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PLANNING TECHNOLOGICAL BUSINESSES: A STUDY OF MARKET POSITIONING AND THE VALUE CHAIN

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ABSTRACT

Purpose: To evaluate the applicability, contributions, and adaptations required for a decision support model in the context of a business model's definition. The business model refers to 10 technological projects.

Originality/gap/relevance/implications: The paper attempts to empirically validate the model proposed by Reis, Ladeira, and Fernandes (2015). In this regard, the paper facilitates the interpretation and application of concepts relevant to the business model's definition, thereby contributing to an estimation between theory and entrepreneurial practice.

Key methodological aspects: The research is qualitative and adopts an action research methodology regarding 10 participating projects of the Incentive Program for Innovation held in the Universidade Federal de Ouro Preto, Minas Gerais. We conducted interviews with 38 professionals in order to understand the model's applicability in different contexts and to assess convergences and differences between each analyzed case.

Summary of key results: The model's application proved to be relevant mainly for the early stages of business planning. The inclusion of the minimum viable product in the model helped with resource design and the development of a product with similar characteristics to market needs. It was suggested that the criteria used to assist the decision-making process were evaluated and selected by the team in accordance with the intended business strategy.

Key considerations/conclusions: It is suggested that future research evaluates the inclusion of i) risk analysis and a contingency plan for the proposed business model and ii) the valuation of technology as an important step for projects that include the transfer of technology to established companies.

KEYWORDS

Market positioning. Value chain. Business model. Minimum viable product. Technology-based enterprise.

1. INTRODUCTION

Defining a business model (BM) that adapts to the commercial needs of technological projects, and that evaluates the different possibilities of market positioning, can be of great importance for the success of a product or service that is being developed. For Chesbrough and Rosenbloom (2002), a BM focuses on the analysis of how the articulation occurs between a product's value proposition, the need to identify the corresponding market segment, the value chain structuring, decisions about costs, and projections of contribution margins and profit. Teece (2010) stated that the essence of a BM is how a company adds value to customers, attracts customers who are willing to pay for that value, and converts payments into profits. Companies reconfigure their BMs to create new values for stakeholders (Deslee & Ammar, 2016; Sosna, Trevinyo-Rodriguez, & Velamuri, 2010).

Despite the recognition of BM evolution, Sosna *et al*. (2010) observe that the concept lacks theoretical foundations in the literature, as well as practical and managerial orientation. According to Reis, Ladeira, and Fernandes (2015), the BM choice of a given company is guided by the evaluation of market positioning and the definition of value chain structure, driven by the decision to make-or-buy as two simultaneous and integrated decisions.

As part of a BM definition, it is important to analyze the market players, customer segment, the problem to be solved, the geographic area of business performance, product/service characteristics, marketing and distribution channels, the mapping of production process activities, and decisions regarding the structure of the value chain to be followed by the project.

The decision-making process for the definition of a BM during the emergence of a technology-based enterprise (TBE) of academic origin, proposed by Reis, Ladeira, and Fernandes, (2015) was constructed from two research perspectives: 1. First, the authors structured the decision-making process for the market positioning definition and for the value chain structure directed by the decision to outsource or internalize a particular activity. With regard to this, the authors suggested the mapping, identification, and refinement of decision-making criteria based on four technological projects developed in the academic environment of the Federal University of Minas Gerais (UFMG), culminating in a "six-step process" (during the research, we will adopt this nomenclature to refer to the study of Reis, Ladeira, and Fernandes (2015); 2. Next, the authors validated the decision-making criteria related to the prioritization of market positioning (step 3) and the deci-

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sion to outsource and internalize (step 6) in a sample of 17 technological projects linked to the UFMG incubator. For this validation, they resorted to a survey with a 27% rate of return. It is observed that the proposed model was not validated empirically by involving the full implementation of the six-step process. In theory, this lack of validation may represent a theoretical gap in the literature.

Thus, the present study intends, through the action research (AR) methodological strategy, to evaluate the full application of the model of the aforementioned decision-making process. It is understood that the model's implementation in the full version, and in other contexts of technological projects, can enable the identification of convergences, similarities, and/or existing divergences. It is believed that from this, it is possible to identify interesting alternatives for proposing improvements, or even eliminating conflicting points of order, for certain project contexts.

This study was conducted using 10 technology-based projects of the Federal University of Ouro Preto, Minas Gerais (UFOP/MG), in the context of the Innovation Incentive Program (IIP). The main objective of the study was to evaluate the applicability and contributions of the six-step process for the different contexts of these projects and identifying the necessary adaptations in view of the particularities presented. It is hoped that the findings can assist researchers in the process of technological business planning while they seek more effective methods that can respond to the problem of how to improve the incorporation of value in their innovative products and services.

The paper is arranged in five sections, including the present introduction: a literature review; the description of the methodological research strategy as the lens to guide the study; the presentation, characterization, and analysis of the technological projects; and, finally, the considerations that are relevant to the contributions, limitations, and propositions for future research.

2. LITERATURE REVIEW

TBEs refer to companies with high levels of technological training (Toledo, Silva, Mendes, & Jugend, 2008). Such training is based on the application of scientific or technological knowledge, employing advanced or pioneering techniques in developing products and services (Meirelles, Pimenta, & Rebelatto, 2008). In this context, a BM emerges as an important level

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of analysis for the emergence of TBEs (Mustar *et al.*, 2006), focusing on the development of strategies for nascent and innovative enterprises (Reis, Ladeira, & Fernandes, 2015).

According to Osterwalder, Pigneur, and Tucci (2005):

> "A business model is a conceptual tool that contains elements of relationships and allows the expression of the business logic of a specific firm. It is the description of value that the company offers for one or more customer segments, firm architecture, the network of partnerships for the creation, marketing and delivery of value and capital for relationships to generate sustainable profits" (Osterwalder, Pigneur, & Tucci, 2005, p. 17-18).

Among some objectives, one can conclude that a BM is concerned with how to transform commercial technologies and the knowledge of universities, combining information regarding "what," "who," "when," "where," "how," and "how much" in the context of an organization delivering products and services to customers (Sinfield, Calder, McConnell, & Colson, 2012). Spieth, Schneckenberg, and Mätzler (2016) further explored this link between a BM and a company's innovation strategy. For the authors, a BM defines the guidelines for a company's strategic behavior. In addition, they emphasize that a BM's innovative role should be explored as an analytical perspective in order to identify sources of superior company performance. Sauer, Frankenberger, Lingens, and Oliver (2016) explored corporate spinoffs, which are companies created from other so-called parent companies, as the main vehicles for BMs' innovations regarding established companies and as ways to create and capture value.

Technological entrepreneurs, because they have differentiated technologies, need to identify business alternatives, carefully analyze the possibilities, and then make decisions with a view to improving market performance (Gruber, Macmillan, & Thompson, 2008). The quality of these decisions is crucial to companies' survival because the decision can affect the evaluation of future opportunities and current business performance (Carr & Blettner, 2010). Löfsten (2016) argued that the survival of new TBEs is linked to their ability to generate patents in their early years. Weiblen and Chesbrough (2015) presented the generation of TBEs as a way to bring large companies closer to more flexible BMs, promoting innovation from the outside to the inside. They also presented open innovation, from the inside out, as a way to promote and establish the use of an organization's technical platform by other companies.

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During the decision-making process for BM decisions, entrepreneurs can explore predictive or non-predictive models (Kraaijenbrink, 2010), whether consciously or not (Krieshok, Black, & Mckay, 2009), and rationally or intuitively (Chwolka & Raith, 2012; Krieshok *et al*., 2009). Chwolka and Raith (2012) examined the problem-solving decisions of nascent entrepreneurs before they entered markets and noted that a lack of planning and rationality lead to failure rather than to business success, and that rational entrepreneurs choose to shut down projects even before entering markets. Thus, given the importance of rationality in decision-making processes, even in a context where intuition is widely practiced, the present study sought to verify the contributions derived from the adoption of a systematization of the decision-making process regarding the definition of a BM, especially in the initial stages of TBEs of academic origin.

Studies exploring the BM theme have also been undertaken in the Brazilian context. Souza and Batista (2014) constructed and validated a BM scale. Araújo and Zilber (2013) described the BM used by small companies for the adoption of e-business. Ades, Vasconcellos, and Plonski (2011) identified the use of marketing strategies in the context of the development of new technologies by TBEs and the definition of an innovative BM. Braga and Meirelles (2012) evaluated the impact of the development and implementation of reverse logistics in the BMs of tire industry companies.

Analyzing these Brazilian studies, and in relation to the choice of market positioning, Reis (2013) declared that it was not possible to find in the literature a reference model that could guide an entrepreneurial team and at the same time assist it in the decision-making process. Regarding value chain structuring directed by the decision to outsource or internalize activities, the literature has been rich and has used various decision-making models (McIvor, Humphreys, & McAleer, 1997; Momme & Hvolby, 2002; Moses & Åhlström, 2009; Platts, Probert, & Cáñez, 2002; Van de Water & Van de Peet, 2006; Zhu, Hsu, & Lillie, 2001). Despite contributing to the literary framework, these models demonstrate certain limitations. It should be pointed out that the models, according to Moses and Åhlström (2008) are a) deductive and supported by idealized scenarios, without empirical support, and do not correspond to the way in which companies actually make their decisions; and b) are static and do not reflect organizational dynamics and complex decision-making processes.

