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Impacts of Technological Innovation on Product and Service Quality and Sustainable Financial, Environmental and Social Results in the Aeronautics Sector: A Brazilian Case Study

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Abstract: As a result of technological advances and the increase in the quantity and diversity of companies operating in the market, an increasingly competitive scenario emerges in which innovative approaches have become important for the survival and visibility of companies in the market. Furthermore, technological innovation can be considered a source of creation of positive or negative financial results and environmental and social impacts, which requires verification. Thus, in this article, results are presented on the impacts of innovation on quality; results are also given in relation to aspects related to financial, environmental and social impacts. The research is a qualitative analysis based on a case study methodology: the focus comprises different companies and areas of a large Brazilian group in the aeronautical industry, which operates in different countries around the world. Professionals involved with technological innovations in these companies were interviewed and the results obtained were utilized to validate and corroborate the research. After conducting the survey, it can be seen that innovation can help in adaptation, meeting the new demands and opportunities of the market, while impacting aspects of quality: conformity to the requirements of the market where the company operates; product, service and/or process performance; customer satisfaction and loyalty. The meaning of quality may vary according to the business objectives of a given company.

Keywords: technological innovation; quality; financial results; aeronautical sector; sustainability

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1. Introduction

As a result of technological advances and the growth in the amount and diversity of organizations that operate in the world market over the years, companies are subject to an increasingly competitive environment [1–4]. Within this context, for the survival of most organizations, it has become paramount to adapt with innovative approaches in their products and services and to make changes in the business models that are considered to be usual; such changes are necessary for improvement, development and stability in the market to be ensured [5–8]. In a competitive market, there is still a need for organizations to meet new market demands; for example, they might develop a sustainable industry model that involves investment in technological innovations that bring financial return [6,9]. Innovation is mentioned in the literature as a supporting tool in building a competitive differential [8]. And it has different characteristics and definitions [10]. A well-established definition is that technological innovation, in turn, is the introduction of technologically new products or processes and significant improvements that have been implemented in existing products, services, and processes [2,11]. Technological innovations in products, services and processes must be defined and guided by observing the characteristics and performances expected by the organization or interested parties, so that efficiency is improved and value is generated for the target audience [11]. But developing competencies in innovation requires a strong set of organizational knowledge, skills, and motivation to ensure that innovation activities are geared to meet market needs and organizational objectives [12].

Theory states that innovation can, among other positive factors, assist in the strengthening and improvement of processes [13]. For this reason, the demand for innovation has intensified within this competitive scenario, leading even large corporations to team up with smaller companies to accelerate their innovation processes [14]. Moreover, to innovate, large investments in innovation are necessary, requiring care and deep and accurate technological analyses in order to ensure the sustainability of the business; in addition, it is necessary to actually become a competitive differentiator, resulting in positive financial returns [15].

In order to evaluate quality and financial results related to innovation, the constructs of the present research are technological innovation and quality and their relationships with financial results within organizations. When analyzing articles with themes related to these constructs, a research gap was observed for technological innovation and corresponding results regarding the quality of products and services [8,12,16–18]. The main goal of this research is to determine the possible impacts of technological innovation outputs on products and services and their quality and financial results in different units of an aeronautical company; additionally, we seek to analyze how they occur.

Figure 1 illustrates the main scope of this research, which is to evaluate the influence of technological innovation on the quality of products and services, and determine how these result from different processes, as well as evaluating the financial results of the organizations that were taken as units of analysis.

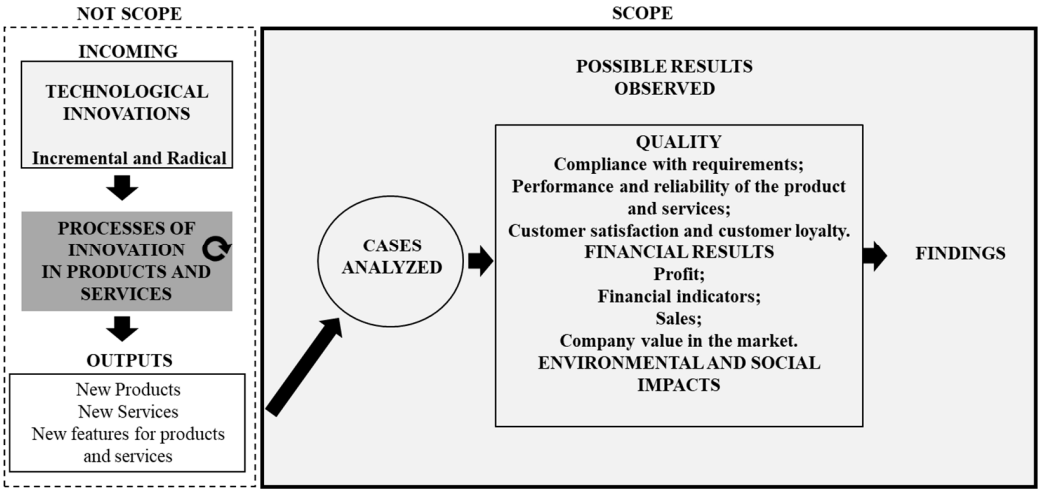

Figure 1. Scope of study.

The central objective of this research is to analyze the possible impacts of the outputs of technological innovation on the quality of products and services and financial results in different units of a company in the aeronautics sector, and to determine how they occur.

In order to achieve the objective of this article, an investigation was carried out in which some intermediate questions were clarified; these unfolded from the central objective:

(a) To conduct a search in the literature to identify possible outputs of technological innovation.
(b) To identify the definitions of quality within the innovation environment.
(c) To identify the possible impacts of the outputs of technological innovation on the quality of products and services.
(d) Using the definitions of the financial results found in the literature, we seek to verify the possible impacts of the outputs of technological innovation on the financial results of the organizations (the units of the analysis).
(e) To corroborate the relevant academic literature on the relationship between technological innovation, quality and financial results.

2. Systematic Literature Review

A systematic literature review was performed to identify research related to the constructs that are the focus of this work (technological innovation, quality and financial results); from this, studies that involved the research topic were selected, such as articles linked to innovation, new technologies and research on the relationship between innovation and quality and/or innovation and financial results. Briefly, the literature review was structured following a systematic approach, as follows:

(a) Identification of articles on the theme of this work for the systematic literature review was carried out through searches conducted in the available databases (Web of Science and Scopus®) and using the search criteria according to the established constructs.
(b) Evaluation of the identified articles and selection of the texts related to the research theme was conducted.
(c) The theoretical foundation was elaborated, addressing the main concepts and definitions identified in the academic literature related to the research topic.
(d) The possible outputs (tangible) and resulting results (intangible) of technological innovation were identified and presented.
(e) The respective (intangible) outputs that impact the quality of products and services within organizations and their financial results were selected.
(f) An analysis of how the identified results can be observed within the organizations was conducted.

A systematic literature review is a way of gaining an understanding of the academic publications on a given subject of interest [19]. Thus, at the beginning of this research process, a systematic literature review was conducted with the aim of listing the main, relevant articles that have been published on the subject, to be investigated and discussed.

To identify articles that address the subject, a search was conducted in the database of the Web of Science (WoS) and Scopus® platforms; such platforms are known for having a large collection of published journals. On these platforms, search parameters were set, in order to identify articles that are related to the research constructs. The words entered were the following: "Technolog* Innovation" AND "Quality" AND "Financ*". The platforms returned a list of possibly relevant articles on the researched theme. Data extraction was performed in June 2022. For broad-reaching results, in order to attain the largest possible number of articles related to the research topic, a word filter alone was performed, and no restrictions related to language, period or region of publication were applied.

The platforms returned a total of 524 (five hundred and twenty-four) articles related to these search terms. For a more adequate and precise filtering of the research related to the themes of this study, a content analysis was initiated to select the articles which are relevant to this work. The studies extracted from the Web of Science (WoS) (222 articles) and Scopus® (302 articles) platforms were consolidated in Microsoft Office Excel® software (Version 18.2311.1071.0); after the content analyses, they were filtered and manipulated to prepare the graphs that are presented in the following sections of this chapter. From the analysis of each article, it was observed that 99 (ninety-nine) articles were duplicates and 13 (thirteen) articles were not available or were not in English, Portuguese or Spanish or they did not address the researched theme, so these were disregarded in the construction of this theoretical review. After that, ninety-seven (97) articles remained, which were used for the elaboration of the analyses of the history of publications on the theme.

Since not many articles relating to the specific theme of this work were identified, the references of the considered articles were evaluated to ascertain whether there were more articles that could be relevant and that were not found in the initial sample. In the sequence, they were evaluated and, if considered to be related to the research topic, the articles were used in the structuring of the theoretical framework. In this step, called "snowballing", an additional 37 (thirty-seven) potential articles related to the research theme were identified. Of this sample, 8 (eight) were not available or were off topic, leaving 29 (twenty-nine) additional articles. In addition, some other documents were identified which were considered to have a relevant theme, such as policies, manuals, books, or

academic research, and totaled 15 (fifteen) documents. Thus, the final sample resulted in a total of 126 (one hundred and twenty-six) articles and 15 (fifteen) other documents. Figure 2 shows the flow of steps for selecting relevant articles from the sample obtained and the number of documents used to prepare this article was 108 (one hundred eight), as shown in references section [1–108].

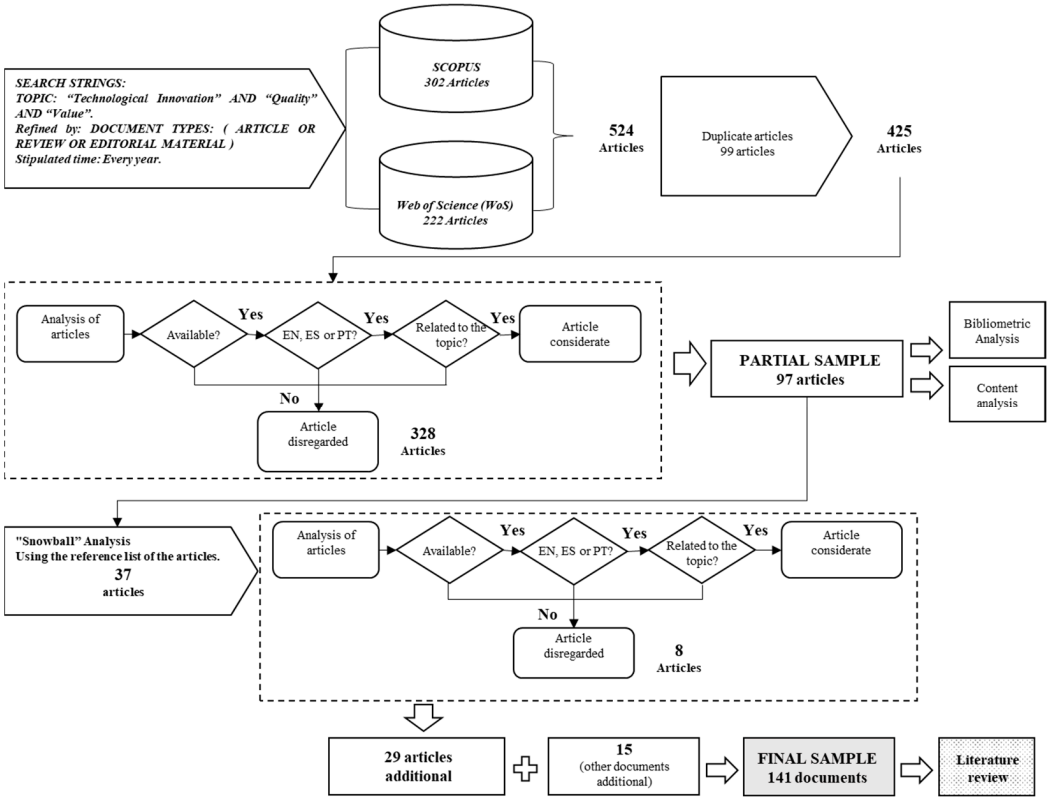

Figure 2. Articles identified in the systematic literature review.

3. Theoretical Background

When a new concept or idea is transformed into a product or process, we can call it innovation [22]. Within a large organization, innovation can take different forms, whether in process, product or technical or administrative environment [23]. It is possible to identify different definitions in the literature for innovation [10,17]. According to [24], "innovation" derives from the word "Innovate" which is a word that, in turn, originates from the Latin "innovare", meaning "to renew" and "to make something new" [24]. It is seen as the introduction of new products, services or processes and can be characterized by a process of exploration that can result in an improvement [16,25].

3.1. Technological Innovation

Technological innovations are characterized as the main source that generates changes in the economy, being the origin of profit and economic development [26]. A well-established definition in the literature, the one which will be taken as the definition in the present research, is that technological innovation is the introduction of technologically new products or processes and significant improvements that have been implemented in existing products, services and processes [2,11].

When a new concept or idea is transformed into a product or process, we can call it innovation [22]. Within a large organization, innovation can take different forms, whether in process, product or technical or administrative environment [23]. It is possible to identify different definitions in the literature for what innovation is [10,17].

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In order to clarify these definitions, Table 1 presents the different definitions of innovation identified in the analyzed academic literature.

Table 1. Definitions of innovation found in the literature review.

Year	Author	Definition
2004	[1]	Innovation is the successful implementation of creative ideas by an organization.
2012	[17]	Innovation refers to new applications of knowledge, ideas, methods, and skills that can generate unique capabilities and leverage an organization's competitiveness.
2012	[16]	Process innovations are changes to existing processes or the creation of new processes used by an organization for the delivery of products or services.
2013	[23]	Innovation connotes the adoption of a new idea or behavior in a company.
2014	[12]	Considering creativity and innovation as knowledge-based capabilities, these processes help the company build its competencies and learn about new technologies that can be exploited to meet market demands.
2019	[8]	An innovation can be the implementation of a new product or process (good or service) or its significantly improved version, a new marketing method, or a new organizational method in business practices, workplace organization, or external relations.

Source: Prepared by the author.

For this research, we adopt the definitions of innovation that were presented by [8,16,17]. These are presented in Chart 4, which, briefly, says that innovation is the creation of a new product, service or process, or even the improvement of an existing product, service or process.

The focus of this research is technological innovations, which can be characterized as radical and incremental; their influence on quality and financial results can be verified, by verifying results from technological innovation, as identified in the analyzed theoretical framework.

