of the distinctive characteristics perceived between this approach and the individual interviews, highlighting the interaction that the group allows and the easiness of the agenda (Malhotra, 2014). To identify customer

requirements, in the exploratory phase the approach may be the focus groups, individual interviews, or the application of projective techniques (the choice between the direct and indirect approach can be made considering the type of audience to be surveyed or the type of product). In the causal phase, the approach will be experimental, remaining this for the concept test and also for the prototype test. In the product performance evaluation with consumers, it is suggested the survey be carried out at the expense of the observation. This choice is justified because, in surveys that measure satisfaction, the probability of error is lower when respondents are directly interviewed (Rossi and Slongo, 1998).

The (ii) sample suggested for the research that will map latent demands is non-probabilistic by quotas. The sampling procedure is justified since in qualitative exploratory studies the focus is on the quality of the answers to be obtained, not on the number of respondents (Churchill and Iacobucci, 2006). In addition, since in this study the objective involves the identification of new product ideas that meet consumer market needs, control variables should be established for the population elements to be selected (such as gender, age, income, and lifestyle, among others).

For the two-phase research that will identify the requirements valued by customers, it is suggested to work with a non-probabilistic sample for the exploratory research, and with a probabilistic sample for causal research. The ideal sampling type as a non-probabilistic is judgment since the subject who will participate in the generation phase of attributes for a new product must be representative of the population of interest and reliable. The ideal sampling type for probabilistic is the stratified one, which first divides the target population into subpopulations and then chooses the elements to participate in each stratum randomly.

The concept test and prototype test surveys should use probabilistic samplings since in these types of studies an objective evaluation of the sample results is desired. The ideal type of sampling in these cases is the conglomerate since through this mechanism the population is divided into exclusive and collectively exhaustive subpopulations. Finally, in the research of product performance evaluation with consumers, guidance is the use of a probabilistic sample and should be used stratification, preferably by quartile.

As for the (iii) instruments that must be used, a semi-structured script is essential to the knowledge of latent demands, so that the discussion of the group remains the focus of the study. In order to identify customers' requirements, it can be used semi-structured scripts in the first phase (if the focus group approach is chosen) or questioning a hidden problem (for individual interviews), or even an association (for projective techniques). In the second phase, a structured questionnaire using a non-metric ordinal scale should be used.

It is also recommended to use the structured questionnaire to test the concept and to test the prototype of a product. In these cases, the ordinal non-metric scale, as well as the metric ratio scale, can be applied. Regarding the research instrument that will evaluate the performance of the product in consumer perception, a structured questionnaire with an interval scale metric, preferably a five-point Likert (ranging from totally dissatisfied to totally satisfied) should be used.

The ideal, with regard to (iv) the procedure, would be, for all types of studies that are necessary, to carry them out in person. However, mainly in performance evaluation research, other means can be employed, such as the telephone and internet. Table 8 presents a summary of the decisions related to the research's development plan.

About information analysis, for research that will map latent demands, it must be applied to a conversation and content analysis to focus groups. To qualify the results, it is possible to apply a multicriteria technique to treat the information through the use of the AHP (Analytic Hierarchy Process) tool in the prioritization of the demands.

In the first phase of requirements research, the analysis mechanism depends on the type of approach that will be used. For focus groups, it can be used conversation and content, and for individual interviews, the most appropriate analysis is content analysis. For the projective techniques of association, it is also recommended to use content analysis. To qualify the analysis, it can be applied the technique of correspondence analysis, where through perceptual maps, it is possible to investigate the correspondence of variables categories. In the second phase of the requirements research, cluster analysis can be used to verify the grouping of variables or objects, and in the sequence,, discriminant analysis can be performed to define the dependence between variables grouped in the conglomerate technique.

In concept-testing surveys, multiple regression or joint analysis should be applied, enabling the identification of which variables have dependency relations with the product. The regression allows measuringmeasuring the intensity and importance of each variable, demonstrating where the strengths and weaknesses of the product are. The joint analysis serves to determine the utility function assumed by the subjects for each attribute and its relative importance

In turn, because the prototype test extrapolates the relations of the variables to the product - since it seeks to identify how the product impacts the process - it is suggested to use a principal component analysis (PCA). The PCA may reveal which process variables should be modified to generate the improvements suggested by consumers. PCA also shows how to add other variables to the product in order to minimize the impact on the process.

In the research that will evaluate the performance, a factorial analysis followed by a multiple regression can be used. The first one serves to group the statistically correlated satisfaction indicators, while the second allows evaluating the capacity of explanation of each indicator of satisfaction on the evaluation of general satisfaction with the product. Table 9 briefly describes the recommended analytical procedures.