Based on these reflections, the model used for the decision-making process for the definition of a BM is composed of six steps (see Figure 1). The first three (steps 1 to 3) focus on positioning and the other three focus on structuring (steps 4 to 6).

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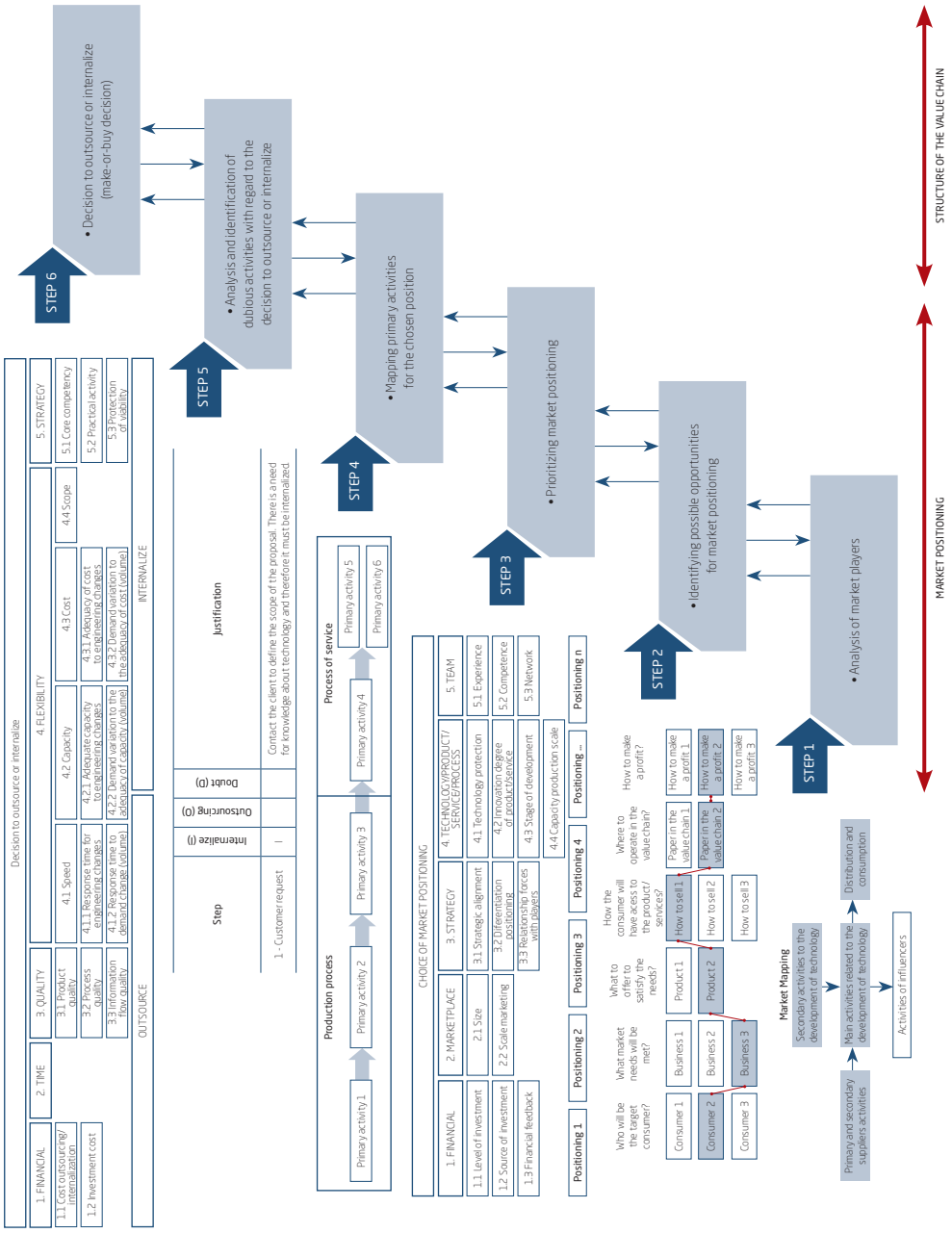
Figure 1

DECISION PROCESS FOR THE DEFINITION OF MARKET POSITIONING AND VALUE CHAIN STRUCTURING



Source: Reis, Ladeira, and Fernandes (2015).

In order to establish market positioning, a mapping of market players (step 1) should be carried out to analyze the possible positioning alternatives (step 2) that consider the type of product, the market, the marketing channels, and the way to obtain income, in accordance with the research of Balocco, Perego, and Perotti (2010), Chesbrough (2007), and Sinfield *et al*. (2012). Once the positioning opportunities have been investigated, the analytic hierarchy process (AHP) must be used to contribute to the decision that is relevant to market positioning (step 3). The AHP method enables the modeling of tangible or intangible quantitative and qualitative variables by structuring the problem in a decision tree, in which the criteria that guide the choices are organized hierarchically (Gomes, Araya, & Carignano, 2004; Schmidt, 1995). In order to implement the six-step process, based on the criteria determined by Reis, Ladeira, and Fernandes (2015), it is necessary to establish the parameters that are capable of guiding the choices.

The project's collaboration team, after defining the positioning, should map the primary activities related to the chosen position (step 4). During this stage, the different tasks regarding selected positioning should be carefully separated in order to facilitate the decision about which activities to outsource and internalize, as proposed by Glimstedt, Bratt, and Karlsson (2010) (step 5). However, once ambiguous activities are detected in relation to the decision to outsource or internalize, the AHP method is used as contributory factor to this decision (step 6).

In order to understand each step of the model, some concepts are presented in Table 1.

Table 1

DEFINITION OF STEPS

Steps		Concept	Author
Definition of market positioning	Market players	It is understood that a company or organization plays some role in a transaction market. This expression comes from the economic area and refers to competitors and/or investors operating in a common market [1]. The first step is to analyse the agents involved in the market and the functions that each performs in order to identify the competitive differentials for the business [2].	[1] [2] Reis (2013)

(continue)

Table 1 (Continuation)

DEFINITION OF STEPS

Steps		Concept	Author
Definition of market positioning	Positioning	The term "positioning" is often used in the context of a company's marketing decisions to indicate the place that the company, brand, and its products will occupy in a given industry [1/ and to indicate a distinct place in the perception and mind of its public [2], in addition to helping determine the market segment that will bring significant returns [3]. Positioning the company in the market means using the appropriate resources and adjusting the strategies in response to market changes, directing the marketing resources between the desired segments [4].	[1] Ries & Trout (1986); Douglas & Crai (1995); Ries (1996); Morgan, Strong, & Mcguinness (2003) [2] Darling (2001); Kotler & Keller (2006) [3] Jackson (2007) [4] Hassan & Craft (2005); Wilson & Amine (2009)
	Positioning prioritization	The authors [1] point out important factors that influence the effectiveness of positioning, the choice of the customer and the potential for profitability, the products and services to be offered, the marketing methods, and the relationship strategies with the various business partners, among others. For Reis (2013), one has to consider the criteria that should be considered when choosing market positioning: financial (level of investment, origin of investment, and financial return), market (size and scale to capability), and team (experience, competence, and network of contacts). After the mapping, a qualitative analysis is done by means of the AHP (analytic hierarchy process) method to expose the best path to be followed based on the evaluated criteria [2].	[1] Ordanini, Micelli, & Maria (2004); Gengatharen & Standing (2004); Pai & Yeh (2008); Balocco, Perego, & Perotti (2010) [2] Reis (2013)
Strucutre the value chain	Mapping Activities	Refers to the mapping of the primary activities inherent to the chosen positioning. For this decision, it is necessary to evaluate the technical ability of those involved in carefully separating the different tasks, process activities, and product components in order to decide which activities/ processes/components will be outsourced and which will be internalized by the company [2].	[1] Reis (2013) [2] Glimstedt, Bratt, & Karlsson (2010)

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Table 1 (Conclusion)

DEFINITION OF STEPS

Steps		Concept	Author
Structutre the value chain	Identification of dubious activities	This process consists of internal and external (market) mapping for the company to understand the players that operate in the EBT market and the activities that the company must internalize or outsource (also identifying dubious activities regarding the decision to outsource or internalize). These mapping represent an important activity for the identification of the alternatives to be prioritized (market positioning alternatives and the identification of dubious activities to then decide how to outsource or internalize them).	[1] Reis (2013)
	Make-or-buy decision	The planning of the decision to outsource or internalize during the value chain struturing represents one of the most complex choices of the companies' managers, since it affects company performance [1] [2]. For the activities considered dubious, it is suggested that the AHP method is applied as a decision-making (make-or-buy decision), based on hierarchical multicriteria factors: financial (cost to outsource or internalize activities and investment), time, quality of product, process, and information flow), flexibility (which with speed and cost capacity should be subdivided in relation to engineering changes and variation of demand, in addition to comprehensiveness), and, finally, security main competence, criticality of the activity, and feasibility of protection) [3].	[1] Leiblein, Reuer & Dalsace (2002) [2] Mcvivor & Humphreys (2000); McIvor (2000) [3] Reis (2013)

Source: Adapted from Reis, Ladeira, and Fernandes (2015).