Product innovations, in addition to the creation of new products, are associated with the creation of new markets and new functionalities; this is a process that can be driven by the advancement of technologies, changes in customer needs, and the creation of competitive differentials. In addition, product innovation can be seen as a continuous and multifunctional process, involving numerous organizational development factors and, at the same time, can generate risks and demand high investments and not meet the initial expectations of the project [15].

3.2. Outputs of Technological Innovation

For the present research, in order to divide up the research scope and provide clarity to the analyzed subject, "outputs" of the technological innovation activities are classified as the tangible end objects, such as products and services. For the outputs to be evaluated with regard to quality and financial results, the results—here, called "intangible"—were evaluated, such as satisfaction, meeting requirements and customer loyalty, among others.

3.3. Impacts of Technological Innovation

Ref. [27], in their research, report that innovation is related to economic development. As an example, they cite that, in 1911, Schumpeter had already recognized that there is a relationship between economic development and technical advancement; based on this assumption, the more that companies invest in technological innovation, the greater and/or better their performance should be. From innovation outputs, different results can be observed. Some authors describe the following possible impacts of innovation: the improvement of product quality; an increase in the quantity of products offered;

the maintenance or expansion of the market share; an expansion into a new market; an expansion of production capacity; expansion flexibility; a reduction in production cost; a reduction in labor cost; a reduction in energy consumption; a reduction in water consumption; a reduction in occupational safety risks; a reduction in the impact on the environment; an expansion of the control of the safety and health of employees; adequacy under the regulations of the domestic market [28].

In their research, ref. [28] highlighted the following main perceived outcomes of innovation: improved product quality; maintenance and/or expansion of market share; expansion of production capacity; expansion of production flexibility. These results suggest that innovation is primarily related to products and the company's performance in the market. In addition, in the OSLO manual, an idea is described, where innovation results are changes in the components of products and services that improve their efficiency or the way they are used [11]. According to [14] some outcomes are expected from the adoption of innovations, some of them being the following: exploring new technologies and business models; increasing knowledge about new technologies; demonstrating that the organization is innovative; improving social and corporate responsibility; gaining a financial return on investment; recruiting new investors; seeking new consumers. In their research, ref. [4] tested two hypotheses that are relevant to the present research: the first is that technological innovation improves organizational performance; the second is that technological innovation influences organizational sustainability.

Technological innovations drive firms towards sustainability; in this way, they achieve superior performances, leveraging results related to efficiency, profitability and competitiveness, among others [4]. In agreement with the relationship between technological innovation and sustainability, ref. [9] also proposed that technological innovation works towards meeting the needs of socioenvironmental criteria, stakeholders' interests, product life cycles, and certifications for the organization. However, innovation can generate negative impacts on organizations, exposing them to greater risks. Another disadvantage is related to the existing difficulty that lies in creating a link between the efforts of innovation, the impact on sales within the organization and/or the company's performance results from the innovation, as well as the extension of the life cycle of the product, etc. Refs. [11,27] exploring the relationship between technological capability and the performance of organizations—suggested that some indicators can assist in identifying the performances of organizations and their technological capabilities, as identified in the literature indicated in the research. There are indicators related to sales, such as return on sales, sales growth and total revenue [27]. Parameters such as overall profitability, profit margin growth, better profitability than competitors, EBITDA (earnings before interest, taxes, depreciation and amortization), growth in the percentage of profit margin and EVA (economic value added) can be evaluated, as they relate to a company's results [27].

Finally, indicators related to the market can be evaluated, such as IPO (initial public offering) and MVA (market value added) [27]. In addition, there are other indicators that are linked to innovation that can be measured within the organization: duration of the existence of R&D, amount invested per year, number of patents and stock prices (for example, stock price variation in recent years and whether there was growth or not) [27]. In their study, ref. [29] present the idea that fostering new technologies requires large amounts of investment and requires high-quality governance, public and/or private funding and alignment with the country's development efforts and those of public and private initiatives. Therefore, these factors can also play essential roles in achieving success in technological innovation activities.

3.4. Quality and Technological Innovation

Non-financial information has become a relevant basis for related parties to understand the true value of a company investing in innovation, because technological innovation is a type of investment that may not bring a return on investment in the short term; but there are other non-financial factors that need to be taken into consideration. For example, one must

consider the relevance of this innovation to customers, the environment and society, the quality, safety and reliability of the product, and the question of whether it can be a source that generates economic growth [20]. Quality in products can exist with different meanings and relevance depending on the industry and/or customer perception. Thus, quality is a complex and multidimensional characteristic; there is no single definition for quality, and it has a vast number of meanings and parameters which the related parties can satisfy [15]. In addition, some authors mention that quality management practices—when applied to innovation—can improve innovation and organizational and financial performance; there may be a relationship between innovation, quality and performance in this format as well [31].

From the innovation perspective, according to [32], the quality of innovation results is characterized in terms of the following aspects: commerciality, which is the ability to achieve innovation and contribute to the competitive advantage of the company; the originality of the technological combination, suggesting the focus of the company's ability to generate new architectures and recombine knowledge; technological recognition, which signals the technical value of the innovation as recognized by others; the internal value, which refers to how the innovation generates internal value, as attributed to the innovation by its assignee. Over time, there have been changes in the concept of quality [33]. There is no comprehensive concept of quality, with no existing consensus on its definition; thus, for this study, a selection of definitions were considered to be parameters for checking the quality of products and services in technologically innovative companies. These will be the object of analysis, among some concepts explained by [34], as the former gurus of this study area. The definitions taken by the present study are as follows:

(a) Conformation to requirements (Philip Crosby and Garvin);
(b) Performance: performance and reliability of the product and services (Garvin and W. Edwards Deming);
(c) Customer satisfaction and customer loyalty (Garvin).

3.5. Technological Innovation and Financial Impacts

Innovation is necessary, but care must be taken so that the development of innovations does not lead organizations to bankruptcy; for this, sustainability is required, closing the cycle of development and ensuring a return on the invested value [35]. Companies need to work efficiently and effectively in an uncertain environment, which is not an easy task; but this is essential for organizational sustainability [4]. Technological innovation improves the sustainability of an organization [4]. For example, technological innovation is seen as a strategic action for producing returns; it is necessary to respond to environmental pressures and ensure sustainability. In the research by [36], the hypothesis of innovation's positive relation to organizational performance is tested.

Organizational performance is recurrently defined as, among other things, financial return, i.e., sales growth [4]. It is broadly seen as the achievement of good financial results. In light of this, the research by [4] analyzes the relationship between technological innovation and organizational performance; here, the authors came to the conclusion that organizational performance is related to the issues of technological innovation and sustainability. In short, financial performance is defined in relation to the achievement of monetary goals and market share. Following what is suggested by [15], in the present research, the following factors will be evaluated (these were extracted from the study of [23]:

(a) Profitability;
(b) Financial results (financial ratios—checking liquidity and indebtedness);
(c) Growth in sales during the past three years;
(d) Growth in market value during the past three years.

4. Methodology Approach

4.1. Research Question

In investigating the "how" and the "why" questions for the occurrence of phenomena, the case study is considered to be a useful methodology [37]. Given this, the present research will be guided by the following question: ***how are organizations impacted by technological innovation in the quality of products and services and in financial, environmental and social results?***

4.2. Research Approach

In deciding on our research method, authors who define methodologies and guidelines for qualitative research and case studies were consulted [38,39]. In order to ensure the diversification of environments and samples—enabling us to understand the impacts of technological innovation on quality more accurately—a multiple-case-study approach was chosen.

The research method proposal presented by [38] suggests the use of a research roadmap—originating from the case study research format—for theory building, containing step-by-step instructions for theory formulation and presentation. This construction starts with the identification of questions from the existing research, but which do not answer the current question, contributing to the evolution of the theory.

After checking the concepts and results obtained by different authors, identified in the academic bibliography—a step emphasized by [38]—the research protocol was structured, followed by questions for conducting the interviews.

In summary, the collection of primary information will be carried out by means of the answers collected in the interview, which will have semi-structured questions. And, subsequently, the documental analysis will be carried out, comprising a survey of the secondary data from the samples; here, the purpose of is to verify the results from reports published by companies on their websites, which are open to the public in general. It is important to emphasize that, since this is a critical analysis, the names of the companies chosen for analysis and the professionals interviewed are not disclosed in this study, in the interest of ensuring their anonymity.

4.3. Case Study Framework and Data Collection

As the research will be qualitative and based on multiple case studies, the steps presented in Figure 3 will be followed for the field research.

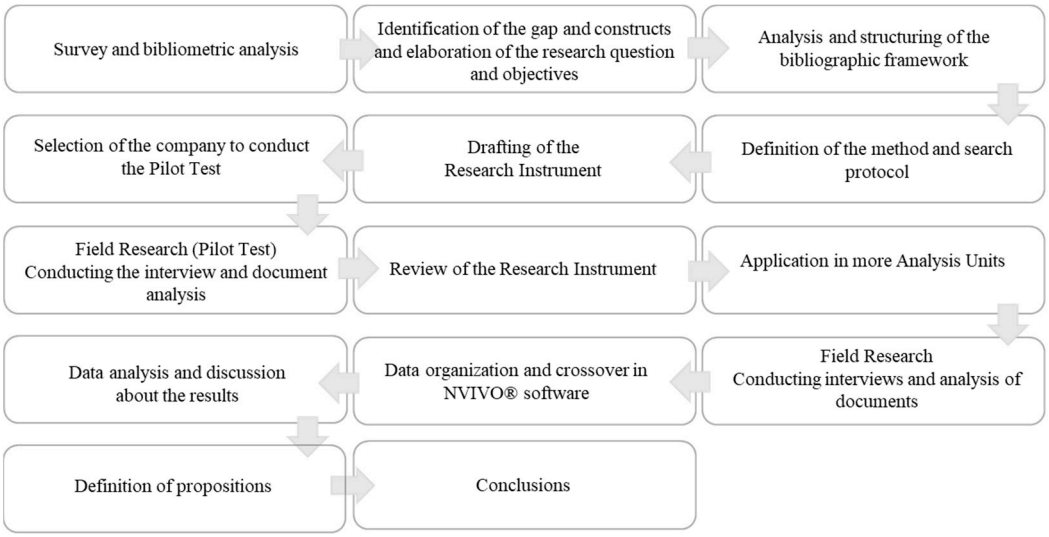

Figure 3. Flowchart of the research method.

To group, compare and analyze the data, NVIVO® software will be used as a supportive tool to help organize and synthesize the data collected. This will help in grouping the interviewees' responses, making it easier to identify similar or contradictory answers, to analyze each case and to present the results.

The results of the recorded interviews will be transcribed, organized and entered into the tool (NVIVO® software), which is intended to highlight the common responses or opposing opinions of the interviewees on a given topic. The results are presented in the section discussing the results.

To define the conceptual–theoretical framework, the literature review presented in Section 2 of this work was used as a basis. Figure 4 illustrates the research model that will be followed. Briefly, the technological innovation outputs and possible outcomes that are investigated for the formulation of the research instrument are presented.

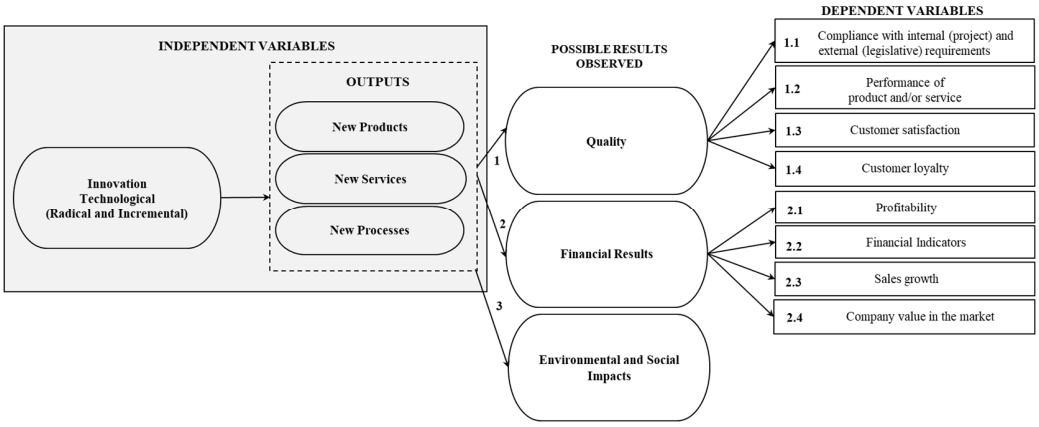

Figure 4. Research model and identification of independent and dependent variables.

In Figure 5, the independent and dependent variables of this research are identified. Here, we identified the independent variables (those that are not evaluated in their interactions and results from different circumstances) and the dependent variables (that are the scope of the analysis of this research and are subject to influences from the environment). The independent variables refer to the variables that influence and affect the results and the dependent variables are the variables that are subjected to that influence [39].

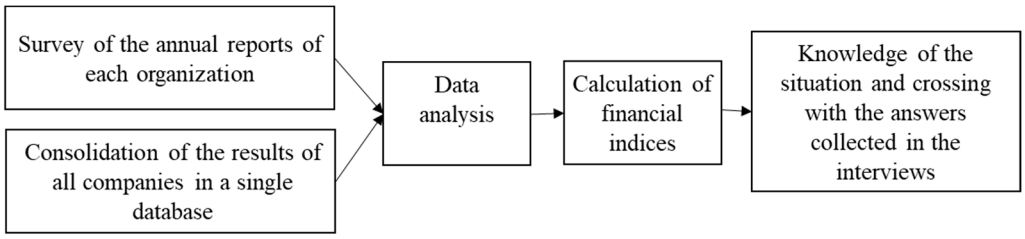

Figure 5. Financial data analysis process.

The purpose of analyzing economic and financial indicators is to determine and assess whether the company has good or bad results in terms of profitability, return on investment, solvency capacity and liquidity. In the context of technological innovation activities, the purpose of this information is to verify the answers given by the interviewees and to refine the results obtained in order to gain a better understanding of them and to improve the precision of the results related to technological innovation activities.

4.4. Means of Data Collection and Analysis

The analysis of the data obtained regarding the cases will be fundamental in obtaining information to answer the objective of this work. The semi-structured questions were

elaborated based on Section 3, thus enabling the collection of primary data. To verify the secondary data, the information from the theoretical framework was analyzed and suggestions were made on how the results generated by the outputs of technological innovation can be identified in the field.