6 Final Considerations

The present article identified and suggested methodological procedures for the main types of market research to be carried out during the NPD stages.

Considering what has been proposed, regarding the (i) mapping of latent demands, it can be said that this is a solved problem since the classes (approach, sample, instrument, analysis procedure) used to treat each information present clear solutions and, in practical and academic terms, refer to consolidated concepts and relatively simple use. An apparent problem may lie in the alternative solution with the use of AHP, given the greater complexity associated with the large volume of processing of identified demands. However, the use of specific software for this purpose may alleviate this difficulty.

With respect to (ii) identification of the requirements valued by customers, both the first and second phases could be carried out simply by the organizations, as proposed in this structure. However, for the (iii) concept test, there is a need for more attention regarding the data collection procedure. The concept test is important because information relevant to the functionalities can be collected from it. These functionalities would correspond to a set of variables that together can be modeled to assign an index, approve or disapprove the product, and provide a set of improvement information. However, a group of clients with knowledge about the product is required, which in cases of radical innovation can make it impossible to obtain the sample.

Similarly, it occurs with the (iv) prototype test, which also depends on the exposure of the innovation to a group of consumers. The (v) evaluation of product performance with consumers is apparently the simplest phase since it is commonly performed for several types of products. In fact, a complication may be to obtain the sample in cases where the products are intended for very specific classes of customers.

Finally, the proposed classification constitutes a structure to be adopted for validation in future studies, which can provide improvements since there are specifics in the different sectors that develop new and innovative products. Furthermore, it is believed that the synthesis proposed in this work contributes to guiding the managers that act directly in the processes of product innovation, helping to minimize errors that may result from inadequate or incomplete marketing research.

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Tables

Table 1 - Approaching types

Indirect approach	Projective Techniques: Questionnaire with an unstructured and indirect form, capable of encouraging the interviewees to project their underlying motivations, beliefs, attitudes, or feelings about the problem being studied. Observation: Systematic recording of the behavior patterns of people, objects, and/or events. This approach can be performed either personally or mechanically.
Direct approach	Focus Groups: Non-structured data collection process aiming at obtaining an in-depth view of a given problem by listening to the speech of a group of people from the target market. Individual interviews: Unstructured, direct, and personal, in which a single subject is interviewed by a trained interviewer. Delphi Technique: A structured exploratory form of research that focuses on the perception of a recognized specialist, usually regarding the anticipation or prediction of future events. Surveys: Interrogation carried out with the sample, through a structured questionnaire, in which it is possible to obtain information regarding the behavior, intentions, attitudes, motivations, demographic characteristics, and lifestyle of the subjects. Experimentation: Causal plan in which a researcher controls a potential cause and analyzes any corresponding changes in the supposed effects.

Table 2 - Sampling Types

Probabilistic samplings	Simple Random: Each element has a known and equal probability of selection, and the sample is extracted randomly. Systematics: The sample is chosen by selecting a random starting point, being each ith element successively taken from the sample group. Stratified: In this technique, a two-stage selection process is employed. First, the population is divided into subpopulations or strata. After the elements to participate in each stratum are chosen randomly. Conglomerate: The population is first divided into exclusionary and collectively exhaustive subpopulations (conglomerates). After a random sample of conglomerates is chosen, and for each selected conglomerate all the elements of the conglomerate can be included or a sample can be extracted probabilistically.
Non-probabilistic samplings	Convenience: The selection of sample units is an interviewer's choice. Examples of convenience sampling are the use of students, members of social organizations, use of customer lists, approaching people on the street, and others. Judgment: Sampling method for convenience in which subjects will be selected based on the researcher's judgment. In this case, the researcher defines what elements should be included in the sample considering their representativeness face to the population of interest, or for other reasons understood by him as significant. Quotas: Sample by judgment in two stages. First, control variables are established for the elements of the population (gender, age, income, among others). Then sample elements are selected based on convenience or judgment Snowball: First an initial group of respondents is randomly selected. Then, based on the information provided by the interviewees, others are selected, repeating the process until reaching the relevant sample.