3. METHODOLOGICAL PROCEDURES

The nature of this research was qualitative and the methodological strategy adopted was that of action research (AP). This approach contributed flexibly in the search for the most relevant information within a studied reality, guiding the research through pre-established objectives. Thus, those involved in the research were led to take action in order to render feasible an analysis of the needs that were involved in the implementation of the six--step process and the adaptations suggested by the research, as well as the possible contributions originating from the adoption of the six-step process. AP contributes to the development of theory through the actions taken,

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allowing researchers to evaluate consequences for those involved with a problem and for an organization (Susman & Evered, 1978; Tripp, 2005). AP is suitable for scenarios where the intervention of researchers and the collection of information relevant to the research are necessary (Thiollent, 1997). Toledo and Jacobi (2013) recommended a balance in the definition of practical objectives that can lead to solutions. They also recommended a balance in the definition of knowledge objectives, which can contribute, in turn, to the clarification of problematic evidence and, thus, to the facilitation of transformative actions. The phases of AP proposed by Susman and Evered (1978) and adopted in this study were: diagnosis (1), planning (2), action (3), evaluation (4), and learning (5).

For the diagnostic phase (1), the technological business planning process of 10 participating projects of the second and third stages of the Innovation Incentive Program (IIP) at Universidade Federal de Ouro Preto (UFOP)/Minas Gerais (MG) was taken as the unit of analysis (the second stage is devoted to the elaboration of feasibility studies on technical, economic, commercial, and environmental impact and the third to the elaboration of the technological plan).

The IIP is an initiative of the Secretaria de Estado de Ciência, Tecnologia e Ensino Superior de Minas Gerais (SECTES/MG), in partnership with the Serviço Brasileiro de Apoio às Micro e Pequenas Empresas (SEBRAE/MG), universities, and local governments. Together, those involved seek to promote technological innovation in the academic environment, either by the generation of TBEs, or by the licensing or transfer of technology to companies established in the market.

From an initial general meeting, times were set for seminars, training, and meetings with teams of researchers–entrepreneurs and scholarship students. In this way, it was possible to follow each technological project, providing and receiving feedback as relevant information on each context in order to develop the research. The intention with the initial diagnosis was to characterize each technological business context so that it was possible to define the planning for data collection. In addition, during this phase training was conducted with all the students (master's degree students and undergraduates), researchers–entrepreneurs of the project, and external consultants in order to ensure parity for the information that would be considered by this research during the second and third stages of the IIP/UFOP.

The goal of the planning phase (2) of the research, in accordance with the literature review on BM, was the structuring in electronic spreadsheets of the concepts and definitions that would be necessary to apply the process proposed by Reis, Ladeira, and Fernandes (2015). The theoretical basis of

the studies aligned with the authors' proposal that the necessary elements of the research must be feasible in order to help define the type of business of the projects under analysis. From the elements present in the theory, frameworks (in electronic spreadsheets) were elaborated so that it was possible to collect the data needed to characterize each technology business (the action phase).

Action phase (3) was marked by the application of the studied process. On-site visits, meetings, and seminars were conducted with the program's management team in order to align the objectives pursued by the research. In addition to direct observation, monthly follow-up visits were used with each team of the different businesses and logbook entries were made. Meetings were also developed via Skype® with each project team (students and researchers–entrepreneurs) to guide them about completing the information, as well as to provide brief theoretical explanations about each content item (BM, market positioning, and value chain). In this exchange, the research team that conducted the study also received important feedback for the database and for strengthening the research protocol.

The meetings via Skype® occurred weekly and lasted approximately 90 minutes each time. This activity lasted nine months, covering the period from July 2015 to March 2016. This was the best moment to collect the inputs needed for the next step. During this phase, documents also had to be consulted (e.g., feasibility studies on technical, economic, commercial, and environmental impact; business plans; and reports of the IIP management team; among others). A total of 14 undergraduate and master's degree students, two research professors, four professionals from funding agencies of the program (two from SEBRAE and two from SECTES), an institutional manager of UFOP, and a coordinator of the program in UFOP took part. Thus, 38 professionals were involved (see Table 2). The selection of the respondents took into consideration their knowledge about the business, knowledge about the program, relevance of the program to the context of innovation in the state of Minas Gerais, and the program's importance to UFOP. The interviews provided a greater understanding of the technology, products, and technological projects market, and clarified uncertainties related to the business. For each of the projects listed in Table 2, the strategy sought by the researchers–entrepreneurs for the generation of technological business was identified; namely, if they were more likely to undertake or transfer the technology. At the end of this study, it was found that of the 10 cases, five chose to transfer and the other five chose to proceed.

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Table 2

CASES ANALYZED

Nº	(Technical projects)	Knowledg area of technology	Number of researchers involved	Internal managers and external partners
1	Increased sperm production	Biology	1	Interns to UFOP:
2	Calibration of polymer machine	Mechanical Engineering	1	1 General manager
3	Digital coupons	Information Technology	2	1 Coordinator
4	Crack Detection	Metallurgy	1	14 Scholars
5	Pap smear	Pharmacy	1	2 Teachers/ researchers
6	Food sticker	Food Engineering	1	
7	Power generation	Sustainable Energy	1	External to UFOP:
8	Quorum sensing	Food Engineering	2	2 SECTES representatives
9	Integrated remote network	Environmental Analysis	1	2 SEBRAE Representatives
10	Sound cage	Control Engineering and Automation	2	3 Consulting

Source: Elaborated by the authors.

From the interviews, feedback was collected and initial adaptations were identified in the frameworks for later validation with the researchers–entrepreneurs and students. The triangulation of information generated by the protocol provided a rich need assessment. In order to validate the information collected, recorded interviews (authorized by means of a free and informed consent term) were used. Codification and transcriptions of the same were then undertaken. The transcripts were sent to the researchers–entrepreneurs of the projects and, from their feedback, constituent elements were identified for the definition of the BM. In order to refine the frameworks, "records in archives, direct observation, participant observation and physi-

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cal artifacts" (Duarte & Barros, 2006, p. 29) were used in addition to the interviews and the feasibility studies on technical, economic, commercial, and environmental impact. The collection of data contributed to a better understanding of the business development stage and clarified uncertainties related to the enterprise. It was from the transcripts that the study managed to obtain a transformation of the qualitative research data (Johnson & Christensen, 2004). During the analysis, an objective and faithful attitude was adopted to all that the researchers–entrepreneurs spoke and felt about during the interviews (Boni & Quaresma, 2005).

The evaluation phase (4) and the learning phase (5) consisted of an evaluation of the contributions resulting from the adoption of the six-step process. The evaluation was restricted to the content analysis of the interviews conducted with the technological project teams. Learning was possible because the validation of the framework of the model, in the light of the cases analyzed, occurred simultaneously to the action because the focus was on research in action instead of action research (Coughlan & Coghlan, 2002). The learning phase focused on the applicability of the process to the different contexts and, finally, on the evaluation of existing convergences, similarities, and divergences. It is understood that those involved in the operationalization of the adopted framework did learn. The following section demonstrates the results achieved and discusses the aspects related to the evaluation and learning phases.

4. THE EMPIRICAL FIELD, RESULTS, AND DISCUSSION

In order to detail the projects studied, Table 3 was constructed. This table contains a brief description of the projects and the profiles of the markets. Cases 1 and 5 are focused on the pharmaceutical area. The first focuses on the development of a drug that seeks to increase the number and quality of male reproductive cells; other case considers the development of software that increases the quality of cytological analysis. Cases 2, 4, 7, and 9 focus on the mechanical area, with the development of machines capable of optimizing processes, generating energy, and monitoring possible nonconformities. Cases 6 and 8 are aimed at the food industry in order to contribute to the quality and monitoring of food.