During the construction of the theoretical framework, different possible results of technological innovation related to quality and financial results were evaluated; then, the outputs that were understood to be possible to observe, measure and evaluate through a case study format were selected. Thus, it became possible to obtain primary and secondary data in line with the objective of the research and according to the theoretical framework presented in Section 3 of this work.

Table 2 shows a brief summary of the characteristics that are considered to refer to quality outputs, as observed in the literature review ("outputs"), what will be collected ("what") and the suggested form for data collection in the field ("how"), in order to effectively answer the research question of this work.

Table 2. Quality-related outputs.

	Topic	What?	How?
QUALITY	Compliance with requirements	Whether a greater/lesser degree of rework is perceived; the guarantee is activated after the application of a technological innovation [47]	Primary Data: Interviews with semi-structured questions [38]. Secondary Data: Company documents, such as productive performance indicators, e.g., whether or not—after innovation in the history of the production process—the product met the requirements parameterized by the company through indicators of rework and customer complaints.
	Performance of product, service and/or process	Whether the product—after technological innovation—gains new characteristics that are considered to be competitive/better differentials: easier to use, greater durability, lower cost, easier or faster to produce for the organization, brings the desired result in a shorter time, etc. In the case of services and processes, for example, greater agility in service is perceived (Garvin).	Primary Data: Interviews with semi-structured questions [38]. Secondary Data: Company documents: - Results of research carried out by the intelligence of launching products or services in the market - Evaluations of whether the company perceives a reduction in cost compared to previous products, processes or products, mainly related to COGS (cost of goods sold).
	Customer satisfaction	Whether better results are observed in the satisfaction surveys deployed by organizations. In the case of a product, whether there is an increase in sales due to a positive or negative spread from the opinion of existing customers about the brand. In the case of services, whether there is a higher rate of customer loyalty [48].	Primary Data: Interviews with semi-structured questions [38]. Secondary Data: Indicators with satisfaction rate (customer satisfaction survey on products and services provided). Usually, this indicator is answered by the customer at the end of a service provision, or through surveys prepared by the organizations' market intelligence [30].
	Customer loyalty	Retention of existing customers.	Primary Data: Interviews with semi-structured questions [38]. Secondary Data: Customer retention goals and result indicators of organizations.

Source: Prepared by the author.

Table 3, in the same way as presented for the quality outputs, presents the results to be observed regarding the outputs of technological innovation related to the financial results. These results were also selected in the theoretical framework because they were observed to be feasible for collection in the field.

Table 3. Outputs related to financial results.

	TOPIC	WHAT?	HOW?
FINANCIAL RESULTS	Profitability	Whether the company has made a profit in the past three years.	Primary Data: Interviews with semi-structured questions. Secondary Data: Profit results in public reports.
	Financial results (financial indicators—verifying investment and indebtedness)	Verify whether the company's financial indicators have performed well or poorly in the past three years.	Primary Data: Interviews with semi-structured questions. Secondary Data: Financial indicators based on the results published in reports (indicators: LG—general liquidity; SG—general solvency; LC—overall liquidity; ROI—return on investment), based on information from the past three years.
	Sales growth	Whether the company has achieved growth in sales over the past three years.	Primary Data: Interviews with semi-structured questions. Secondary Data: Information in public reports about companies' revenue over the past three years.
	Growth in market value over the past three years	Whether the company has increased its market value in the past three years.	Primary Data: Interviews with semi-structured questions. Secondary Data: Information published in reports on market value over the past three years.

Source: Prepared by the author.

After identifying the companies and professionals that fit the research prerequisites, an invitation was sent to them; this provided the context of the research objective and informed recipients that data would be treated confidentially. The interviews were conducted after the company's approval and with the consent of the interviewed professionals. Table 4 shows the relationship between the questions in the questionnaire used and the scope evaluated in the present study.

During the field interviews, the interviews were conducted with more than one person who performs activities related to technological innovation in Organization A; in addition, some doubts that arose during the data analysis were clarified punctually with some interviewees. The data collected in the interviews, document analysis and clarification of any doubts were able to assist in the verification of the answers in order to obtain objective results. After the interviews, which were recorded and transcribed, the NVivo12® software was used to assist in conducting comparisons between the interviewees' statements and their respective analyses. The purpose of the analysis of economic and financial indicators is to determine and evaluate whether the company has good or bad results regarding profitability, return on investments, solvency capacity and liquidity. In the context of technological innovation activities, this information aims to verify the answers of the interviewees and to accurately assess the obtained results for a better understanding and accuracy of the results related to technological innovation activities.

Table 4. Relationships between assessed scope and questionnaire.

Evaluated Scope	Questions
Whether the company develops new products and innovates in services [28,41].	Does the company have a routine for launching new products and/or services or existing products and services with new features? If so, how often? How many products/services have been launched in the last three years?
	What are the main drivers/aspects considered by the organization for the promotion of innovation activities?
1.1—How are organizations impacted by technological innovation in the quality of products and services, in terms of compliance with internal (design) and external (legislative) requirements? [28]	Do you regularly seek to identify and meet the requirements imposed by the market in which you operate (legislation)? How often? Are the customer's interests also considered? Please cite examples.
	Is there a process to evaluate whether the products or services that have undergone technological innovation meet all the technical requirements that were defined in the project? If so, how is it done and what were the last results obtained?
1.2—How are organizations impacted by technological innovation in the quality of products and services, in terms of performance/performance of the product or service? [28]	Are the performance characteristics of the product or services constantly improved? If so, what are examples of improved features and how is this result confirmed/tested?
	Does the innovation carried out in the products or services generate a higher perceived quality of the product compared to that of competitors? Please cite examples.
1.3—How are organizations impacted by technological innovation in the quality of products and services, in terms of customer satisfaction? [12,40,41].	Are there customer satisfaction indicators about the products and services? If so, what are the goals and are their results satisfactory over the past three years?
1.4—How are organizations impacted by technological innovation in the quality of products and services, with regard to customer loyalty?	How are new technologically innovative products and services received by the market from a reliability point of view?
	Does the company remain stable/constant in the number of sales or does it exceed them monthly? If so, have the results of the past three years met or exceeded the target?
	Is there a customer retention plan? If yes, result of the indicators in the last three years.
2.1—How are organizations impacted by technological innovation in financial results, in terms of profitability? [15]	Has the company made a profit in the last three years? If so, do you think there is any connection with innovation activities?
2.2—How are organizations impacted by technological innovation in financial results, with regard to financial results (financial indicators)? [15]	Does the company need to finance investments in innovation with financial institutions?
2.3—How are organizations impacted by technological innovation in financial results, in terms of sales growth? [15]	Has the company increased its number of sales in the last three years? If so, do you see any relationship between this number and innovation activities?
	Have sales results over the past three years met or exceeded the target?
2.4—Market value [15]	Has the company increased or maintained its market value over the past three years? In your opinion, does this have anything to do with innovation activities?

Source: Prepared by the author.

4.5. Research Protocol and Instrument

In the "Pilot Test", a set of 32 (thirty-two) questions was asked; these were part of the research instrument used in the pilot test. This repertoire of questions was read to the interviewees during the scheduled sessions, which were expected to last 60 (sixty) minutes each. The questions were formulated based on the academic bibliography. Table 5 presents

the information that informed our decision of which studies to use as references for the elaboration of the questions in the research instrument.

Table 5. Main studies considered for the formulation of the questionnaire.

Year	Author	Researched Topic	Research Method
2020	[7]	Quality management and digital transformation	Theoretical review
2020	[49]	Digital transformation and value creation	Case study
2019	[41]	Maturity in innovation management	Case study
2019	[93]	Outputs of technological innovation	Theoretical review
2019	[8]	Quality and innovation	Case study
2018	[42]	Outputs of technological innovation	Survey
2017	[35]	Critical factors and digital transformation	Survey
2017	[43]	Indicators to measure innovation results	Theoretical review
2015	[28]	Outputs of innovation	Survey
2014	[12]	Critical success factors	Theoretical review
2012	[17]	Quality and innovation management	Theoretical review
2009	[44]	Relationship between innovation and competitive advantage	Survey
2005	[40]	Relationship between innovation, quality, growth, profitability and market value	Survey

Source: Prepared by the author.

The questions were extracted or adapted from the references mentioned in Table 5. Based on the research question, we formulated the questions that were present in the questionnaire. In some cases, questions already applied in preexisting forms of research were considered. In other cases, the questions were adapted or formulated based on the literature review (Section 2). In the search of [17], for example, conducted a quantitative study on the theme of innovation and quality; one of the hypotheses presented by the authors is that quality can be positively related to innovation. Initially, in the research form, were elaborated to verify whether the company participating in the research carries out technological innovation practices, with these thus being framed as units of analysis. These questions were extracted from the form by [41], which was prepared with the objective of verifying whether the investigated company has innovative activity in another research context. Thus, these questions were considered to be qualifiers for the sequence of the interviews. After that, in part IV of the questionnaire, questions 1–10 were formulated to verify the outputs related to technological innovation within the organizations. These questions were elaborated based on the observed and selected outputs of the evaluated bibliography. The questions which were formed to verify whether there are outputs related to new products and services were elaborated based on [28,41]. The questions related to the outputs related to the creation of new processes were elaborated considering the research of [35,41]. To verify the existence of outputs related to the new characteristics for products and services, the questions elaborated by [41] were adapted.

The questions that were formulated to verify the existence of outputs related to the generation of patents/publications were generated based on [8,17,45]. To verify the existence of outputs related to digital transformation and/or the automation of processes based on technological innovation, a question was generated based on [8]. To determine the presence of technological innovation outputs related to tax and/or financial benefits, a question was created based on the research by [8]. The suggested propositions related to quality have the objective of verifying whether results are observed within organizations, and whether they are influenced by the outputs of technological innovation regarding the quality of products and services. The possible results were identified in the theoretical

framework, as shown in Section 2. After that, specific results were selected in order to ensure that the investigation was feasible and objective. Questions 11 and 12 are related to compliance with internal (project technical) and external (legislative) requirements and were elaborated based on [28]. Ref. [42] state that innovations can originate from the need for changes in administrative processes. Ref. [93] report that technological innovations are often linked to process management and the need for continuous improvement, fostering innovations in processes, products and services that are strategic for the organization in order to improve performance. Ref. [35] in the survey carried out in their research, present a reflection on the issues that arise in the relationship between digital transformation and the company during this process to go through innovations, introducing new technologies and improving results. In addition to the above references, questions 13–15 were developed from [28] to verify the results related to the performance of the product and/or service. In her research, ref. [12] makes a proposition that, in highly customer-oriented companies, the capacity for innovation is strong. And [40] report that innovation can increase customer satisfaction. In turn, ref. [28] state in their research that customer orientation is a variable, which should be taken into account in innovation analyses. Ref. [41] present a dimension of the orientation of innovation for customers and market knowledge. Therefore, questions 16 and 17 were developed with the objective of verifying customer satisfaction based on research by [12,40,41]. Two questions (18 and 19) were also elaborated to verify the existence of customer loyalty to the organizations. In their research, ref. [28] state that innovation can generate benefits for organizations, e.g., in an organization's performance. Ref. [43], in turn, address the possible outputs of innovation; among these, one is the declaration of possible factors influencing innovation, related to quality and financial results.

For the evaluation of the suggested propositions on the influence of technological innovation on the results related to value generation within organizations, questions adapted from the propositions suggested by [8,28] were used. Ref. [8] explore the outputs arising from innovation and identify knowledge management as a possible output. This includes the following aspects: increased productivity; the promotion of the company's image; easier access to tax benefits and financing; the automation of processes; increased profitability. In this work, they were classified as value generation, following the considerations of the bibliographic reference, and originated the formulation of the questions that appear in the research instrument. Initially, to verify the increase in the companies' portfolios, questions 20 and 21 were elaborated based on the output of technological innovation; this is related to the creation of new products and services according to [28,41]. In their research, ref. [49] present in their research the issue of the need for knowledge management and training, which they state is paramount in an environment of digital transformation and the use of new technologies. One of the hypotheses presented in the research of [44] addresses the issue of training as it relates to the positive results of innovation. To verify knowledge management, questions 22 and 23 were elaborated based on the research of [8,28]; in their research, these authors report that the increase in productivity and profitability within organizations are outputs of innovation. In their research, ref. [4] test two hypotheses that are relevant to the present research; the first is whether technological innovation improves organizational performance and the second is whether technological innovation influences organizational sustainability. Thus, questions 24 to 26 were formulated to verify whether there is a relationship between the outputs of technological innovation and the financial results of the organization, such as productivity, cost reduction and profitability. These questions were elaborated based on [4,8,28].

Questions 27 and 28 on image promotion/notoriety were developed based on the work of [8]. Finally, the questions (29–32) related to sustainability were elaborated in order to verify whether there is a relationship between technological innovation and results on socioenvironmental sustainability. Within the context, it is emphasized that the issues related to sustainability in the present research covered only socioenvironmental issues. In view of this, these questions were elaborated based on the theoretical framework [9,35]. In addition, in order to obtain recent data, a request for data on the performance of

organizations in a recent period of about three years was included in the questions. Related to secondary data, data issued by the organization from recent years (2017, 2018, 2019, 2020 and 2021) were also considered. After the pilot test was performed and the form was accordingly revised—in the pursuit of maintaining the verification of quality-related results—the scope that was previously called "value generation" was changed to "financial results"; this was due to the aim of maintaining the objective scope of the study. Thus, a new systematic literature review was performed, and the research instrument was revised for the questions. Issues related to technological innovation and financial results were based mainly on the research conducted by [15].

4.6. Pilot Test

To verify the proposed research model, a pilot test was initially carried out, the objective of which was to determine whether the structure of the field research and the proposed research instrument were functional and to evaluate the quality of the data obtained from the application of the form. The interview was conducted with a selected professional who works in activities related to technological innovation in a company that meets the previously defined qualifying criteria.

With the pilot interview, it was also possible to evaluate the time needed and determine whether all the questions are clear and whether they are aligned with the propositions. In addition, the test helped to ascertain whether the answers to these questions achieve the proposed objective, bringing results for analysis in the work. The pilot test was recorded, and the interview lasted about 45 (forty-five) minutes, which is shorter than the expected period of 60 (sixty) minutes.