Table 3 - Data Collection Instruments

Approaches	Data Collection Instrument
Projective Techniques	Association: a script that presents the interviewee with a stimulus asking himself/herself to respond with the first thing that comes to mind.
	Completion: a script that requires the respondent to complete an incomplete stimulus situation. It is possible to elaborate scripts to complement a sentence or story.
	Construction: it is suggested that the elements of the sample construct a response in the form of history, dialogue, or description.
	Expressive: A verbal or visual situation is presented to the interviewees so that they can relate the sensations and attitudes of other individuals to the situation.
Observation	Ethnography: insertion and experience of real experiences. Researchers who use ethnography spend long periods with the participant and write narratives that describe the study's target behavior.
	Semi-structured Script: the form of an instrument in which open questions defined according to the purpose of the study are filled by the researcher.
	Closed Script: form in which structured questions are filled by the researcher as a result of his observation.
Focus Groups	Semi-structured Script: Questions previously established by the researcher to be released to the group, according to the research objective.
Individual Interviews	Progression: the questions emanate from the characteristics of the product to the characteristics of the user.
	Questioning a hidden problem: the instrument is elaborated on considering the need to identify sensitive points related to personal concerns.
	Symbolic analysis: the script is elaborated so that the symbolic meaning of the objects of interest can be known.
Delphi Technique	Structured Script: the instrument that evaluates the opinion of experts on behavioral forecasts.
Survey	Structured questionnaire: a formal questionnaire that presents the questions in a predetermined order, with most of the questions as fixed alternatives questions.
Experimentation	Structured questionnaire: a formal questionnaire that presents fixed alternative questions concerning the attitude and behavior of the person, and can be applied before and/or after they are exposed to the factors being controlled.

Table 4 - Types of Measurement Scale for Questionnaires

Non-metric Scale	
Nominal	This scale uses numbers as labels to identify and classify objects.
Ordinal	This scale uses ranking, which means, the object is placed in a certain category so that the elements of the sample order it according to some criteria (importance, preference, among others).
Metric Scale	
Interval	This scale uses numbers to classify objects or events through a mechanism that indicates an equal distance between them. Likert scale and Semantic Differential are examples, among others.
Ratio	Scale that provides the highest level of measurement. In this type of scale, there is always the zero point that is a single origin.

Table 5 - Summary of Qualitative Data Analysis Techniques

Analysis Techniques	Description
Content Analysis	Method of text analysis developed within the empirical social sciences in which most of the procedure ends in numerical descriptions of certain characteristics of the analysis corpus. It is even possible to use statistics to complement the analysis
Conversation Analysis	Method of analysis of the speeches of the person that integrated the study, applied when the objective focuses on exploring the types of categories presupposed by the participants and not by the researcher. A methodology that allows showing how the elements of the sample join and contrast objects and actors.

Table 6 - Summary of Multivariate Data Analysis Techniques

Objectives	Techniques
Investigation of dependence between variables	Discriminant Analysis: Separates the populations determining which were the most influential variables.
	Regression Analysis: Evaluates the relationship between a dependent variable and several independent variables.
	Canonical Correlation: Maximizes the relationship between the dimensions associated with independent and dependent variables.
	Logistic Regression: Identifies whether statistical differences exist between the scores of a set of variables for two or more groups that were previously defined, which is, determines how much the dependent variable is explained by the group of independent variables.
	Joint Analysis: Determines the utility function assumed by the elements of the sample for each attribute and its relative importance, that is, it measures the impact of certain attributes on the preference of the consumer.
Grouping of Objects or Variables	Multivariate Analysis of Variance: Examines the effect of independent variables on a set of dependent variables, in other words, it identifies the independent variables that differentiate a group of dependent variables.
	Conglomerate Analysis: Group similar elements from one or more common characteristics, that is, it detects a set of groups that minimizes variation within groups and maximizes variation between groups.
Data Reduction	Correspondence Analysis: It manifests, through perceptual maps, the correspondence of categories of variables.
	Exploratory Factor Analysis: Reduces the number of variables, that is, investigates which variables form coherent and relatively independent subsets of each other.
Construction of Hypotheses and Tests	Confirmatory Factor Analysis: Reduces the number of variables by grouping them according to the hypothetical model.
	Structural Equations Modeling: Specifies causal relationships between latent variables by testing theories through hypotheses.

Table 7 - Objectives and types of research throughout the NPD

PD Stages	Objectives	Types
Pre-Development	To map latent demands with consumers.	Exploratory Research.
Development	To identify customer requirements.	Exploratory Research and Causal Research.
	Concept testing.	Causal Research.
	Prototype Testing.	Causal Research.
Post-Development	To evaluate product performance with consumers.	Descriptive Research.