Table 3
DESCRIPTION OF THE PROJECTS ANALYZED

Description	Marketplace
Project: Case 1 **Knowledge area:** Pharmaceuticals **Application:** Male infertility regarding low sperm count and/or sperm motility.	
Medication based on a species of plant that changes male behavior and induces an increase in the number of spermatozoa produced by it, in addition to an improvement in semen quality.	15% of Brazilian couples have problems with infertility, and male infertility is linked with 30% to 60% of these cases.
Project: Case 2 **Knowledge area:** Mechanics and organic chemistry **Application:** The manufacture of organic electronic devices, conductive tracks, resistors, capacitors, flat inductors and laser diodes, transistors, and OLEDs.	
Polymer printing machine that allows you to mold objects from polymers (plastic). This equipment aims for the production of a detailed object with volume and depth, obtained by overlapping several layers of polymers, layer by layer, giving the final shape.	Companies and institutions of scientific and technological interest, who need an efficient and low-cost machine in their research. This machine will be useful for research into ways of building circuits with organic components such as the manufacture of organic sensors and discrete organic components.
Project: Case 3 **Knowledge area:** Mobile and cloud computing **Application:** Document management and cloud storage.	
The technology developed was born from a concept called "information management in the agent life cycle" (IMALC), which consists of a new paradigm of information and document management.	General population with access to smartphones and Internet access. Brazil had record sales of smartphones in the third quarter of 2014, surpassing the 15 million mark, which supports the deployment of software that operates under the concept of cloud computing and mobility.
Project: Case 4 **Knowledge area:** Applied mechanics **Application:** Detection of fractures in sleepers made of steel.	
The purpose of the technology is to detect deterioration of the geometry of the rails and the appearance of its fractures. The process for obtaining the data is done by producing a stimulus on one end of the sleepers with a hammer or similar tool.	Large companies that use railroads as part of the flow of their production, mainly for the ore. An important context for the analysis of the trinkets of sleepers, since the loads are considered heavy and the incidence of cracks is higher than compared with those lines that are used just for the transport of passengers.

(continue)

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Table 3 (Continuation)

DESCRIPTION OF THE PROJECTS ANALYZED

Description	Marketplace
Project: Case 5 **Knowledge area:** Computation and cytology **Application:** External quality monitoring for cytopathological type II exams.	
Analysis of cervical cell samples by imaging treatment. It is intended to create a high-performance semiautomatic computational tool capable of identifying and quantifying cellular components.	Laboratories of cytopathological examinations. Actors and target market of public policies to support technology: Viva Mulher Program (created in 1996) that encourages the control of cervical cancer; National Policy on Cancer Care (BRASIL, 2005), Pact for Health (BRASIL, 2006); National Plan to Strengthen the Network for the Prevention, Diagnosis, and Treatment of Cervical Cancer.
Project: Case 6 **Knowledge area:** Food and chemistry **Application:** Quality monitoring and deterioration of meat in real time.	
Sensor of the chemical type the verification of the pH alteration of foods. It undergoes a change of color (light pink to violet) when in the presence of compounds released from the metabolism of decaying bacteria. The technology contributes to reducing the excess of meat waste in Brazil caused by bad conditions.	Population in general are configured as consumers in order to evaluate the quality of products to be consumed, avoiding various diseases such as salmonella. The food industries are the potential customers.
Project: Case 7 **Knowledge area:** Electrical **Application:** Economic and sustainable energy generation.	
Generation of electrical energy by means of the waterfall of the residential or building reservoir. It works in a similar way to a hydroelectric plant.	The population in general represents the potential consumers to reduce the cost of energy (with the lack of rainfall, the value of the electricity tariff may raise the value of the product by 45.7%).
Project: Case 8 **Knowledge area:** Food and chemistry **Application:** Smart packaging with natural preservatives.	
The research studies a way to incorporate the extract (Brazilian fruit isolates) of antimicrobial action in cellulosic film, in which the extract would be released from the same on the packaged food product. In addition to economic benefits, it can reduce losses and reduce intoxications and other problems related to food consumption.	Food and packaging industries (cellulosic film with compounds inhibiting bacterial quantum sensing may add value to a market already consolidated).

(continue)

Table 3 (Conclusion)

DESCRIPTION OF THE PROJECTS ANALYZED

Description	Marketplace
Project: Case 9 **Knowledge area:** Geotechnology **Application:** Control/monitoring of water systems, energy, and mass gravitational movements.	
The goal of the technology is to monitor and report any pre-defined site/equipment changes in which it is deployed, in real time, bringing the information to the interested parties through an already developed software.	Brazilian cities. Brazil has a large number of cities that do not have remote monitoring and/or control for water management. Another fact is that large companies already seek management and monitoring by this type of technology.
Project: Case 10 **Knowledge area:** Blockbuster Games – Technology and Innovation **Application:** Social inclusion of visually impaired people through assistive technology in the gaming market.	
Simple and innovative equipment, which integrates two technologies that already exist in the market, and enables the creation of games with sounds, through a virtual 3D environment, making its use viable for the visually impaired.	Entertainment market for the visually impaired. Other applications of technology may be embedded in the education and military markets.

Source: Elaborated by the authors.

4.1. Analysis of the BM for the cases studied

From the structure of the six-step process, the present study proposed modifications, specifically in step 2, focusing on the identification of possible positioning opportunities. Initially, five constructs (Reis, Ladeira, & Fernandes, 2015) oriented the identification of the following positions: 1. target consumers; 2. market needs to be met; 3. products and services to be offered; 4. marketing channels to be explored; and 5. ways of making a profit.

The proposed adaptation consisted of reducing the number of constructs to three as follows (see Figure 2): 1. client/market: characterization of the market problem, customer profile, market trends, and geographic area of operation; 2. product: technological platform identification, product and service description, minimum viable product (MVP), and value attribute; and 3. channels: identification of marketing and distribution channels.

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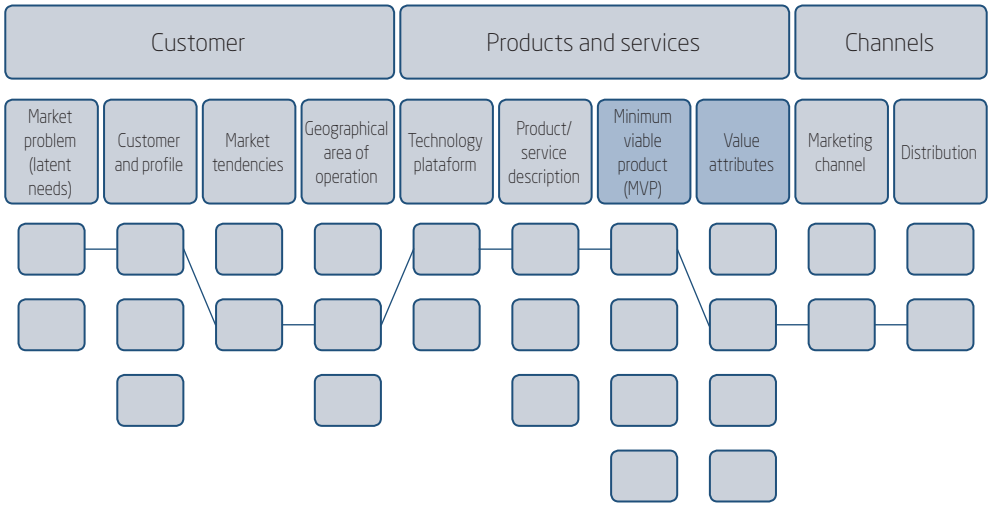
Figure 2

MODEL FOR IDENTIFICATION OF MARKET POSITIONING



Source: Adapted by the authors from Sinfield *et al.* (2012).

In addition to an improvement in providing details of potential customers for a business, the structure highlights the different product configurations incorporated into the MVP concept, which means having a product with a minimum number of functionalities necessary to ensure delivery (Eisenmann, Dillard, & Ries, 2013) and value attributes (such as price, durability, comfort, delivery time, and image). The value of the product is defined based on its performance (Kachani & Shaatov, 2011; Meredith, McCutcheon, & Hartley, 1994; Stonehouse & Snowdown, 2007).

In order to characterize each product and explain the strategy adopted by the researchers on the decision to undertake or transfer, Table 4 was elaborated. In the process of analyzing each case, we tried to adopt a logic that would help the researchers–entrepreneurs to characterize market positioning and the projects' value chain.

With regard to the analysis of the value chain, we tried to identify the business activities that would be outsourced or internalized. Because we had doubts about the strategy to be used for the activity, the decision was taken to outsource or internalize as a way to help the team with the process of prioritizing the activities that constitute the business value chain.

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Table 4

ANALYSIS OF THE BM OF THE 10 CASES STUDIED

BUSINESS MODEL	
MARKET POSITIONING	VALUE CHAIN
Project 1: Case 1	**Strategy: Transfer**
Client/market: • Market problem: 15% of couples have fertility problems, 50% of which are caused by the male factor. • Customer profile: Human. • Market trends: High demand for methods that expansion and/or allow human fertility. • Geographical area: Pharmaceutical market worldwide.	**Outsourcing activities:** There were none.
Product: • Technological platform: Increase of fertility. • Description of products/services: The intended end product is an effective medicine for the treatment of male infertility. This is able to increase fertility in men who have sperm production deficits. • Minimum viable product (MPV): Performed pivotal tests on an increase of fertility in mice. • Value attributes: Human fertility, innovation, healthy method.	**Make-or-buy decision:** • Selection of plants; • In vivo tests.
Channels: • Marketing channels: Resales in pharmacies, drugstores, e-commerce. • Channels of distribution: Third parties.	**Internalyzed activities:** • Preparation of the ethanolic extract/characterization of the compounds/material collection/ statistical analysis of the material.
Project 2: Case 2	**Strategy: Transfer**
Client/market: • Market problem: The need for technologies that support organic electronics. • Customer profile: Research centers such as universities and electronics companies. • Market trends: In the market there is polymer deposition equipment; however, it is generally imported and has a comparatively high cost. The equipment developed has a relatively low cost; in addition, there is no specific research using automotive injection nozzles in the injection of polymers, which is the potential for innovation, and technology already patented by the project researchers. • Geographical area: Minas Gerais, southeast Brazil.	**Outsourcing activities:** • Product formalization, adjustments, and industrial adaptation; • Product delivery; • Training for handling