During the interview, it was observed that some questions were formulated differently, but resulted in similar answers and achieved the same objective. Then, after the pilot test, the research instrument was revised, and some questions were incorporated into the previous questions and/or excluded in order to make the questionnaire more fluid and objective, without impacting the quality of the data to be obtained, according. Briefly, during the pilot test interview, it was observed that question 3 was similar to question 1, about launching new products, and derived similar information. The question of new features that had not been foreseen in the questionnaire was incorporated into question 1 of the new version of the questionnaire. Question 10 was also removed from the form because it was implied that, with the reduction in fees, there is a direct reduction in the "costs" of the product and/or service that can be incorporated into the reduction in the price or the increase in the profit margin. This information is collected through other questions. Question 15, on the other hand, was redundant with the presence of question 14, in terms of evaluating product performance. Therefore, it was considered that it was answered in another question and was excluded from the new version of the form. It was observed that question 16 was redundant with the presence of question 11, as question 11 already asked and provided the answer about the process for identifying the requirements. Therefore, this was excluded and the part concerning client interests—which had not been foreseen—was incorporated into question 11. Questions 20 and 21 were answered in question 1, which provides answers about how many products are launched and their new features. The launch of products translates into an increase or renewal of the portfolio and this information can be observed in the company's documents. Question 31 was in duplicated with question 29, because the life cycle is a characteristic that is considered to be sustainable; for this reason, question 31 was removed in the new form. Finally, the other questions were withdrawn due to the change in the scope of the research after the qualification exam, according to the guidelines received.

4.6.1. Pilot Test Data—Quality

In this section, the results of technological innovation obtained during interviews and document analysis related to quality are presented. Table 6 shows the results collected in the interviews regarding quality.

Table 6. Data collected in the interview related to quality.

Code of Proposition	Evaluated Factor	Interview
INTECQUP11	Compliance with internal (design) and external (legislative) requirements.	There are areas of market intelligence, innovation and digital within each business unit that identify customer and market requirements about each business area and align with engineering.
		The company has indicators that verify the performance of the product; an example is the verification of COGS (costs of goods sold) to verify whether, from an innovation or innovative process, there was a cost reduction, for example. To verify whether costs have really been reduced, it is necessary to contact the area of each business unit to obtain this information.
INTECQUP12	Performance of the product or service.	It is part of the organization process. A verification of the objectives achieved of the deliveries against the approved budget is made, and this activity is part of the routine implementation of any product investment project that is of the company, including innovation. However, for the results of each project, it is necessary to check with each specific business unit.
		The company invests in product maturity to reduce warranty claims, but data on the performance of these products during the warranty period are managed by the support and services areas, so it will be necessary to collect more information from these areas.
INTECQUP13	Customer satisfaction	There are indicators to check customer satisfaction, but to check the results it is necessary to check with each specific BU (business unit).
INTECQUP14	Customer loyalty	The company has published reports; it is necessary to check the numbers in it in relation to customer loyalty.
		There is, however, a need to check with the "Retain Customers" value stream team of each BU.

Source: Prepared by the author.

Based on the secondary data, complementary data were observed for the present research in the items related to quality. In the document analysis, it is possible to observe—through the launches of new products made by the organization—that there is consideration of internal (project) and external (legislative) requirements. Regarding the performance of products and services—the units evaluating the organization's highly complex processes—it is possible to state that it performs a series of tests and, due to being a product of high complexity and responsibility, it needs to undergo a series of analyses; these should be undertaken not only by the company but also by regulatory agencies and even the customers.

The products launched in the last three (3) years have achieved the proposed objectives. An example is the multi-mission transport aircraft that achieved the objectives expected by the company and which has already been introduced in the national and international market, with subsequent sales for the organization. For the customer satisfaction survey, the organization makes use of MFA (multi-factor analysis) product and service delivery indicators. All business units have the goal of achieving a score of 7 (seven) and all of them have managed to achieve this grade in the last 3 (three) years. The company has a value stream called "Retain Customers", the objective of which is to generate the loyalty of existing customers. The company's contracts are usually long due to the high technological complexity of its products and the provision of specialized services that are required. In a way, it is possible to say that technology retains customers due to the fact that they are dependent on a specific and/or unique supplier. It was not possible to verify a consolidated

indicator on customer retention due to the fact that this information is decentralized. Table 7 presents a summary of the documentary evidence related to quality.

Table 7. Documentary evidence related to quality.

Evaluated Factor	Evidence
Compliance with internal (design) and external (legislative) requirements.	Organizational structure containing the areas that perform the mapping and studies of the requirements that are applicable to the products. The company's annual reports also include meetings with CETESB, health surveillance, federal/state police, ministries, mayors, municipal secretaries of education, class entities and Brazilian business associations for relations with regulatory bodies, routine inspections and compliance with legislation, survey of needs and expectations of the municipality related to education and social development, strategic and political discussions and greater integration and learning from various sectors.
	Presented indicators of reduction in COGS (costs of goods sold) resulting from implemented innovations fostered by innovation programs within the organization.
Performance of the product or service.	Data not made available by the organization.
	The company states in its annual reports that it invests a high amount annually in the technological improvements of its products and processes.
Customer satisfaction.	One of the values of the organization is that it exists to serve customers. In the company's reports, it is stated that surveys are carried out with the objective of determining the level of customer satisfaction. In addition, in the organization's annual reports, it is possible to observe that the company promotes events to listen to their customers, gathering data on their satisfaction with the products and collecting information that helps in the adoption of improvements in products and processes to improve the interface with the customer.
Customer loyalty.	Sales in 2020, 2019 and 2018 were BRL 19,769,193,000, BRL 21,994,560,000 and BRL 18,832,886.00, respectively.
	The company states that it has a customer loyalty plan. The organization is in key rankings for product support and customer support, respectively. This reinforces the organization's position in customer loyalty, which, according to the company, must be ensured at every relationship opportunity, from prospecting to after sales. The company has a support and service delivery area that, as stated by the company, was strategically created to leverage after-sales business, creating synergy between all business units, promoting efficiency and global performance and respecting the specificities of each segment and region, with a focus on thinking about tomorrow and retaining customer loyalty.

Source: Prepared by the author.

4.6.2. Pilot Test Data—Financial Results

The data referring to the financial results of the pilot test were not brought into this section due to the scope being changed to "Financial Results" after observations made in the qualifying exam.

4.6.3. Summary of Pilot Test Results

After conducting the interviews and document analyses, results related to the research theme were obtained. Based on the data collected, Table 8 was prepared.

Table 8. Summaries of results related to propositions.

Construct	Evaluated Factor	Observed Results
Quality	Compliance with internal (design) and external (legislative) requirements [28]	"Organization A" has formal processes in place to meet the requirements. For project requirements, there is a range of tests that the products need to go through due to the complexity of the products. Regarding market requirements, the company has a market intelligence team who are specialized in analyzing the requirements of different countries in order to meet not only national but also international requirements for the commercialization of products and services in these markets. In addition, the products are tested on a recurring basis and are only launched on the market after approval and certification by competent bodies.
	Performance of the product or service [28]	The company improves the characteristics of products/processes, for example, with equipment that lasts longer or is less detrimental to the environment. In addition, there are indications of changing features for a better customer experience, for example, noise reduction for a more pleasant journey.
	Customer satisfaction [12,40,41]	The company has satisfaction indicators, providing results within the expected parameters.
	Customer loyalty	The company builds customer loyalty, in addition to its performance, through the development of specific technologies; the customer becomes dependent on the company for maintenance, parts supply or various services.

Source: Prepared by the author.

The information presented in Table 8 about "Organization A" is analyzed in more depth, discussed and compared with the other cases and with the theoretical framework in the following sections of this study. In general, from the results observed in the pilot test, it is possible to confirm that technological innovation and its outputs can result in a higher quality of products and services and generate value for organizations. A fact observed during the data collection stage in the pilot test is that technological innovation generates products that, in some cases, are unique in the market; when the manufacturing company is the owner of the intellectual property, it becomes the sole source for the supply of products and services on such technology, as it is the only holder of knowledge about the solution, translating technological dependence into customer retention and, consequently, loyalty.

4.7. Conducting Field Research

A total of nine (9) interviews were conducted, one of which was the pilot test. The interviews were conducted with professionals who work in areas of the selected companies and their activities are directly linked to technological innovation activities. To ensure an appropriate sequence for the research, the following step-by-step instructions were followed:

(1) Authorization was requested from the company to carry out the field research, considering its business units and group companies as the units of analysis for this work.
(2) An invitation email was sent to employees who work in activities related to technological innovation.
(3) In the case of a positive response, the interview was scheduled and recorded.

(4) The data from the interviews were transcribed into text and the data were evaluated with the aid of the NVIVO® software. The analysis of the cases of the data was performed individually and was carried out in two stages: individual analysis of the cases and comparative analysis to verify the existence of common points.
(5) In addition, documents provided by the interviewees and annual reports published by the company on its website were evaluated.

4.8. Cases Presentation

Of the information attained about the companies, only that which was necessary in understanding the research environment and the results—as they relate to the analyzed phenomenon—were brought into this research. The companies were selected for the relevance of technological innovation in the group's business. In the analysis of the data, the company's level of competitiveness, the market in which it operates and, finally, the way it has been achieving its objectives considering the adversities of the economic environment and the market in which it operates in recent years were considered. The data for the presentation of the companies were collected from their websites or documents made available by the organizations.

4.8.1. Organization A

"Organization A" is a large Brazilian company (according to the classification in Chart 14, as it has more than 500 employees) with a global profile, with several units around the world. The company operates in different segments of the aeronautical market. The company's business is to generate value for its shareholders, customers, employees and society through ensuring the full satisfaction of its customers in the global aeronautical market. As its values—that shape attitudes and unite actions to ensure the perpetuity of the company—the company declares the following, among others: "Boldness and Innovation" and "Sustainable Future". By checking the organization's product portfolio, it is possible to confirm that the company is a manufacturer of highly complex products directly related to technology, in addition to being a provider of specialized services for the products manufactured by it. The analyzed company has already been recognized for winning PNQ (National Quality Award) awards; in addition, the company has several innovation awards. In 2021, for example, the company was nominated for the International Yacht and Aviation Awards 2021 for the innovation in design requirement. Thus, even before conducting this research, it was possible to state that the selected company meets the main requirement for being a unit of analysis of this research: to have activities that are directly related to technological innovation. The complexity and size of the organization make it an environment that is conducive to radical and incremental or even disruptive innovations (which are not the object of analysis in this work). The company states that it invests almost ten percent (10%) of its revenue in research annually, along with development, innovation and the improvement of industrial facilities; further, it reports that almost half of this revenue comes from significant innovations and/or improvements implemented in the last five years. Within "Organization A", the business units that are divisions within the company by type of "core business" were evaluated; the reflection of this division in the work was important to include in presenting the different perspectives of each area on quality and the respective financial results. Each business unit produces different technological innovations, has a different target audience and may perceive the results of technological innovation differently according to the environment to which it is exposed. For this reason, different results and points of view may be obtained in each of the areas, including different views on the financial results, because the company also segregates this information by business unit.

The first business area considered, "Business Unit 1", is the main one in the organization and the one that generates the most revenue. It sells aircraft for commercial use in passenger transport and has products that are recognized in the market which operate for their quality and reliability. In this segment, the company declares itself the third largest

in the world, being a pioneer in feature innovations in some products in its portfolio. The interviewed professional has a degree in electrical and electronic engineering and has been working in Organization A for approximately 16 (sixteen) years, with the last 4 (four) years being dedicated to the market intelligence area of UN1, as director of the department.

"Business Unit 2" also has a good share in the market in which it operates, which is recognized for its quality and reliability. This area sells executive-use aircraft, usually smaller ones that have a good position in the market. The interviewed employee has a degree in mechanical engineering. He has been working for about 7 years in Organization A, with approximately 2 years dedicated to the market intelligence area of UN2, currently playing the role of market intelligence executive.

"Business Unit 3" is linked to defense and security products, in which the portfolio goes beyond aircraft. Therefore, it is an area that offers a great diversity of products and solutions to its customers. The organization declares this area of the company as a leader in the defense and security segment in Latin America. The UN3 interviewee has been working continuously within Organization A for almost 22 (twenty-two) years. He has a degree in aeronautical engineering and is currently a specialist in market intelligence in UN3.

Finally, the company's fourth business unit is focused on the service sector. This area provides maintenance, training and after-sales support services for all platforms and solutions marketed by the company. The organization states that, in this area, there is a team that is highly qualified which makes use of digital platforms and ensures a high worldwide coverage of service centers for the convenience of its customers. The employee interviewed at UN4 is an engineer and currently works as an area manager. He has been working in Organization A for 11 (eleven) years.

4.8.2. Organization B

Created in 2009, "Organization B" is a Brazilian company involved in systems development and application of technologies. It is a company with about 300 employees, distributed throughout the national territory. It is a medium-sized company, with about 13 years of activity delivering technological solutions. The company declares that it operates in different sectors (for example, defense, traffic and air flow control, energy, instrumentation, nuclear, shipping, logistics, health, public management, public security, urban mobility and surveillance and monitoring, among others). The interviewee in Organization B has been working in the company for 24 (twenty-four) years, has a degree as a systems engineer and currently works in the area of business development.

4.8.3. Organization C

The third company, "Organization C", is the result of a joint venture between Brazilian companies; its activities are focused on the integration of space systems. It is a medium-sized company that declares itself to be a leader in the sector in Brazil, in which it provides satellite solutions for civil and military use. The professional interviewed in Organization C has been with the company for about five (5) years, working for the last two years as a commercial director, and has a degree in business administration.

4.8.4. Organization D

"Organization D" is, among the units of analysis, the newest and smallest company. It has been in business for a little over two years. It is a company with products and services that can be considered to be the most technologically innovative among the cases evaluated; it is focused on vertical-takeoff and -landing electric aircraft and urban air mobility infrastructure. The company states that it aims to accelerate the creation of solutions to make the urban air mobility (UAM) market a reality. The interviewed professional, representative of Organization D, is the current president of innovation and digital transformation in the group. He has a degree in chemical engineering and a master's degree in the area and has been working in the group for approximately nine (9) years.

4.8.5. Organization E

Operating since the 2000s, "Organization E" is the largest Brazilian company in the cyber security and digital fraud prevention sector. It is a medium-sized company with more than 400 employees. The organization declares that it is a company with constant research activities, occupied with the creation of new digital protection solutions. It declares that it combines technical expertise, solid methodology and high-quality technology to deliver a portfolio of more than seventy solutions. The interviewee of Organization E has been working for the company for approximately 19 (nineteen) years. He is currently the director of the business development area and has a background in business and information technology.

5. Results

This section presents the results collected in the field research, both during the interviews and in the documentary analyses. The subsections are divided by organization and then summarized by research theme to ensure good organization of the data.