Table 8 - Research Development Plan

Objective	Approach	Sample	Instrument
To map latent demands with consumers	Focus Groups	Non-probabilistic (quotas)	Semistructured script
To identify customer requirements	PHASE 1:	PHASE 1:	PHASE 1:
	Focus Groups or Interviews	Non-Probabilistic (judgment)	Semistructured Script
	or Projectives	PHASE 2:	Questioning a Hidden Problem
	PHASE 2: Experimentation	Probabilistic (Stratified)	Associations
Concept testing	Experimentation	Probabilistic (conglomerate)	PHASE 2: Structured questionnaire with ordinal non-metric scale
Prototype testing	Experimentation	Probabilistic (conglomerate)	Structured questionnaire with non-metric ordinal scale or metric ratio scale
To evaluate product performance with consumers.	Survey	Probabilistic (Stratified)	Structured questionnaire with interval scale metric (Likert)

Table 9 - Suggested analysis methodologies for different types of research

Objective	Data Analysis
To map latent demands with consumers	Conversation and content analysis Multicriteria technique for processing information through the use of the AHP (Analytic Hierarchy Process)
To identify customer requirements	PHASE 1: Conversation and content analysis Content analysis Correspondence analysis (independent closure of approach) PHASE 2: Analysis of conglomerates Discriminant Analysis
Concept Testing	Multiple Regression or Joint Analysis
Prototype Testing	Main components analysis
To evaluate product performance with consumers	Factor analysis Multiple Regression

Figures

	DEVELOPMENT STAGES	OBJECTIVE	INPUT	OUTPUT
PRE-DEVELOPMENT	STRATEGIC PRODUCT PLANNING	To get a plan that controls the company's product portfolio	Strategic business planning	Products selection for portfolio
	PROJECT PLANNING	To develop the project plan for each portfolio product	Strategic product portfolio list	Formal documentation of the project plan for each product
DEVELOPMENT	INFORMATIONAL PROJECT	To develop a set of product requirements	Project plan for a specific product	Target specifications of the product
	CONCEPTUAL PROJECT	To create project solutions from the target specifications	Target specifications of the product	Conceptual product detailing
	DETAILED PROJECT	To detail in technical information the product conception	Product concept proposal	Advanced prototype / Approved product
	PREPARATION OF THE PRODUCT'S PRODUCTION	To test and plan the production through pilot batch	Approved product	Approved pilot batch / approved process / certified product
	PRODUCT LAUNCH	To Implement the sales, communications and distribution plan / Development of production	Approved pilot batch	Product launch and production
POST-DEVELOPMENT	MONITORING AND PRODUCT IMPROVEMENT	To monitor product adherence on the market	Product introduction on the market	Profit stabilizes or declines
	PRODUCT DISCONTINUITY	To prevent the product from causing damage to the company	Decline of the sales life cycle	Product disposal

Figure 1

New Product Development Process Stages

NPD STAGES	MARKET RESEARCHES TO BE DEVELOPED	MAIN RELATED ARTICLES
PRE-DEVELOPMENT 1) Strategic product planning 2) Project planning	Mapping of latent demands with customers	Urban, et al., 1996; Troy et al., 2001; Suwannaporn and Speece, 2003; Hoeffler, 2003; Van Kleef et al., 2005; Hauser et al., 2006; Veldhuizen et al., 2006; Vom Brocke and Lippe, 2015; Chang and Taylor, 2016; Cui and Wu, 2016.
DEVELOPMENT 3) Informational project 4) Conceptual project 5) Detailed project 6) Preparation of the product's production 7) Product launch	Identification of requirements valued by customers Evaluation of the product concept Evaluation of the product prototype	Matsatsinis and Siskos, 1999; Olson et al., 2001; Hoeffler, 2003; Cova and Sale, 2005; Veldhuizen et al., 2006; Swink and Song, 2007; Alexander et al., 2008; Zhao et al., 2009; Hofmann et al., 2010; Mugge and Dahl, 2013; Slater et al., 2014; vom Brocke and Lippe, 2015; Chang and Taylor, 2016; Cui and Wu, 2016.ng and Taylor, 2016; Cui and Wu, 2016.
POST-DEVELOPMENT 8) Monitoring and product improvement 9) Product discontinuity	Evaluation of the product being sold	Matsatsinis and Siskos, 1999; Moreau et al., 2001; Hoeffler, 2003; Shih and Venkatesh, 2004; Herzenstein et al., 2007; Libai et al., 2009; vom Brocke and Lippe, 2015; Chang and Taylor, 2016; Cui and Wu, 2016.

Figure 2

Relationship between NPD and Market Research