(continue)

Table 4 (Continuation)

ANALYSIS OF THE BM OF THE 10 CASES STUDIED

BUSINESS MODEL	
MARKET POSITIONING	VALUE CHAIN
Project 2: Case 2	Strategy: Transfer
Product/service: • Technology platform: Organic electronics. • Description of the product/service: The polymer printing machine is a technology that enables the molding of objects from polymers (plastic) using a machine. • Minimum viable product (MPV): Pivotal realization from the concept of a nozzle automotive injector. • Value attributes: Quality, flexible, organic, exclusivity in the national market.	Make-or-buy decision: There were none.
Channels: • Channels of distribution: Distributors, developer companies, manufacturing companies, and research institutions. • Marketing channels: Social networks and direct contact with possible buyers.	Internalyzed activities: • Research and development/ structuring/programming/ mechanical assembly/software development.
Project 3: Case 3	Strategy: Entrepreneur
Client/market: • Market Problem: Paper-based document management. • Customer profile: Department stores, credit card companies, hypermarkets, supermarkets, shops, pharmacies, bars, bookstores, etc. • Market trends: Greater use of mobile devices and internet access, cloud storage. • Geographical area: Minas Gerais and later to expansion to Brazil and to the world.	Outsourcing activities: There were none.
Product: • Technology platform: cloud storage. • Description of products/services: tax coupons, personal documents, contracts, other. • Minimum viable product (MPV): Pivotal use made of storage of coupons and cloud data. • Value attributes: Functional reliability of the service, leve of customization, degree of innovation, superiority of value proposition.	Make-or-buy decision: There were none.

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Table 4 (Continuation)

ANALYSIS OF THE BM OF THE 10 CASES STUDIED

BUSINESS MODEL	
MARKET POSITIONING	VALUE CHAIN
Project 3: Case 3	Strategy: Entrepreneur
Channels: • Marketing channels: Strength of own sale, e-commerce. • Distribution: Technical representatives, servers/network.	Internalyzed activities: • Research and study on tools to aid in the development phases/ analysis of the requirements for coding the server in each cash register/implementation of the server and client module (to be executed in the cash registers)/ tests, validations, and debugging of the client module/study of interface and usability for creation of the interface with end user (foreground)/analysis of the requirements for coding the interface with end user.
Project 4: Case 4	Strategy: Transfer
Client/market: • Market problem: Detection of cracks in steel sleepers based on tacit knowledge. • Customer profile: Mining companies, steel mills, responsible for maintaining the sleepers. • Market trends: The incentive to innovation is very big. Companies are adopting increasingly automated systems. Due to the change in the sleepers, many of these are potential buyers of the technology. • Geographical area: Brazil, specifically in the southeast region.	Outsourcing activities: • Product delivery; • Installation.

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Table 4 (Continuation)

ANALYSIS OF THE BM OF THE 10 CASES STUDIED

BUSINESS MODEL	
MARKET POSITIONING	VALUE CHAIN
Project 4: Case 4	Strategy: Transfer
Product/service: • Technology platform: A wide range of problems involving vibratory aspects can be approached and solved through the technology in question. • Description of the product/service: Crack detector or failures due to mechanical vibrations on steel objects. • Minimum viable product (MPV): Laboratory tests using similar structures, such as steel billets and discarded bed scraps, which helped to analyze vibration in a quick and practical way, identifying ruptures. • Value attributes: Quality, functional availability, deadline, reliability, ease of data collection, innovative and sustainable character.	Make-or-buy decision: • Functional tests of quality control.
Channels: • Distribution: Direct mail, sales representatives. • Marketing: Sales representatives, websites, and exhibitions.	Internalyzed activities: • Software implementation/ accelerometer deployment/ system assembly/product formalization/handling/ maintenance guidance.
Project 5: Case 5	Strategy: Transfer
Client/market: • Market problem: Maintenance and quality assurance in cytological tests. • Clients' profile: Cytological examination laboratories (public and private). • Market trends: Institution of National Qualification in Cytopathology (QualiCito) – FEDERAL GOVERNMENT LETTER No. 1,504, JULY 23, 2013. • Geographical area: Minas Gerais.	Outsourcing activities: • Installation of the system/tests and validations/distribution/ installation of the system for the client/ monitoring (provision of the service).

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Table 4 (Continuation)

ANALYSIS OF THE BM OF THE 10 CASES STUDIED

BUSINESS MODEL	
MARKET POSITIONING	VALUE CHAIN
Project 5: Case 5	Strategy: Transfer
Product: • Technological platform: reassessment of type II cytopathological examinations by standardized mathematical methods. • Description of products/services: Analysis software for cytopathological examinations (reevaluation). • Minimum viable product (MPV): Laboratory test for reevaluation of type II cytopathological exams. • Value attributes: Quality, leve of customization adaptation to other types of analysis, reliability, degree of innovation, and low cost.	Make-or-buy decision: There were none.
Channels: • Marketing channels: Strength of own sale, dissemination in websites, specialized sellers, laboratories (partners). • Distribution: partnership with companies, specialized vendors, fairs, and congresses in the area.	Internalyzed activities: • Software development/training for the use of software
Project 6: Case 6	Strategy: Entrepreneur
Client/market: • Market problem: Deterioration of food products due to poor storage conditions. • Customer profile: Companies in the food industry, supermarkets, farms, among others of the genre. • Market trends: Greater concern of people with food. • Geographical area: Minas Gerais and expansion to Brazil and the world.	Outsourcing activities: There were none.

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Table 4 (Continuation)

ANALYSIS OF THE BM OF THE 10 CASES STUDIED

BUSINESS MODEL	
MARKET POSITIONING	VALUE CHAIN
Project 6: Case 6	Strategy: Entrepreneur
Product: • Technological platform: Adhesive that adapts to the environment where it is inserted given the previously established restrictions. • Description of products/services: A product that aims to monitor in real time deterioration changes in meat and show the consumer that it is no longer in a position to be consumed. • Minimum viable product (MPV): Pivotal tests made with adhesive paper and in natural products to verify color change according to the pH variation of the food. • Value attributes: Quality, biodegradable, innovative and sustainable, low cost, and non-toxic.	Make-or-buy decision: • Product delivery; • Training for handling.
Channels: • Marketing Channels: Dissemination in social networks, publication in articles, and own sales force. • Distribution: Accomplished by third parties and consumer companies.	Internalyzed activities: • Research and development/ structuring/programming/ functional tests/project analysis/ formalization of the product.
Project 7: Case 7	Strategy: Entrepreneur
Client/market: • Market problem: Frequent absence of rain leading to the compromise of the supply of electricity. • Customer profile: Construction companies, hotels, resorts, housing programs, etc. • Market trends: Increasing increase in the supply of electrical energy. • Geographic area: Minas Gerais and expansion to Brazil.	Outsourcing activities: • Construction of the microturbine.

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Table 4 (Continuation)

ANALYSIS OF THE BM OF THE 10 CASES STUDIED

BUSINESS MODEL	
MARKET POSITIONING	VALUE CHAIN
Project 7: Case 7	Strategy: Entrepreneur
Product: • Technological platform: Generation of energy from the waterfall of water tanks in the property. • Description of products/services: The product aims to generate electricity through the waterfall of the residential or building reservoir (the concept works in a similar way to a hydroelectric plant). • Minimum viable product (MVP): Tests to generate a minimum acceptable amount of energy from the waterfall of a water tank. • Value attributes: Economy, sustainability, innovation, marketing argument.	Make-or-buy decision: • Sale of the product; • Installation of the system for the client.
Channels: • Marketing Channels: Reseller, e-commerce, and sales representative. • Distribution: Carried out by third parties and own freight system.	Internalyzed activities: • Adequacy of the microturbine for the water pipe.
Project 8: Case 8	Strategy: Transfer
Client/market: • Market problem: Loss of food Through growth of microorganisms. • Customer profile: Companies in the food industry, pharmaceutical industries, and chemical industries. • Market trends: High demand for methods that extend the shelf lives of products. • Geographical area: Minas Gerais and expansion to the southeast and later to Brazil.	Outsourcing activities: There were none.