5.1. Results of Cases 1, 2, 3 and 4—Organization A

"Organization A" was used for the "Pilot Test"; a professional who is currently the Manager of Innovation Strategy and Digital Transformation, and has been for just over two years, was interviewed. He has worked in the area of innovation in other recognized companies, in addition to having published academic papers on the subject. At the beginning of the interview, parts 1 and 2 were completed using the research instrument and then part 3 was initiated with questions about the outputs of the innovation activities and, respectively, about the research propositions. Table 9 summarizes the primary data collected on the outputs of innovation activities within the organization.

Table 9. Technological innovation outputs—Organization A.

Construct	Interview
New Products and Services	The company has a systematic process for innovation. It develops products considered disruptive, such as electric landing aircraft, vertical takeoff and that can be operated autonomously. In addition, the company has developed new products for existing markets, such as large aircraft for transporting large cargo and military missions, VIP executive aircraft and—in the field of commercial aircraft—recently completed the launch of a new generation of aircraft.
New Features for Products and Services	The organization promotes changes or adaptations in the characteristics of the products, according to the experience of the users. For example, business aviation has made design innovations based on user experience, such as the concept of sound and picture quality experience, interior seating and comfort. These changes have been made on the basis of customer requirements. There are adaptations to meet environmental issues; an example is electric or hybrid propulsion in the pursuit of generating lower emissions. In addition, there are adaptations that are made in the products to meet standards and regulations.

Source: Prepared by the author.

In addition to the answers from the interviews, the documents which are available on the organization's website were evaluated. Table 10 summarizes the evidence observed.

Table 10. Evidence of technological innovation outputs—Organization A.

Construct	Evidence
New Products and Services	On the company's website, it is possible to observe the launch of all the products mentioned by the interviewee.
New Features for Products and Services	On the company's website, it is possible to observe the launch of new versions of existing products, that is, the same platform with new features.

Source: Prepared by the author.

Regarding new products and services, the organization made its documents available; here, it was possible to observe that, in the last 3 (three) years, the company launched new aircraft platforms in the market; in addition, it has other products under development that are scheduled for launch in the coming years, whether as disruptive, radical or incremental technological innovations. Among the products launched in the last 3 (three) years, a large aircraft for multi-mission transport (largest aircraft ever manufactured in South America) stands out. The aircraft can be used for humanitarian support, medical evacuation, search and rescue missions, wildfire suppression and superior cargo and troop transport and drop capabilities, as well as in-flight refueling. Another revolutionary example is the launch of the company's executive aircraft platform, which was developed with the best flight experience in mind. This aircraft stands out for its comfort, low cabin altitude and an unbeatable range and offers the best performance in restrictive airports. There is also the first manned electric aircraft on the Ipanema platform, which is in the final stages of assembly: the technology demonstrator aircraft with 100% (one hundred percent) electric propulsion.

In addition, the company announced the launch of new products for the near future on its website. The company announced, for example, a partnership with another urban transport service provider to develop small vertical-takeoff and -landing electric vehicles for shorter urban commutes. The company states that the product is not only an opportunity to improve urban mobility but is also a new technology with the potential to improve performance and efficiency in a variety of aerospace applications. Another prominent product that is under development in the company is a new unmanned aircraft. It is possible to observe in the organization's reports and website that the processes are reviewed on a recurring basis in order to ensure efficient performance. These reports record initiatives related to the automation of processes and the addition of new technologies, such as the addition of digital tools into administrative, manufacturing and testing processes. The company states in its reports that it considers that one of the most important aspects in ensuring the implementation of the digital strategy is the human factor. To this end, the company conducts training on new technologies for employees in order to engage and train its employees in the subject.

For new products, services and processes, the company also invests in the improvement of existing products and services, generating new features for them. On its website, information was found showing, for example, that the company has a portfolio diversification strategy; also, it is starting to provide a new product recognized as an innovative solution in the market. In addition, the company has, among other R&D projects, initiated the development of a light transport aircraft with a hybrid engine. It has similar dimensions as old platforms in the transport of cargo and personnel and seeks to replace them, such as military and commercial aircraft.

In the company's annual report, published in 2019, it was verified that it is investing in the research, development, innovation and improvement of assets and facilities, in addition to providing instruments of differentiation in a competitive global market. The company also points out that the effort in these themes translates into the solid generation

of knowledge and technological solutions, in line with what is mentioned by [46], who cites technological innovation activities as a source of fostering new knowledge.

The company declares that, in 2018 alone, there were 93 (ninety-three) new patents published: 23 (twenty-three) in Brazil and 70 (seventy) abroad. In 2018, USD 313.8 million was invested in product development studies, technological improvements, agreements, partnerships and research at the company. For the years 2019 and 2020, no public reports on the topic were published by the company in its annual investor report. With regard to digital transformation and/or automation, it is possible to observe in the company's annual reports that there are internal initiatives that aim to develop improved efficiency, quality and agility. On the company's website, there is information that the company makes investments and uses automation technologies that are capable of ensuring the appropriate level of quality in a regime of high-production cadences. The company has invested in the digital area through a digital transformation office that has, among other purposes, the function of consolidating technologies such as the internet of things and artificial intelligence in the company's day-to-day operations. During 2018, five (5) projects were initiated, with a focus on administrative services and customer service.

The company has initiatives that foster incremental innovation and stimulate innovation activities through a program for employees. One of the programs receives suggestions for the development of routine activities and has already facilitated the participation of more than 13,000 (thirteen thousand) people; and, in 2016, 11,650 (eleven thousand six hundred and fifty) initiatives were implemented. There are also initiatives to stimulate ideas related to technology and innovation and to provide space for the consolidation of ideas. Today, the main initiative of this program is related to fostering an atmosphere of startups in the company; the program additionally assumes the role of catalyzing exponential technologies and identifying disruptive opportunities for the business. Within this context, the company also started immersion activities in the innovation hubs of Silicon Valley and Boston, in the USA. In addition, the company also promotes itself with the presentation of the main technological advances under development, which can be strengthened with integration of the various areas of the company. Regarding tax and/or financial benefits, in the latest report published by the organization, it can be seen that the company also allocates resources to innovation in Brazil; an example of this is its participation in initiatives such as the Aerospace Investment Fund (FIP), which allocated BRL 3 million to four companies with the objective of strengthening the national production chain in the aerospace and defense and security segments. Additionally, in the report issued by the company in 2018, referring to the results of 2017, the company states that, in the last 3 (three) years, the percentages of annual investment in technological development applied in projects for environmental gains were 78% (2015), 80% (2016) and 77% (2017) of its revenue.

5.1.1. Business Unit 1

For Business Unit 1, technological innovation activities were observed in different products. Innovation in this area is primarily focused on the following: product strategy; maintenance of participation and competitiveness in the market in which it operates; meeting the needs of customers; performing efficiently and comfortably; meeting the requirements of regulatory bodies. In Table 11, the main outputs of technological innovation identified in Business Unit 1 (UN1) are summarized.

In the interview, it was possible to ascertain that the company innovates with their different products and the characteristics of these products. A specific family of aircraft has undergone different types of innovation, including its characteristics, over the years. In addition to the launch of new aircraft and aircraft versions, the technologically innovative features are product improvements, such as better performance, lower maintenance costs and adaptation to the specific needs of customers, among others. After this stage of the interview, the "intangible" results of innovation related to the quality of products and services were evaluated. The summarized results are shown in Table 12.

Table 11. Evidence of technological innovation outputs—UN1.

Research Question Code	Evaluated Factor	Answers during the Interview
TECHNOLOGICAL INNOVATION OUTPUTS	The company/business unit develops new products and innovates in services or incorporates new features into existing products.	Not only within the business unit, but within the entire company there are technological innovations. The DT (Technological Development) team is always studying new products and new solutions. An example is the X family of aircraft. It is a product launched by the company and that has been updated in new versions since its entry into service, back at the beginning of this century. This aircraft is an example of an avionics system. There were improvements regarding the performance of the aircraft, when it was changed, for example, the wingtip, we changed other characteristics to improve consumption, we also made packages of intense improvements in the maintenance part. Other improvements that have been implemented are, for example, characteristics for landing at airports with specific characteristics, working on characteristics such as ascent speeds, different angles and different curves. So, challenges like this require innovations in various systems and, perhaps, other products to meet specific needs.

Source: Prepared by the author.

On the point of compliance with requirements, the interviewee mentioned that the requirements defined for the products are typically met, but the definition of the requirements can involve a vision of strategy and several negotiations. It is necessary to evaluate between what is possible, what the customer wants and what also brings a good result in terms of financial and strategic results for the company. Regarding product performance, an example was given: one of the products in its portfolio, after undergoing technological innovations in its characteristics, went from a market share of less than 50% to a market share of up to 80% due to the advantages observed by the market. Today, it can be said that the company is the only one in this specific market, because the competitor ended up not surviving with this reduced market share. So, a relatively small and even little-noticed innovation actually brought about a significant change in the competitive positioning of the product. As a good image of the technologically innovative product, the company ended up gaining satisfied customers and attracting new ones, in addition to ensuring the loyalty of existing ones.

A relevant point that was mentioned by the interviewee is that, when the company brings an innovation, it is often unaware of the problems that will arise in the technological innovation. So, of course, it is necessary to work to adapt, to solve the problems that were otherwise unknown. In addition, it is necessary to check in with the interests of the customers, to determine what the customers expect, to identify what the necessary improvements in the product are and to apply them effectively in this process of maturing the product. Table 13 presents a summary of the technological innovation outputs and financial results at UN1.

Table 12. Evidence of technological innovation and quality outputs—UN1.

Research Question Code	Evaluated Factor	Answers during the Interview
INTECQUP11	Compliance with internal (design) and external (legislative) requirements	It's the requirements and they're well defined. And when internal, the feasibility of achieving it is also considered. Because if you look exclusively at what the market wants, it's typically an inequality, as we all want the best thing possible, only as cheap as possible as well. That is not feasible. So it is necessary to find a balance between what is feasible, cost and adequate price, so that the customer is satisfied with the result.
INTECQUP12	Performance of the product or service	With technological innovations, product performance is usually improved. For example, the one on the wingtip of this plane. The company developed a wingtip that was very different from what existed until then in this class of aircraft. The performance of the aircraft in terms of fuel consumption has been considerably improved and this has brought about a repositioning of this product in the market.
INTECQUP13	Customer satisfaction	Using as an example a product that went through a more significant technological innovation, where we put a different generation engine, with an absolutely different technology. The company had enormous difficulty in introducing this new technology for reasons of gaining market reliability. It was the first time that someone was actually making an airplane with this technology and then, over time, all the other airplanes came with this technology and came with a better maturity, bringing a very important competitive differential.
INTECQUP14	Customer loyalty	The example given of the company's growth in a segment, becoming the only one in the market of that aircraft is an example of loyalty, as customers returned to buy or indicated/generated a network of satisfaction about the technologically innovative product.

Source: Prepared by the author.

Table 13. Evidence of technological innovation outputs and financial results—UN1.

Research Question Code	Evaluated Factor	Answers during the Interview
INTECRFP21	Profitability	There is no rule or trend about financial results, because there are solutions that are specific, precisely to reduce costs. It has solutions that are to increase the perceived value of the product.
INTECRFP22	Financial results (financial indicators—verifying investment and indebtedness)	As in the previous question, innovations are part of the organization's strategy, they can bring the maintenance of financial results, but there is no rule.
INTECRFP23	Growth in sales	Innovations are made with a focus on a significant gain in sales or profit for the business unit, for example, launching a new product to increase margin, in addition to sales growth.
INTECRFP24	Market Cap	Strategically, innovations are made for the company's survival, competitiveness, and increased sales and/or margin. There is no rule, as mentioned, but being part of a set of factors can be linked to the growth of the organization and, consequently, its market value.

Source: Prepared by the author.

Regarding profitability, the UN1 interviewee stated that technological solutions can have different strategies, but that these do not necessarily bring more profit. Different approaches can be carried out, for example, to readjust a product to a competitive environment that is often aggressive, or in a situation where the company is losing market share. And this act of repositioning the company is not necessarily made in the pursuit of more results. Sometimes, the company may accept only a minimal outcome at first, but in doing so, the company is ensuring that it survives and remains and competitive and relevant in the market. Innovation does not have a rule in the sense of return, as there is a business strategy behind it. Each technologically innovative solution that the company develops varies: some will bring better results and others will ensure the survival of the company. The interviewee also mentioned that, when the topic is innovation, the company may often seek to change their competitive positioning; here, something different is talked about, which the company is unaware of and is learning about, so the tendency is that there is a learning curve.

5.1.2. Business Unit 2

The interview for Business Unit 2 was conducted with a professional in the area of market intelligence who has a good understanding of issues such as defining requirements for new products or new functionalities for existing products. During the interview, it was identified that this area of operation of the company is responsible for high-quality, executive-use aircraft, which are recognized and well-positioned in the market, managing to maintain a good share in the market. Table 14 presents a summary of the technological innovation outputs of this business unit.

Table 14. Evidence of technological innovation outputs—UN2.

Research Question Code	Evaluated Factor	Answers during the Interview
TECHNOLOGICAL INNOVATION OUTPUTS	The company/business unit develops new products and innovates in services or incorporates new features into existing products.	The company has a series of products resulting from innovations, mainly in areas such as Commercial and Executive aviation, because Defense is a separate market, it is more complicated to develop new products, to innovate within defense. The company has different examples of new aircraft launched in recent years, as well as evolution of existing aircraft, in which the characteristics have been improved.

Source: Prepared by the author.

During the interview, two examples of the new aircraft launched for sale in the executive segment were cited, as well as specific developments in improving characteristics such as performance, landing in specific conditions, comfort and noise reduction. With regard to quality, Table 15 presents a summary of the responses obtained in the field.

The interviewee reflected that the area has met the external requirements of its projects and the result of this is the satisfaction of its customers and its performance in the market. In addition, the company and its products need to undergo tests and certifications from competent entities that are highly judicious, so that the products also meet external requirements, i.e., mandatory standards and rules for products and companies operating in this market. For performance, technological innovations are made with the objective of bringing a better performance, relative to fuel consumption, reduction in pollutants and other issues that generate greater customer satisfaction. Since the company carries out technological innovations with a focus on increasing the satisfaction of its customers, satisfaction is reflected by the increase that has occurred in its market share over the last few years and the reliability of the products before existing and potential customers.

Table 15. Evidence of technological innovation and quality outputs—UN2.

Research Question Code	Evaluated Factor	Answers during the Interview
INTECQUP11	Compliance with internal (design) and external (legislative) requirements	The requirements for innovative projects are shaped by the customer's needs, either to meet a specific situation or to generate better convenience and satisfaction. In addition, our industry is extremely demanding, with several requirements, tests and analyses and certifications that the product needs to pass and obtain in order to be marketed.
INTECQUP12	Performance of the product or service	The technological innovations that have recently been applied in aircraft already developed bring better performance to the product from the point of view of performance, be less polluting and bring greater comfort to passengers through noise reduction, for example.
INTECQUP13	Customer satisfaction	As mentioned in the previous example, the change in the aircraft for noise reduction is an example of improvement oriented towards customer satisfaction. There are other altered features or products created that are oriented to meet a specific customer need with the aim of generating user satisfaction.
INTECQUP14	Customer loyalty	Regarding loyalty, innovation is used to open markets, but companies that do not innovate end up being left behind, so in addition to opening new markets or winning new customers, innovation also allows you to keep existing customers.

Source: Prepared by the author.

From the point of view of loyalty, the interviewee mentioned that technological innovation, in addition to stepping into other markets, helps the company in maintaining existing customer loyalties. This is because specific developments in the characteristics of certain platforms ensure that the company are not left with outdated technologies. They continuously work on the improvement of existing aircraft solutions to ensure that they adapt better to the needs of the customers and to the rigorous standards that the products must meet. In turn, they undertake continuous improvement and are increasingly judicious. Table 16 presents evidence related to the financial results in UN2.

The results of the interview conducted at UN2 show that the financial results of technological innovation activities depend on the strategies of organizations. According to the interviewee, technological innovations can either result in profitability or not result in profitability; this is because they can be developed in line with other objectives, such as cost reduction, increased market share, increased visibility and added value on products. It may be the case that not all financial results are positive, because technological innovation may not bring profits, for example, but they may instead meet the company's objective of increasing its market share and gaining new customers.

Table 16. Evidence of technological innovation outputs and financial results—UN2.

Research Question Code	Evaluated Factor	Answers during the Interview
INTECRFP21	Profitability	The interviewee comments that not all technological innovations carried out have profitability as their main objective, some may have as their objective, for example, to expand the company's market share, but others may have the objective of increasing the profit margin, but it depends on the company's strategy. In the beginning, technological innovations can make the product expensive, but due to the added value, it brings a better result. And there are those innovations that are specific to reducing costs and bringing a better result.
INTECRFP22	Financial results (financial indicators—verifying investment and indebtedness)	Technologically innovative products bring significant gains to the business unit. Being seen as essential for the survival of the business. The financial results that can be observed are cost reduction, increased sales or simply maintaining the company's share and relevance in the market, keeping the business alive.
INTECRFP23	Growth in sales	It depends on the company's strategy for technological innovation, some may aim to increase sales value and market growth, others only to reduce costs, for example.
INTECRFP24	Market Cap	The company has increased its market share in the executive aircraft business and gained space in this market, consequently being able to influence its market value positively.

Source: Prepared by the author.

5.1.3. Business Unit 3

Business Unit 3 is a unit that is seen by the company as having more conservative products among all the units due to the characteristics of its products and customers. However, technological innovations are still present in this area. Table 17 presents a brief summary of the information collected in this interview.

UN3 highlights the launch of a new aircraft which was the largest aircraft ever manufactured in Latin America; in addition, the company launched different solutions in the market, which are declared by the interviewee to be "conceptual innovations", that open other markets; they do not neglect to consider the aviation market as the main market that the company occupies—a situation which will continue to be the case for a long time. Table 18 shows data collected in the UN3 interview related to technological innovation and quality.

According to the data collected in the UN3 interview, the interviewee's view is that the company cannot incorporate any requirement into the product or create a new product based on an idea that the customer does not want; this would be a recipe for the company's failure. There is little room for research to be conducted simply for the pleasure of researching something new and developing; this activity is usually performed in universities. In companies, research and development activities are linked to market success. There are deviations from one thing or another, sometimes in the DT (Department of Technological Development); this department carries out activities that are a little misaligned with the market—for example, the idea is usually born with an direction that is aligned with the market, and sometimes the market changes in the meantime before the activity is completed. These cases are rare, and most activities originate based on customer needs.

For the issue of requirements specifically, factors such as customer needs—which are largely a reflection of the country's needs—in addition to requirements or standards that arise, are considered in the UN3. To ensure such considerations, surveys are carried out to

determine whether a given functionality, product or solution will be an appropriate goal in serving the market.

Table 17. Evidence of technological innovation outputs—UN3.

Research Question Code	Evaluated Factor	Answers during the Interview
TECHNOLOGICAL INNOVATION OUTPUTS	The company/business unit develops new products and innovates in services or incorporates new features into existing products.	In the aeronautics industry, "Organization A" was the most prolific and most fertile company in the subject of technological innovation in the last 15 or 20 years in Brazil. The company has systematically launched different products in different markets. "Organization A" operates in a considerably broader manner than most other companies that, in my opinion, "Organization A" is the most capable of innovating, and is certainly able to maintain current products and incorporate innovations into those products. The company has been practicing this for a long time and you just have to look at the longevity of our products. An example of things that we have been bringing to the products to keep them current, since the launch of the X aircraft, several versions have been made. The X aircraft, which in the past also had several new systems to always be up to date. Another example is the X aircraft, which is both a conceptual innovation, but also the incorporation of innovative elements into an already established platform. The new version of the aircraft has undergone so many innovations that it is almost an entirely new design.

Source: Prepared by the author.

The company has only one example of failure, which is aircraft X; in the interviewee's view, this is a unique case within the company. Within UN3 and the company in general, products need to be innovative for survival—there is no other reason for this, in the interviewee's view. The products developed by the area exhibit very high performance and are highly technologically advanced.

Thus, the consideration of customer needs and innovating strategically in order to ensure a differential in the market and to be competitive are the economic factors that lead a company to succeed in the market—so, what leads a company to develop technological innovations, in the interviewee's view, is a matter of survival, simple as that. Table 19 below shows evidence of technological innovation outputs observed in organization A–UN3:

According to the UN3 interviewee, innovation activities within the company require investments, but the interviewee did not have an understanding of the organization's investment or indebtedness. Innovations are brought to products to improve their positioning, but this action is not static; rather, it is very dynamic. The company needs to always work to keep the product alive, active, desirable and holding its market share. The company uses the price factor and the volume factor to optimize its activity, and it may not be the aim to make a profit at first, but rather to establish itself in a certain market.

Table 18. Evidence of technological innovation and quality outputs—UN3.

Research Question Code	Evaluated Factor	Answers during the Interview
INTECQUP11	Compliance with internal (design) and external (legislative) requirements	There is a lot that is done because of requirements, certification standards and the need to make changes to something, sometimes because of legislation and sometimes because of world realities. The company today is developing a whole concept of aircraft, because of the need, for example, for environmental issues. The challenge is real, companies have to do their part, the market rewards this not only with recognition, but also with the purchase of products. Technologically innovative aircraft require investment to become environmentally friendly, economical, comfortable and effective. Then, the company meets mandatory requirements to start operating, be it regulation, customer, comfort issues, among others.
INTECQUP12	Performance of the product or service	In the 80s, the X aircraft introduced scimitar-shaped propeller blades to the market that no one used at that time, it was an innovation. Today, almost all airplanes use this type of aerodynamics in their propellers. We can mention that this type of performance-enhancing innovation has been in the company's DNA since it started operating. And it's not always an innovation like this, of the disruptive type, DT's technological innovation, they can be day-to-day innovation to bring benefits to the product, from modifications that improve safety and from the point of view of materials. From a manufacturing point of view, the introduction of automatic systems on the assembly line is formed by robots to improve uniformity and consistency in manufacturing. In addition, the software upgrades that we see in our cell phones and in our computers happen in airplanes as well, sometimes in electronics, sometimes in their own mechanics. The search for reducing fuel consumption for the customer to have more operating profit.
INTECQUP13	Customer satisfaction	As the requirements are aligned with the customer's needs, innovations usually bring satisfaction about the products marketed by the company and as we do this well and with quality we tend to succeed. However, success depends a lot on the market and the product must be well aligned with that. For example, in the Commercial or Executive Department, luxury or more comfortable items generate satisfaction, in the case of Defense, the reliability, robustness of the product and adherence to the missions of the Armed Forces generate satisfaction.
INTECQUP14	Customer loyalty	Defense, more specifically, depends on the local government for a new product on the market or with new characteristics to gain market share, if there is no local support, most likely these products will not be successful. Therefore, the product needs to be initially aligned with the country's needs and that the country's Armed Forces are customers, bringing and demonstrating the reliability of the products and opening markets. So it is not enough to innovate in the case of Defense, it is also necessary to have local support and proven reliability in the operation of the products sold.

Source: Prepared by the author.

Table 19. Evidence of technological innovation outputs and financial results—UN3.

Research Question Code	Evaluated Factor	Answers during the Interview
INTECRFP21	Profitability	The innovation activities are aligned with the company's strategies, which consequently is to make a profit. An example of profitability growth in sales is what happened at UN2 a few years ago, where there was a strategic change to keep the products technologically updated, decreased the number of planes sold and increased the price of the planes, reducing the market share, but obtaining a higher profit, so it is a set of factors that need to be aligned with the business strategy.
INTECRFP22	Financial results (financial indicators—verifying investment and indebtedness)	The company's competitors are doing the same thing all the time, so they bring elements to their products, to better position their products and our response is to do the same thing in order to meet the company's goals and strategies. Therefore, the financial results that will obtain positive results must be those aligned with these strategies.
INTECRFP23	Growth in sales	The company seeks to innovate to have products at a lower cost of materials or production or to sell more, but the result will depend on the business strategy, it is not only the technology element that is considered.
INTECRFP24	Market Cap	Innovation can influence the growth of the organization's market value, but the market value or not can also be related to other factors.

Source: Prepared by the author.

Therefore, in the opinion of the interviewee, the financial results related to innovation activities will depend directly on the company's strategy. The company can, for example, invest in innovation to increase its market share, its number of sales or its profitability. In the opinion of the interviewee, it is possible to use this as a support for growth, but the growth of the organization and its market value will also depend on other factors.

5.1.4. Business Unit 4

UN4 is responsible for marketing services for the products sold by the company. Table 20 provides a brief summary of the technological innovation activities that are involved in UN4. Table 20 below shows evidence of technological innovation outputs observed in organization A–UN4:

Table 20. Evidence of technological innovation outputs—UN4.

Research Question Code	Evaluated Factor	Answers during the Interview
TECHNOLOGICAL INNOVATION OUTPUTS	The company/business unit develops new products and innovates in services or incorporates new features into existing products.	UN4 cites as examples of innovation made by the company the launch of two specific aircraft in recent years, as well as specific solutions and requirements that have been changed as a result of improvements to existing products. In addition, the area is responsible for serving these new products or with new characteristics with services that are developed by the area, some services are specific to the type and size of aircraft or solution, for example.

Source: Prepared by the author.

From the point of view of technological innovation activities, the company carries out innovations; UN4 innovates to meet the demands of services for new products, solutions or new product features. Table 21 below shows evidence observed in organization A–UN4:

Table 21. Evidence of technological innovation and quality outputs—UN4.

Research Question Code	Evaluated Factor	Answers during the Interview
INTECQUP11	Compliance with internal (design) and external (legislative) requirements	The interviewee does not have access to details about the conformity of the products, but knows that there are strict quality criteria. The company works with Safety, Quality, Delivery and Cost (SQDC), which is one of the pillars of the company's products and services.
INTECQUP12	Performance of the product or service	The company needs to meet standards, for example, for gas emissions and noise. An example of this is Europe's airports, where many airports are very restrictive about noise. The company needed to adapt and carry out some technological developments to be able to suppress aircraft noise. So the main pressures in the area are those of new regulations. In these cases, the product must perform according to the standards because it is subject to a fine, so we have to ensure the performance of the aircraft within these parameters for the customer and these situations stimulated many developments of the company's products.
INTECQUP13	Customer satisfaction	According to the interviewee, customer satisfaction is built through the quality of the company's products and services. The company has been concerned from the beginning that the technologically innovative or a new feature is well accepted and is reliable for the market. In addition, it is not the value of the technology that will make the difference, but the gain it will bring to the user. The X aircraft is an example of this, it brought a performance gain, reduced fuel consumption and was very well received by the market. However, if the company launches a technology that causes problems in the field, it may not be well noticed, even bringing good performance results, for this reason it is necessary to take care to obtain customer satisfaction.
INTECQUP14	Customer loyalty	The loyalty of the services is achieved from the good service, which is born, according to the interviewee, from an adequate service or above expectations and reliability.

Source: Prepared by the author.

In business unit 4, the interviewee stated that the company is able to use innovations to ensure the better performances of products. In addition, the company invests in development because, according to the interviewee, there is little advantage to be held in having a team that works on new technologies and another that makes products—rather, it is necessary to have synergy.

It is necessary to have interaction, integration, involvement and constant communication between teams to provide a high-quality service so that the technologies show good performances throughout the product cycle and are accepted by the customer and the market. Table 22 below shows evidence observed in organization A UN 4?

Table 22. Evidence of technological innovation outputs and financial results—UN4.

Research Question Code	Evaluated Factor	Answers during the Interview
INTECRFP21	Profitability	The interviewee states that the area has innovation initiatives focused on cost reduction. An example of this was a machining and forming project that resulted in a more efficient use of aluminum and resulted in less waste, reducing costs. However, there are technological innovations with other focuses than cost reduction that can become, for example, the most expensive or time-consuming process.
INTECRFP22	Financial results (financial indicators—verifying investment and indebtedness)	The company has financial indicators that have fluctuated between positive and negative. The interviewee does not have access to the financial information arising from the innovation activities to clarify whether there may be any relationship or not.
INTECRFP23	Growth in sales	Sales of services grow as the sale of products increases.
INTECRFP24	Market Cap	The interviewee does not have access to information about the organization's market value. The information published by the company shows an oscillation in market values over the past few years.

Source: Prepared by the author.

5.2. Results of Case 5—Organization B

Organization B is a company that has solutions in which it makes use of its own development software and installs and configures it, integrating different devices (hardware). Table 23 below shows evidence observed in organization B:

Table 23. Evidence of technological innovation outputs—Organization B.