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Table 4 (Continuation)

ANALYSIS OF THE BM OF THE 10 CASES STUDIED

BUSINESS MODEL	
MARKET POSITIONING	VALUE CHAIN
Project 8: Case 8	Strategy: Transfer
Product: • Technology platform: Smart packaging. • Description of products/services: Product that becomes an extra barrier to microbial control. Extracts of proven antimicrobial action and inhibition of communication of microorganisms (quorum sensing) are released in packaged foods. • Minimum viable product (MPV): Pivotal tests regarding the stability of the compound. • Value attributes: Quality, biodegradability, and differentiation.	Make-or-buy decision: • Product delivery; • Training for handling.
Channels: • Marketing Channels: through rural producers, suppliers, sale by own sales force, and resales. • Distribution: Rural producers, suppliers, third parties, and consumer companies.	Internalyzed activities: • Research and development/ structuring/programming/testing plastic films/inhibitory effects tests/product formalization.
Project 9: Case 9	Strategy: Entrepreneur
Client/market: • Market problem: Water management and availability of information processed in real time to agencies and citizens. • Client profile: Condominiums, prefectures, water agencies, inns and hotels, individuals, environmental engineering companies, sanitary engineering companies. • Geographical area: Regional (100 km radius from Ouro Preto).	Outsourcing activities: • Manufacture of printed circuit boards; • Assembly of printed circuit boards (centralizer/remote and antenna); • Installation of the system for the client (procedures).

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Table 4 (Continuation)

ANALYSIS OF THE BM OF THE 10 CASES STUDIED

BUSINESS MODEL	
MARKET POSITIONING	VALUE CHAIN
Project 9: Case 9	Strategy: Entrepreneur
Product/service: • Technology platform: based on geotechnology. • Description of products/services: Centralizing station with monitoring and control software via the web; remote station with photovoltaic panel; remote station with mains power. • Minimum viable product (MPV): Pivotally made in laboratory with electronic circuit board to define the technology that is embedded in the product. • Value attributes: Quality; high customization capacity; affordable cost to the target markets; easy implementation of the network; easy network expansion; reliability; artificial intelligence; self-monitoring health network; providing real-time information on the monitored/controlled system; registration and availability of information in database for historical generation.	Make-or-buy decision: There were none.
Channels: • Marketing channels: door-to-door; automation companies, environmental engineering company, sanitary engineering companies; disclosure on own site; technical representative; sales representatives; publication of articles in specialized journals. • Distribution: Own freight; third-party freight; post offices; partnership with companies.	Internalyzed activities: • Recording of the firmwares on the boards/making the cables between subsystems/validating the boards (application area)/installing the remote card in a metal enclosure/installing the control card in a metal enclosure/installing the antenna plate in a plastic enclosure/rack mounting remote control and control rack/signal cable manufacturing/validation of remote and control racks/commissioning/monitoring and analysis of data/annual database maintenance/development and implementation of interactive artificial intelligence built in for optimized control.

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Table 4 (Conclusion)

ANALYSIS OF THE BM OF THE 10 CASES STUDIED

BUSINESS MODEL	
MARKET POSITIONING	VALUE CHAIN
Project 10: Case 10	Strategy: Transfer
Client/market: • Market problem: Lack of entertaining games for people with a high degree of visual impairment. • Customer profile: People with visual impairment. • Market trends: Great market potential. Many investments being made in the assistive technology area. • Geographical area: São Paulo, southeast region, Brazil.	Outsourcing activities: • Distribution; • Installation.
Product/service: • Technological platform: Interchange of the visually impaired, visual training with the use of sensors, learning of children through didactic games. • Description of the product/service: Highly structured sensory stimulation game, and use of 3D sounds. • Minimum viable product (MPV): Pivotally made from carton box, used speakers and support structure with pvc for a good simulation platform. In addition to this model, new concept of the structure in virtual environment was carried out using design concepts. • Value attributes: Quality, reliability, social inclusion, degree of innovation, affordable price to the market.	Make-or-buy decision: • Distribution; • Structural construction and assembly; • Development of printed circuit board of the sound signal.
Channels: • Channels of distribution: Participation in events, dissemination in own site and specialized websites, own sales force, partners. • Marketing channels: Partnership with retailers, specialized stores, education institutes, and Ministry of Defense.	Internalyzed activities: • Application programming; • Integration between structure and control; • Assembly of the system; • Maintenance of the system.

Source: Elaborated by the authors.

4.2. Analyses and results

This section presents the reflections on the application of the six-step process (Figure 1) for the 10 cases. Table 5 discusses the contributions, similarities, and particularities of applying each step to the projects.

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Table 5

EVALUATION OF PROJECTS

		Case analisys
Definition of Market Positioning	Market Players	Cases 1, 3, 8, and 10 presented a broad market application of their technologies, demonstrating adaptability to different market segments. This stage involved collaboration during the initial phases of the business formulation process because this enabled the identification of all the possible applications of the technologies and aided in the survey of each client's specific needs. In addition, collaboration helped in the mapping of all the processes necessary for the execution of the production of the product or service. It also contributed to the identification of suppliers and the importance they represent in the product development process. In relation to cases 2 and 5, this process contributed to a clear objective and visual organization of the work structure in order to facilitate and characterize the immediate needs (in relation to the resources made available for this project) and market demands through feedback to managers. These measures aimed to identify processes that could be improved, as well as assisting in the search for new sources of resources. For cases 4 and 9, the stage contributed mainly to the facilitation of the company's formalization, the management of the productive processes, the administration of resources, and decision-making. However, with regard to case 6, because it is a more specific product for the food sector, the researchers-entrepreneurs considered that its adoption could bring greater contributions in the future, more specifically with the insertion of the technology in the market. In case 7, it was identified that the analysis of market players can be a useful tool; however, it was difficult for project designers to recognize and identify the management tools for the business model.
Definition of marketing positioning	Identification of maketing positions	The cases studied covered several areas of knowledge. Many of their representatives had no experience in the field of business, as found in Case 1, where the researchers-entrepreneurs had many uncertainties about the types of positioning to be adopted. The researchers-entrepreneurs could not even identify the types. In cases 2 and 3, this step guided and helped to identify the opportunities and requirements to serve the types of positioning, especially those that had as their objective more than one segment to be served by technology. For cases 4, 5, and 7, identifying model-based placements helped to make the academic research more applicable and with a greater impact on the market because it improved the perspective of the demands from the beginning and used them as the basis for development. In cases 6, 8, and 10, the researchers had already identified some positions. The adoption of this stage helped the researchers to reflect on other aspects that could benefit the future of a business. As an example, they used the technology platform concept and were able to identify new, previously unknown market segments. Complementarily, for case 9, where the researcher understood the importance of positioning identification, the concept served as an aid to the implementation of strategies geared toward a segment that would be suitable.

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Table 5 (Continuation)

EVALUATION OF PROJECTS

		Case analisys
Definition of marketing positioning	Positioning priorization	With the introduction of the prioritization of positioning, it was noticed that in cases 2, 4, and 9, the financial criterion was significantly important. In cases 1, 3, 5, and 10, the criterion on market accessibility was identified as very relevant, especially when associated with an innovative product. This aspect has shown that having a criterion of evaluation and a direction for a business is desirable. This stage also contributed to the projects whose developed technologies incorporated the prescriptions established by the clients, as happened in case 4. In case 5, the tool was valid to help the choice of positioning. The same was observed in case 7, which as a technology focused on the generation of energy, presented several segments as options for performance. Each of the positioning options observed in case 7 should be explored in order to classify them in relation to their respective potentials. In cases 6, 8, and 9, this step served to reinforce the prioritization of existing positions, as well as to aggregate new knowledge about the main alternatives that can be invested.
Structuring the value chain	Mapping activities	For cases 1, 3, and 4, during the design of the research project, the activity mapping had already been carried out. This is where the hypotheses of the productive processes were created. In cases 1, 5, and 10, with the presentation of the methodology, the researchers began to have a more systemic view of the market, obtaining greater detail of the activities and the process as a whole. Specifically in case 5, it was possible to visualize the steps and to understand the process and all the macro activities more effectively. This was in relation to the part that would involve the production process, the development of the software, the assembly of the system, the tests and validations, and also the provision of services, distribution, installation of the system for the client, the training to use the software, and the monitoring of the same. From this, it was possible to understand at what stage of the production process the technology in question was positioned. However, in case 9, in addition to helping organize the process documentation (production or service provision), the tool made it possible to improve communication between the members of the entrepreneurial team involved with the mapped activities. For cases 2, 6, 7, and 8, the mapping stage was of great importance for the researchers, having been applied since the beginning of the development of the technology until the moment of definition of the business model. In this way, it was possible to assist both the systematization of documentation and the visualization of the steps that constituted the process, as well as the organization of the information that involved the managerial part of the business.