Research Question Code	Evaluated Factor	Answers during the Interview
TECHNOLOGICAL INNOVATION OUTPUTS	The company/business unit develops new products and innovates in services or incorporates new features into existing products.	The interviewee mentions that there is an area of innovation within the company and each business unit has activities focused on its segment. The corporate area supports the business areas in the technological innovation activities of the solutions. Carrying out proofs of concept, innovating some things in the command and control line and, sometimes, also internalizing what the technological development area produces. They were cited as an example of technologically innovative products developed in recent years by the company: the creation of corporate command and control solutions or air traffic defense and control.

Source: Prepared by the author.

According to the results collected in the interview, the company has an innovation area that centralizes the innovative activities within the organization. It is possible to recognize that the company carries out technological innovation activities because it develops new solutions that are focused on the technological area and carries out the continuous improvement of its solutions, developing new characteristics. Table 24 presents a brief summary of the evidence collected during the interview on the technological innovation and quality-related activities within Organization B.

Table 24. Evidence of technological innovation and quality outputs—Organization B.

Research Question Code	Evaluated Factor	Answers during the Interview
INTECQUP11	Compliance with internal (design) and external (legislative) requirements	The company declares that the solutions developed meet the delimited requirements that usually arise to meet customer needs.
INTECQUP12	Performance of the product or service	The interviewee did not indicate an improvement in performance due to technological innovation. In general, the company works on updates to meet customer needs and this would be the main focus of the solutions developed within the organization.
INTECQUP13	Customer satisfaction	The company invests in innovation with a focus on satisfying customers and bringing competitive differentials. The company also invests in after-sales to provide adequate service for the solutions developed, building reliability for its products in the market in which it operates.
INTECQUP14	Customer loyalty	The company states that throughout the operation of the solution, the company is usually responsible for providing after-sales services, as it is the company that has the knowledge of the technology, which there are few or no companies with knowledge in certain markets. In addition to factors focused on generating customer satisfaction, this can be considered another factor that generates loyalty.

Source: Prepared by the author.

The interviewee pointed out that the company usually seeks to develop its solutions to meet the needs of customers, so for a sale to be carried out, it is necessary for the company to effectively meet these requirements. Many of the organization's customers are government customers, where the company needs to meet the specific requirements of these agencies and those of the country in which the customer is located. During the interview, one point mentioned by the interviewee was that new products usually have a learning curve. Internal developments usually bring profitability to the organization; in external sales especially, profitability tends to be better, mainly due to favorable exchange rates.

In the strategic terms of market entry, an alternative option that is sometimes available is to reduce profit to make the product competitive; this enables the company to force their entry into a market in which it does not yet operate or to have a more competitive price than its competitors. In the domestic market, the company usually sells to government agencies through public tenders; to win this type of competition, it is usually necessary to reduce the margin. Table 25 presents a brief summary of the company's results for technological innovation and financial results.

Regarding the financial results, it is highlighted that the company has good financial results: profitability in recent years, exponential increase in sales, good liquidity indicators and low debt. ROI was a positive point identified within Organization B, which, over the years, resulted in indicators greater than two most of the time; is, it returned the amount invested with profit and increased its market value.

Table 25. Evidence of technological innovation outputs and financial results—Organization B.

Research Question Code	Evaluated Factor	Answers during the Interview
INTECRFP21	Profitability	According to the interviewee, the company's sales typically reach a standard profit margin, determined by the organization. However, this margin can vary according to the organization's strategy, for example, products for entry into a market tend to have a lower margin.
INTECRFP22	Financial results (financial indicators—verifying investment and indebtedness)	The company's indicators show financial health with growth in a few years. Even the return on investment indicators are considered good when compared to the other companies in the group.
INTECRFP23	Growth in sales	The interviewee reported that he has noticed a growth in sales in recent years, in which sales are aligned with the organization's goals. The company's reports show results in which there has been growth in sales over the past six years.
INTECRFP24	Market Cap	According to the company's reports, its market value has grown in the past three years.

Source: Prepared by the author.

5.3. Results of Case 6—Organization C

Organization C is a purely technological company, which was founded to develop a segment of specific, high-tech products. Table 26 summarizes the evidence that the company has technological innovation activities.

Table 26. Evidence of technological innovation outputs—Organization C.

Research Question Code	Evaluated Factor	Answers during the Interview
TECHNOLOGICAL INNOVATION OUTPUTS	The company/business unit develops new products and innovates in services or incorporates new features into existing products.	The interviewee mentions that the company, as a developer of space systems, works all the time with technological innovation. In the case of space product development, it is assumed that the company thinks well in advance about the product it will launch, because due to the complexity of the product it is necessary to develop it for specific needs and that its technology is still useful in the face of other technologies in the face of the deadline for its development, that is, it needs to have a vision of the whole and market trends. The interviewee mentioned during the interview that he has technological innovation in his vein and that he launched a totally innovative satellite developed by the organization and other technologies developed from preexisting innovations and knowledge.

Source: Prepared by the author.

The company mainly develops satellites for use in Brazilian air/space. The company has a satellite that was fully developed by the organization. From the data collected, the company's vision stands out: it states that, for technological innovation, it is necessary to always have a vision, to always be aware of what is emerging in the market—trends, opportunities and possible products—in the coming years. In addition, in order to have

value, innovation needs to solve a relevant problem; that is, when a creative innovation process is carried out, according to the interviewee, it has to be focused on generating a product or service that brings added value for those who are buying it. So, many times, a process of technological development is started with the view of a certain goal, but when the development activity is being carried out, the company begins to realize that other factors have emerged throughout the project; this is more or less the case with one of the products that the company has developed. "Product X", which is the first nanosatellite developed by the industry in Brazil, emerged as a validator of the technologies developed by Organization C. In other words, this product brings together a series of technologies developed by Organization C: embedded systems, on-board management software, attitude control and satellite pointing (altitude orbit). This allows the satellite, for example, to point to one side or the other when necessary to carry out certain missions. Thus, Table 27 presents the results for the technological innovation activities related to quality in Organization C.

Table 27. Evidence of technological innovation and quality outputs—Organization C.

Research Question Code	Evaluated Factor	Answers during the Interview
INTECQUP11	Compliance with internal (design) and external (legislative) requirements	The interview said that innovation is directly linked to meeting the customer's expectations and whether the product meets the customer's needs. When the product and/or service meets these requirements, it is considered by the company that it has quality and it did not happen that a product provided by the company was unsatisfactory and not accepted by the customer.
INTECQUP12	Performance of the product or service	The company has recent products that have not yet undergone improvement innovations, but the interviewee mentioned that the new products launched by the company have new characteristics to meet needs that were not met until then, that is, they have characteristics that the equivalent products in the market did not have until then.
INTECQUP13	Customer satisfaction	Since the innovations developed by the company are carried out to serve the customer, the answer is yes. The interviewee mentions that the company, together with the Commercial team, throughout the development and performance of the products, have ways of capturing feedback on what is being done, for this reason the products launched have a good return and achieve customer satisfaction.
INTECQUP14	Customer loyalty	Because it has recent technologically innovative products that are under development or in the beginning of operations for specific customers, there is currently no visibility on loyalty issues.

Source: Prepared by the author.

The interviewee pointed out that the definition of high, medium or low quality—when it comes to products—is another discussion, that depends on the analysis of other aspects. The fact is that the product needs to be efficient and solve a problem or achieve an expected result. In addition, to measure customer satisfaction, the company maintains continuous contact with the customer to understand whether the product is meeting their needs or not, and to what extent they need to make improvements; that is, monitoring of the product's performance is ongoing. From this close relationship, the company guarantees satisfaction and seeks customer loyalty. Table 28 presents evidence of the financial results arising from technological innovation activities within Organization C.

Table 28. Evidence of technological innovation outputs and financial results—Organization C.

Research Question Code	Evaluated Factor	Answers during the Interview
INTECRFP21	Profitability	The company does not have a positive track record of profitability. The interviewee commented that because it is a company that works with technology that requires investment, currently the company has found it difficult to source investments and obtain financing, it has used its results to carry out innovation activities.
INTECRFP22	Financial results (financial indicators—verifying investment and indebtedness)	The company has good short- and long-term liquidity indicators and low indebtedness.
INTECRFP23	Growth in sales	The company has fluctuated in the number of sales in the last five years, and there is no rising or falling line.
INTECRFP24	Market Cap	The company's market cap has increased when compared to the 2019 and 2020 reports, years in which the company declared its market value.

Source: Prepared by the author.

Organization C has positive financial results in terms of growth in market value, low indebtedness and liquidity. According to the financial statements published in recent years, the company has not made a profit and consequently does not have an ROI with positive results.

5.4. Results of Case 7—Organization D

Organization D was born out of a technologically innovative product and to participate in a specific new market. Table 29 presents a summary of the evidence of technological innovation obtained during the interview conducted with the professional in the area.

Table 29. Evidence of technological innovation outputs—Organization D.

Research Question Code	Evaluated Factor	Answers during the Interview
TECHNOLOGICAL INNOVATION OUTPUTS	The company/business unit develops new products and innovates in services or incorporates new features into existing products.	The group is perhaps one of the companies that has the most robust culture of technological innovation in Brazil. The group has a number of new products and services launched on the market. Some examples are the new large aircraft launched in 2019, the products related to urban mobility. In addition, there are software and parts developed by the company that can be considered more innovative than the new products themselves, as they are new technologies, bringing to the product characteristics that do not exist in other products on the market.

Source: Prepared by the author.

After observing the technological innovation activities carried out by the organization, according to the research protocol, we conducted a verification of the impacts of innovation on the quality of products and services. Table 30 summarizes the answers obtained from the interviewee on this subject.

Table 30. Evidence of technological innovation and quality outputs—Organization D.

Research Question Code	Evaluated Factor	Answers during the Interview
INTECRFP21	Profitability	The company deploys innovations that, in some cases, can be translated into greater profitability, not necessarily increasing sales.
INTECRFP22	Financial results (financial indicators—verifying investment and indebtedness)	Not necessarily. The company invests in innovations in its products with private capital or enters into partnerships for the development of new technologies or new products and solutions.
INTECRFP23	Growth in sales	Technological innovations are not always translated into growth in the number or value of sales. It may happen, for example, that as a result of the innovation of the portfolio the number of sales falls by 10%, for example, but in this same scenario it may happen that your profit rises by 10%. However, the company cannot stop innovating because the market is constantly evolving and those who do not adapt will be left behind and, consequently, face a drop in sales and a reduction in market share.
INTECRFP24	Market Cap	Historically, yes, the company is constantly growing its value in the market and its strategy as well as innovation activities are linked to this strategic growth plan of the organization.

Source: Prepared by the author.

During the interviews, the vision of Organization D—as a company recently separated from its headquarters—was influenced by the vision and activities carried out by the group. In Table 31, the results observed during the interview are summarized, regarding the view of the interviewee on the impacts of technological innovation activities and the financial results.

Table 31. Evidence of technological innovation outputs and financial results—Organization D.

Research Question Code	Evaluated Factor	Answers during the Interview
INTECRFP21	Profitability	The company deploys innovations that, in some cases, can be translated into greater profitability, not necessarily increasing sales.
INTECRFP22	Financial results (financial indicators—verifying investment and indebtedness)	Not necessarily. The company invests in innovations in its products with private capital or enters into partnerships for the development of new technologies or new products and solutions.
INTECRFP23	Growth in sales	Technological innovations are not always translated into growth in the number or value of sales. It may happen, for example, that as a result of the innovation of the portfolio the number of sales falls by 10%, for example, but in this same scenario it may happen that your profit rises by 10%. However, the company cannot stop innovating because the market is constantly evolving and those who do not adapt will be left behind and, consequently, face a drop in sales and a reduction in market share.
INTECRFP24	Market Cap	Historically, yes, the company is constantly growing its value in the market and its strategy as well as innovation activities are linked to this strategic growth plan of the organization.

Source: Prepared by the author.

5.5. Results of Case 8—Organization E

The company has three pillars of services: consulting, one-off projects and services of a continuous nature. The latter the company refers to as security services, in which the company monitors the customer's environment to some degree. The company is also integrated with other companies; here, the company presents solutions from other companies and resells the products. Through the implementation and continuous management of these products, the company has an extensive portfolio. Table 32 provides a brief summary of the evidence of technological innovation activities within the organization.

Table 32. Evidence of technological innovation outputs—Organization E.

Research Question Code	Evaluated Factor	Answers during the Interview
TECHNOLOGICAL INNOVATION OUTPUTS	The company/business unit develops new products and innovates in services or incorporates new features into existing products.	The interviewee points out that the company has a technologically innovative cybersecurity solution. This solution has been divided into three different service packages to best suit customer and market needs.

Source: Prepared by the author.

The company develops solutions for customers to solve cybersecurity problems. Usually, customers come to the company because they need a specific solution/technology, so the company realized that it needed to expand its portfolio and bought a company specializing in innovation. However, the company also develops its own products and markets the products as a whole to meet specific safety purposes. The interviewee commented that, from time to time, they need to update their portfolio to meet the demands of the market; the cyber security market has a great need for updating because it is dynamic and must meet the specific needs of each client's sector and business. Thus, the company always needs to develop its solutions, adapting and evolving as new threats emerge and evolve.

For example, the Security Operation Center is a service of a continuous nature and is a service that needs to be monitored all the time, 24 (twenty-four) hours a day, monitoring the customer's environment; this is because, if it is identified that someone is trying to attack their environment, then the company receives several alerts from internal and external systems. The company correlates these data in real time and applies some heuristics and rules to detect anomalous behavior. The company then alerts the customer every time to check whether an attack attempt is taking place. So, approximately every three years, the company needs to update its entire methodology as threats evolve. Cyber attackers also invest in technology, and their tools are automated, with investments in artificial intelligence; thus, new techniques of attack emerge, and these can be applied at a great scale (in several companies)—the cheaper the attack, the more profit the threat will obtain. This is the goal of cyber attackers, and the company deals with these situations to prevent them from occurring. Table 33 provides a brief summary of the observations related to technological innovation and quality.

During the interview, it was identified that the company constantly seeks to develop improvements to existing solutions or create new solutions; so, they work on the evolution of products and their portfolio, as this is an inherent characteristic of the market. As a product evolves, it tends to become very good, without any flaws. If product development takes too long, then the product can become obsolete, as the market evolves rapidly. The solution initially needs to meet the minimum requirements of the customer and market and evolve according to customer feedback. The company has performance indicators in terms of response time for the customer, to ensure that the solution is delivering not only the best solution, but that it is doing so within the requirements that are expected by the customer throughout the process. Most of the time, this indicator demonstrates that performance requirements are met. The Table 34 below shows the Evidence of technological innovation outputs and financial results:

Table 33. Evidence of technological innovation and quality outputs—Organization E.