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Table 5 (Continuation)

EVALUATION OF PROJECTS

		Case analisys
Structuring the Value Chain	Identification of Dubious Activities	For all the analyzed cases, this step was considered of great importance because it was necessary in order to identify the activities that add value to the developed technology. At this step, it was possible to associate each case with a predominant activity, whether of the production process or of service rendering. For cases 6, 8, and 10, this step contributed to a better visualization of the structure of the value chain. As observed in case 1, each project within its particularity needed to go through an analysis of the decision to internalize or outsource its activities in the value chain. In case 1, for example, there was a need to outsource some activities (not mentioned by the researcher), since the technology was largely developed in the research laboratory of the university. This fact demonstrated that the project could not enjoy an infrastructure adequate enough for its development as a whole, mainly because of the complexity of the technology. For case 2, from the analysis of the activities, it was possible to verify that some activities, when outsourced, would be able to add higher quality to the product to the detriment of its internalization. As an illustrative example of case 2, it can be mentioned that the construction activity of the circuit boards would in theory avoid the loss of resources for the development of a part already on the market. Similarly, considering case 7, the construction of a large-scale turbine within the laboratories would be impracticable, thus demonstrating the pertinence in outsourcing this activity. For case 9, it would be more efficient to internalize activities, such as the development of test plate prototypes, or even the production of a few samples of a piece. However, if the researchers decided to undertake such activities, there would be a clear increase in production, making it more advantageous to outsource the plate-making process. In this way, the team (case 9) could focus on the productive process of the business. Analyzing cases 3 and 5 is significantly important at this stage because there was a demand from the entrepreneurial team to predetermine what would be outsourced or internalized from the early stages of technological development. With regard to cases 3 and 4, their applicability was not verified at this stage. The low utilization of this stage in cases 3 and 4 seems to be linked more to the decision to transfer the technology to established companies. Even though it is an important step in the structuring of the business value chain (since the company that receives the technology can benefit from this information), there was no interest in exploring the practical contributions, even though the benefits of technology-recipient companies were perceived.

(continue)

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Table 5 (Conclusion)

EVALUATION OF PROJECTS

		Case analisys
Structuring the Value Chain	Make-or-Buy Decision	For cases 1, 4, 6, 7, 8, 9, and 10, this stage demonstrated usefulness in the decision-making process regarding the future of technology. The contribution of this step is that after the elaboration of the functional prototype, and following preparation for market entry, a product may have its development costs reduced. This was possible by evaluating the most costly stages of the production process. Another strategic point in which it was possible to observe the contribution of this stage concerns pricing policy. At this point, once you have investment and know the value that the market is willing to pay, you can determine if the direct and indirect costs will help to make the business structure feasible. In theory, this can help market entry and reduce financial uncertainties. Regarding case 2, this stage was interesting during the development of the technology, more specifically at the time of prototype elaboration. As in the other cases, we identified the need to adopt this step after establishing the prototype. However, for cases 3 and 5, the phase in question did not show applicability because its activities were already well defined; namely, the researchers already knew the steps that would be needed to be internalized and outsourced. Thus, this process would not add information relevant to the development of the business at the stage at which they were. However, it was evidenced by the researchers that the method could be adopted in the initial phases of the project during the process of structuring the opportunity and before the elaboration of any formalization of the technology.

Source: Elaborated by the authors.

The decision support process (Figure 1) led the project researchers to identify the business opportunities in which a developed product could achieve a satisfactory commercial applicability. In this regard, see the argument proposed by the investigator of case 2:

> In some surveys, this may be interesting before and in others later, perhaps before we have an analysis of whether or not those possibilities are there (in the project) at that moment. So, it is interesting; and for the time being we notice that it is appropriate to our reality, but we must bear in mind that there may be differences depending on the area of development of the business, ... well this is the impression (Verbal information, researcher, case 2, emphasis added by the authors).

The process helped significantly with the evolution of the technology and product because it allowed a quick and precise decision to enter a market, as argued by a member of case 3:

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> I think it is fundamental to define whether the path to be followed is A or B, which relates to the question of access and the market potential of each of these options. Certainly, new methods will emerge, but until then I perceive a strong tendency to incorporate this into our way of thinking and managing the business (Verbal information, researcher, case 3).

It is observed that the analysis of the market players contributed to the definition of customer segment as a marketing strategy to minimize the uncertainties of demand. As explained by the investigator of case 2:

> It helps you organize the structure of your work. Helps you get information from the market, like this: Who do I want to attend? What kind of problem do I want to solve? Also, do I need feedback to identify what I need to improve and adapt, and how to achieve this. So that's it, when it's organized in a more visual way, let's put it this way, it makes it a lot easier for the team. (Verbal information, researcher, case 2).

From the analysis of the players and the identification of the different market positioning opportunities, the prioritization method was applied to determine the most appropriate position for the project context, taking into account financial aspects, the team, the type of technology/product/process, the market, and strategy. In relation to the mapping of the primary activities related to the chosen position, it was possible to reach a greater understanding of the whole activity procedure and make it possible to identify interesting parts of the technology to be patented.

Step 6 of the model assisted in identifying the activities that would be internalized by the TBEs and those that would be outsourced. This step was of significant importance to minimize the chances of failure, as the researcher of cases 6 and 8 reports:

> In our head is one thing, then it may be totally different and become unfeasible. I'll have to start analyzing; so, of course, this tool helps, yes. I'm not just talking about the knowledge that it made possible, but for the potential of application in all the technological projects that we developed in the laboratory. It is clear that a choice, often simple, can be radically important in order to reduce the costs and efforts in carrying out an activity, you know? I always thought, in a way, to optimize the use of resources, but I always stopped because of

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> many doubts about which better way to follow (Verbal information, researcher, cases 6 and 8).

The decision to outsource or internalize activities became important during the consolidation of marketing practices and pricing policy. This step helped in the process of defining the costs associated with technological development. Its importance was evidenced when there were already studies of product consolidation and business viability, which was highlighted again by the researcher in cases 6 and 8:

> I see a great benefit to using this prioritization when the business is more mature ... when I will start marketing my product. Because, in these phases, I will check whether or not it compensates me (Verbal information, researcher, cases 6 and 8).

It was observed that the six-step process contributed to an improvement of researchers' understanding about the perception of factors that are involved with a business. These factors have previously been obscure because the researchers have no experience in business relations and entrepreneurship techniques. The modification of the structure of the studied process enabled the generation of value and knowledge about techniques, such as the MVP and the concept of platform management, for the process of project improvement.

4. CONCLUSION

Given the importance of identifying collaborative models regarding the formation of knowledge, which helps in the definition of market positioning and value chain structuring, an intervention process was carried out during the IIP–UFOP. From the process proposed by Reis, Ladeira, and Fernandes (2015), adaptations were made, mainly in the identification stage of market positioning alternatives (where MVP was included). The process with the respective adaptations was applied in each context separately, with the purpose of assisting in the construction of BM for different technological business profiles.

The application has proved to be relevant in the context of technological projects, especially when the initial phases of the business planning process are evaluated. During research development, project teams had a better

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understanding of their businesses and the potential to develop new market positions. From the clarifications about the model and the conceptual basis that supported it, the entrepreneurial teams became more capable of promoting interferences in their strategies. Thus, it was proven by the study that, as BMs are refined, the implementation and consolidation of marketing strategies also adapt to new contexts, reducing uncertainties and increasing the chances of success in the market.

Based on the study, it was identified that in cases 1 to 5, the information collected in the practical context provided evidence capable of proving that the characteristics present in the products actually met the markets' needs and allowed the teams to identify, in an assertive manner, the segments in which they should compete in order to minimize the chances of failure. Thus, in the context of the technology planning process, and evaluating cases 1 through 5, the six-step process contributed to the early stages of development.

With regard to the business planning process, the focus was on three points: i) structuring the company, ii) market positioning, and iii) identifying the type of competition strategy to be adopted by the project (namely, competing for cost or differentiation). At this point, it could be seen that the strategy adopted in the project directly influenced the process of planning and the transfer of technology (mainly in the patenting phase), since recipient companies (companies that benefit from the exploitation of technology) demand guarantees about the technology they acquire. It can be seen from case 4 that the use of MVP was seen as a way of performing interventions in the model before idealizing the prototype, thereby helping to relate to the client.

> It would be the case that you see your technology working in the laboratory, and see what improvements are possible to increase the capacity of your structure and, at the same time, test if your process is robust enough to maintain the product, with the technology incorporated, right?! With acceptable levels of quality and market expectation (Verbal information, researcher, case 4).

The investigator of case 3 also considers a way of observing whether the prototype performed matches the expectations of the final consumer.

> I think having a method that can guide the feedback form of your customer's information, incorporating it in the process of your business, will contribute to launching a product with more chance of

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> success. It is necessary to specify a minimum legal product, which is the minimum that the market expects (Verbal information, researcher, case 3).

In cases 6, 7, and 8, the stage involving the MVP was evaluated as a way of monitoring the new demands and needs of the market. This was in addition to assisting in the design of resources and in the elaboration of products with characteristics equal to the markets' needs. The researchers say that MVP use has assisted in the process of identifying opportunities for improvement, especially if the MVP is tied to some sort of checklist or standard checklist.

> I realize that from the intermediate stage of business development to the end it is easy to see that MVP can serve at those moments when we can feed back the way of thinking about the product and the application of technology, and then increase business ... I think that this way of validating with the client my hypotheses and desires fits into what I deem important for my business. The middle phase of my business would be where I have already tested the hypothesis and where I clearly see the role of MVP. So, I get the application of my product, which throws me into a phase more advanced than the phase in the laboratory, because I see real applications within what the market expects of me and the product (Verbal information, researcher, case 6).

Despite these elements, there was a challenge in the full implementation of the six-step process in cases 3, 7, and 8 because of the lack of market information, which made it difficult to identify a BM appropriate to the value proposition and the management of the technology that is to be made available to the market. Evaluating these cases, it is noticed that the entrepreneurs were able to raise scenarios and questions that were necessary for market positioning. However, because the steps involved in the collection of market information do not contain content capable of feeding the process under analysis, it was necessary to reorganize the guidelines that guided the entrepreneurial team as the means to seek additional information. In this sense, criticisms of the model of Reis, Ladeira, and Fernandes (2015), given the stage of development of each technological project, are related to the moment of research in which the model should be presented to the interested parties. In order for the six-step process to have its contributions leveraged, it is necessary that the feasibility studies on technical, economic,

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commercial, and environmental impact enables a survey and understanding of market information, highlighting the need to identify business possibilities and identifying clients with real problems that the developed technology can answer. In addition, the feasibility studies on technical, economic, commercial, and environmental impact is expected to provide information for the alignment and review of data relevant to decision-making by the entrepreneurial team.

In this way, we can see that this research provided an enrichment of the theoretical framework, in that it validated the model of Reis, Ladeira, and Fernandes (2015) in the context of 10 technological projects, presenting the contributions under different application contexts, besides contributing to the expansion and revision of the field of study on the subject, especially for TBEs of academic origin. Even though the paper does not provide a theoretical contribution, it seeks to facilitate the interpretation and application of relevant fundamentals about a business model delineating a reference model. The proposal of a study directed to the development of methodologies that help the structuring of a business model in technological projects potentiates the generation of business in the academic environment. In this way, it is noticed that one of the benefits generated in the research is related to a greater approximation and integration between universities and markets, which in theory is a positive aspect and strengthens the study's proposal.

In the researchers' explanations, it was realized that the systematization of the decision-making process is necessary for business modeling (definition of positioning and value chain). Although all criteria have been considered important, it is interesting that a preliminary assessment is made with each entrepreneurial team so that they can identify those criteria that they consider most critical for initial project development (a way to reduce the number of criteria initially). It is understood that there are different levels of criticality for each project context that deserve attention, given the complexity of each scenario analyzed. Thus, when starting business technology planning, it is relevant to decide on: 1. the amount of criteria to be adopted during the decision-making process; 2. the alignment of each criterion in relation to the initial strategy of the business; and 3. the expectations of the entrepreneurs and team in terms of the selected criteria. The adoption of these points would make it possible to reduce the number of criteria in a preliminary prioritization.

Once the selection of the criteria for decision-making was completed, because the team was certain of the prioritized decisions, the process of planning the technological business could be added to "new" steps, expan-

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ding the model of Reis, Ladeira, and Fernandes (2015). The adoption of these new steps would act as a way to consider information and continuous feedback from the market, which would allow the construction of new scenarios and new possibilities for the BM intended by each technological project. This includes the risk analysis and contingency plan for the proposed BM.

Despite presenting a consistent proposal to help the process of technological business planning, in the context of innovative projects from the academic environment, there are still criticisms of the six-step process. It is noticed that the application of the process has a more directed strand for projects that are intended to be undertaken than for those characterized as transference. In this sense, it can be affirmed that there is still a deficiency in the business planning process that involves the transfer of cases, especially for the aspects related to the valuation of the technology, which was not contemplated by the applied process. The valuation of technology is an important point and deserves to be explored in future studies in order to identify how its use can help to improve the arguments regarding the sale (marketing) of, negotiation about, and attractiveness towards investment funds, independent investors, angel capital, and development agencies.

The inclusion of MVP in the positioning phase (see details in Figure 2) aims to validate the information provided by researchers and define the characteristics that the product and technology have to present in order to increase their chances of success in the market. MVP's adoption was an example of the dynamics that can be adopted, making the six-step process flexible to meet the varied contexts of technological projects.

Regarding the methodological strategy, it was possible to construct a table demonstrating the characteristics of each case based on the elaborated frameworks, the data collected, and the codification of the information for each data collection instrument. The existence of regularities between the characteristics were then identified. From this, it was possible to obtain clear, convergent, and divergent patterns among the observed cases because it was possible to validate initially established propositions and/or complement them.

Finally, it can be emphasized that this work opened some paths for future research, instigating studies aimed at the development of structures that facilitate the process of planning TBEs' business. Given the suggestions for the expansion of the model used, it is suggested that research is developed with the intention of unfolding the activities of the valuation process and risk management for each adopted business model. The importance of developing a multicriteria and multimarket valuation methodology for

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post-patent technology that considers process uncertainties and managerial flexibility is also highlighted. For the management of risks, the structuring of a methodology that can help an entrepreneurial team in the identification and measurement of risks, and ways of mitigating them, during the structuring of a technological business is recommended. In this way, it is possible to structure a process that contributes to the encouragement and generation of technological businesses in the academic environment, and to the perception of the university as a leading producer of technologies applicable to the context of the regional economic and sociocultural reality.

PLANEJANDO NEGÓCIOS TECNOLÓGICOS: UM ESTUDO SOBRE POSICIONAMENTO MERCADOLÓGICO E CADEIA DE VALOR

RESUMO

Objetivo: Avaliar a aplicabilidade, contribuições e adequações necessárias ao modelo de auxílio à tomada de decisão quanto à definição do modelo de negócio no contexto de dez projetos tecnológicos oriundos do ambiente acadêmico.

Originalidade/lacuna/relevância/implicações: Ao buscar a validação empírica do modelo proposto por Reis, Ladeira e Fernandes (2015), o artigo facilita a interpretação e aplicação de conceitos relevantes à definição de modelo de negócio, contribuindo para a aproximação entre a universidade (teoria) e mercado (prática empreendedora).

Principais aspectos metodológicos: A pesquisa é qualitativa e a estratégia metodológica adotada foi a pesquisa-ação em 10 projetos participantes do Programa de Incentivo à Inovação realizado na Universidade Federal de Ouro Preto, Minas Gerais. Foram realizadas entrevistas com 38 profissionais. Elas foram gravadas, transcritas e validadas de forma a entender a aplicabilidade do modelo nos diferentes contextos para avaliar convergências e ou divergências existentes.

Síntese dos principais resultados: A aplicação do modelo demonstrou-se relevante, principalmente para as fases iniciais do planejamento do negócio. A inclusão do Mínimo Produto Viável no modelo auxilia no dimensionamento dos recursos e na elaboração de um produto com características semelhantes às necessidades mercadológicas. Sugeriu-se

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que os critérios levantados para auxiliar o processo decisório fossem avaliados e selecionados pela equipe de acordo com a estratégia pretendida para o negócio.

Principais considerações/conclusões: Como trabalhos futuros, sugere-se avaliar a inserção de novos passos: i) análise dos riscos e plano de contingências para o modelo de negócio proposto; ii) valoração da tecnologia como um passo importante para projetos com interesses em realizar transferência de tecnologia para empresas estabelecidas.

PALAVRAS-CHAVE

Posicionamento mercadológico. Cadeia de valor. Modelo de negócios. Mínimo produto viável. Empresa de Base Tecnológica.

PLANEANDO NEGOCIOS TECNOLÓGICOS: UM STUDIO SOBRE POSICIONAMIENTO MERCADOLÓGICO Y CADENA DE VALOR

RESUMEN

Objetivo: Evaluar la aplicabilidad y, las contribuciones y adecuaciones necesarias del modelo de apoyo para la toma de decisiones relativas a la definición del modelo de negocio en el contexto de diez proyectos tecnológicos en el ámbito académico.

Originalidad/laguna/relevancia/implicaciones: En la búsqueda de la validación empírica del modelo propuesto por Reis, Ladeira y Fernandes (2015), el artículo facilita la interpretación y aplicación de los conceptos relevantes para la definición del modelo de negocio, lo que contribuye al acercamiento entre la universidad (teoría) y el mercado (la práctica empresarial).

Principales aspectos metodológicos: La investigación es cualitativa y la estrategia metodológica adoptada fue la investigación de acción en 10 proyectos participantes en el Programa de Incentivo a la Innovación realizada en la Universidade Federal de Ouro Preto, Minas Gerais. Se realizaron entrevistas con 38 profesionales, que fueron grabadas, transcritas y validadas con el fin de entender la aplicabilidad del modelo en diferentes contextos para evaluar las convergencias y/o diferencias.

Síntesis de los principales resultados: La aplicación del modelo ha demostrado ser relevante principalmente para las primeras etapas de planificación de negocios. La inclusión del "producto viable mínimo" en el modelo ayuda en el dimensionamiento de los recursos y en el desarrollo de un producto con características similares a las necesidades del mercado. Se sugirió que los criterios planteados para ayudar al proceso de toma de decisiones fueran evaluados y seleccionados por el equipo de acuerdo con la estrategia prevista para el negocio.

Principales consideraciones/conclusiones: Como trabajo futuro, se sugiere evaluar la inclusión de nuevas etapas: i) análisis de riesgos y plan de contingencia para el modelo de negocio propuesto; ii) valoración de la tecnología como un paso importante para proyectos con intereses en la realización de la transferencia de tecnología a las empresas establecidas.

PALABRAS CLAVE

Posicionamiento mercadológico. Cadena de valor. Modelo de negocios. Producto viable mínimo. Empresa de base tecnológica.

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