Research Question Code	Evaluated Factor	Answers during the Interview
INTECQUP11	Compliance with internal (design) and external (legislative) requirements	The interviewee states that the company has two areas that are fundamental in verifying whether the project requirements have been met. The product management area is the people responsible for the product, they are the ones who talk to the marketing team, to the commercial, to listen to the market and understand what a value solution is, they are the ones who model these products and what are the requirements and characteristics that this product has to meet, In addition, they are the ones who interface with the technical team Operational Development to turn this fact into a product that stops standing. And there is a second team that is in the middle of the road that is called "customer success", this team has 2 objectives. The first is to ensure the success of our product at the time it was consumed by the customer to ensure that he will get the best out of our product, but also this team that receives the customer's feedback on the quality of what the company delivers. As the company works closely together, it currently ensures compliance with project requirements and external requirements, where applicable.
INTECQUP12	Performance of the product or service	The company has visibility into performance between time and the customer, so for all solutions the company determines with the customer for response times to ensure that it is delivering not only the best solution, but within the requirements that are expected by the customer from the door to the inside. This area that verifies performance is a new area, about three years old. Generally and historically, the company declares that it has always developed new products, evolved products together with customers to ensure excellent performance, a characteristic being the issue of response time to a customer who had a specific pain.
INTECQUP13	Customer satisfaction	The interviewee mentions that the company has made its customers satisfied with the solution it has delivered and is expanding its market share or entering markets that it was not before due to this construction of a good image about the solutions they deliver and their quality.
INTECQUP14	Customer loyalty	It is perceived by the company that the solutions delivered generate loyalty by maintaining and growing the market share in which the company operates, but no other formal indicators were mentioned.

Source: Prepared by the author.

During the interview, it was found that the company has grown over the last few years, but so has the market in which the company operates. For the interviewee, innovation is defined by building new things, but the company also innovated in giving a new "look" to the products it had already developed; that is, they remodeled the format of the packages which are received by customers, and from this change, the products became very successful. These new package formats have been accepted well by customers, but nothing in the solution has changed, only the way they are presented. Thus, in the opinion of the interviewee, it is not enough just to have the solution, but it is also necessary to understand how it generates value to reach the target audience and achieve success. With this approach, the company was able to attract new customers and reach international markets.

Table 34. Evidence of technological innovation outputs and financial results—Organization E.

Research Question Code	Evaluated Factor	Answers during the Interview
INTECRFP21	Profitability	The interviewee mentions that these new solutions that the company presents to the market usually bring a return that may not be expected. There is some difficulty from the point of view of presenting the value to the market. The company's reports for the past two years demonstrate that there is no net profit. However, the interviewee states that the company has been successful in developing new solutions and they are the ones that have leveraged growth. The company, for example, has tripled in size in the last 5 years.
INTECRFP22	Financial results (financial indicators—verifying investment and indebtedness)	The company demonstrated improved liquidity and reduced indebtedness in the last published report, when compared to the previous year.
INTECRFP23	Growth in sales	The company has achieved growth in sales in recent years, which is also due to the growth of the market in which it operates.
INTECRFP24	Market Cap	It was not possible to locate information on the company's market value in the published financial statement reports.

Source: Prepared by the author.

5.6. Results Related to Technological Innovation and Quality

During the analysis of the cases, in the interviews and in the document analysis, it was possible to observe that—within the organizations evaluated—there is an intersection between the results of technological innovation and quality activities in terms of meeting requirements and satisfying customers. Although the organizations have different definitions of what quality is (because the characteristics of the needs that must be met, the perceptions of the market and the aspects that generate value for the customers of each product are different), all of them consider it to be important to meet customer needs and to conform to the requirements of regulatory agencies. In other words, it is necessary to meet internal and external requirements, even if they are different and have different levels of demand; this must be carried out according to customer needs, legislation and the market, without any significant reworking occurring, according to the definition of quality made by [47].

In most cases, it was determined that technological innovation activities—corroborating what was seen in the analyzed literature—have a mutual main objective: to meet the requirements of the market or customer. These are considered inputs in technological innovation [45]. Table 35 presents, in summary form, a discussion of whether or not companies perform technological innovation activities according to the data collected in each unit of analysis (cases) and whether the examples of technologically innovative products and services (tangible outputs), cited by the interviewees, were found to be present.

It was found that all units of analysis (cases) perform technological innovation activities, either by developing new products or features for their product or by developing new solutions or services to meet the needs of new technologies developed in the market where they operate.

Customer satisfaction was the most-cited goal when the interviewees were asked why they felt innovation is necessary. This finding is in accordance with that which was presented by [12], who states that there are companies that work and generate innovation in a customer-oriented way, to meet their needs and thus generate satisfaction. Another recurrently mentioned point was that innovation is necessary to maintain the market position of the company or to bring differentials. In some cases, it was mentioned that innovation endows products with characteristics that became competitive differentials—for

example, improvements in the performance of aircraft and solutions. This is the case whether the change is related to issues of cost reduction for the customer or to greater safety, reliability, and compliance for customers.

Table 35. Summary of the technological innovation activities and the cases analyzed.

Evaluated Scope	Organization A Business Unit 1	Organization A Business Unit 2	Organization A Business Unit 3	Organization A Business Unit 4	Organization B	Organization C	Organization D	Organization E
If the company develops new product and innovates in services [28,41]	Yes, three innovations were cited during the interviews.	Yes, innovations in aircraft and new models have been cited.	Yes, the launch of an entirely new aircraft and various solutions were cited.	Yes, the unit creates new services to serve the products launched by the company. Three new aircraft, new features and new solutions were mentioned.	Yes, the company develops software for integration between systems.	The company develops satellites and has as an example of product the technological development the first satellite designed by the national industry.	The company was opened with the purpose of developing and manufacturing and marketing a specific innovative product that aims to serve a new market.	The company develops software and has intellectual property of cyber security solutions. The company exemplified three solutions developed by the organization for different security purposes.

Source: Prepared by the author.

As cited by [48], an increase in the sales of a certain organization may occur due to a positive or negative propagation, arising from the opinion of existing customers on the brand. Within this context, it was possible to observe, in some of the cases analyzed, that technological innovations ensure customer loyalty when there is—in addition to good product performance—adequate after-sales service, culminating in the construction of a positive image for the brand.

Furthermore, it was identified that, for new products and services, there is a continuous learning process; throughout a product's cycle, there may be a learning curve and product maturation. This was mentioned by some interviewees, and requires attention and care from the company so that there is a degree of responsiveness, with quick solutions being found to ensure greater customer satisfaction.

5.7. Results Related to Technological Innovation and Financial Results

During the interviews, when asked about the technological innovation activities and the financial results of their companies, in most cases, the interviewees answered that the technological innovation activities help—among other factors—to maintain the companies' competitiveness. They state that they are essential for the survival of the companies, corroborating with what is explained by [17], that innovation can aid in competitiveness.

The interviewees pointed out, in most cases, that the technological innovations developed by the organization helped in increasing sales and winning new customers, but innovation does not always perform well or bring the results that are expected from a financial point of view. It is necessary that these activities are aligned with the company's strategy and within the market trends in order to achieve success. Another point mentioned by the interviewees—which was not identified in the evaluated bibliography—is that, for an innovation to bring real value, it is necessary that it is developed within a certain timeframe, and that it adheres to the market needs when it is launched. This is because, if the solution misses this "time interval" of applicability, then it may be ready at a time when other technologies are available that provide the same solution, or it is no longer necessary.

Moreover, another finding is that the way the product or service is presented to the customer may be fundamental to the perception of value and acceptance in the market; for this, coherent planning and strategy may be essential in the success of the technologically innovative product or service. Amidst the economic scenario in Brazil in the past three years, it was possible to observe that not all the companies obtained positive financial

results; for this reason, the documentary analysis was extended to include the years prior to the last three years. Organization A, in the years before the COVID-19 pandemic and other economic factors that resulted in a market crisis, had more positive results in terms of profit and ROI ratios, lower debt ratios and a higher market value than it does now.

5.8. Results Related to Technological Innovation and Environmental and Social Impacts

The results identified in terms of social and environmental impacts were mainly related to the development of more efficient products with lower pollutant emissions, as well as the use of biofuels.

Social impacts were also identified in relation to the need to hire specialized professionals and to increase companies' investments in knowledge entities or partnerships with universities. In addition, the organizations are developing technologically innovative products that can positively transform urban air travel, contributing to better urban mobility.

The growth in the sales and market shares of these companies can also create new job positions in the countries where they operate.

Impacts of technological innovation on the environment and society were identified during the research, but the authors note that, in order to assess these aspects in greater depth, future work on these dimensions and further research are necessary, as more information remains to be explored.

6. Discussion

The technological innovation activities identified within the evaluated cases resemble the definitions of technological innovations suggested by [46], the Organization for Economic Cooperation and Development [4,11]. These cite that technological innovations meet the following descriptions:

(a) Any change in a given technology—for example, it is innovation that effectively creates products, services or processes, or improves existing ones [46].
(b) The introduction of technologically new products or processes and significant improvements that have been implemented in existing products, services and processes [11].
(c) The implementation of an idea for creating a new product, service or the introduction of new elements in a production or service realization process [4].

After evaluating these cases in organizations that carry out technological innovation activities, it was possible to determine whether the results are positive or negative. Regarding quality, it was possible to state that technological innovation can be directly related to quality in products and services. In most cases, the need to meet internal and external requirements was identified; additionally, we found there is a need for technological innovation activities to meet the defined requirements, being in line with [47] definition of quality. In the evaluated cases, it was determined that technological innovation results in the improved performance of products and services; this is similar to what was seen in the literature studied—innovation can be considered as a source for improvement [41].

Customer satisfaction was also found to be important in the cases evaluated. It was identified that there the following aspects are important: realization of customer-oriented innovations [12]; existing customer satisfaction analysis indicators with results within the expected parameters, as they relate to the quality of products and services provided [30,36]; strategies oriented toward meeting customer retention/loyalty needs through fostering customer satisfaction, reliability, solution maturity, high availability of products and services and specialized and specific technical knowledge to meet customer, market and legislation needs.

Regarding the financial results, some organizations showed negative results in certain periods, but checking the history of previous years, the companies showed that they had been performing well; occasionally, in the years 2020 and 2021, they had bad results that may have occurred due to external factors, such as the global economic crisis, the COVID-19

pandemic and the great impact of these circumstances on the commercial aviation market and the partners and customers of the organizations.

Quality, financial results and environmental and social aspects depend on the businesses' strategies, as well as the goals and what is considered to comprise quality from the perspective of each organization and its stakeholders. Figure 6 presents a consolidated summary of the results observed in the field for each case analyzed.

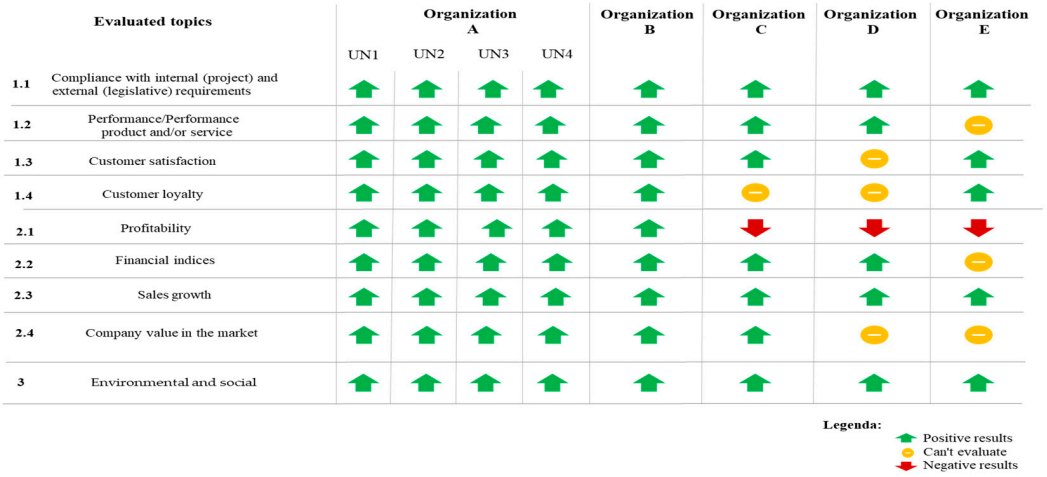

Figure 6. Overview of the results obtained for each case.

In summary, it is possible to state from the obtained results that organizations are impacted, in general, positively by technological innovation in the quality of products and services. In view of the points evaluated, it was possible to make the following observations:

(a) Organizations stated that, in most cases, the products and services that undergo technological innovation meet internal requirements (of the project or the organization) and external requirements (from regulatory bodies). The interviewees mentioned that the internal requirements must adhere to the customer needs and be aligned with the business strategy for the activities to achieve the results that are the goal of the organization. Another point on the theme is that the development of new characteristics must occur within a certain timeframe, because if the planned time is exceeded, then the innovation may become obsolete and no longer useful to the market.

(b) Regarding performance, the interviewees reported different technological innovation activities that had been carried out within the organization that resulted in a better performance of the products and services: reduction in operating costs/use of the solution; better performance regarding the reduction in fuel use; reduction in gas emissions; greater convenience for customers; the incorporation of new features to meet specific situations. For the improvement in the characteristics of products and services, it was mentioned that there is the possibility that technological innovations in the characteristics of products can generate a totally modified product which—when compared to the previous version—is even more efficient, despite the name for the product being kept the same on the market. It was stated by the interviewees that technologically innovative products and services may require a maturation and a learning curve to reach their best performance.

(c) Regarding customer satisfaction, it was stated by most of the interviewees that technological innovation activities originate mainly with the aim of meeting needs, resulting in customer satisfaction. As a result of satisfaction, some of the organizations that perform technological innovation activities pointed out the importance of the maintenance or growth of participation in certain markets in which they operate. Some mentioned the advantage of holding the majority of a specific market, resulting from

the construction of the brand image with products, solutions and services that satisfy their customers and that are reliable.

(d) Regarding customer loyalty, some of these companies have been in operation for a short time or have produced new solutions for specific customers; thus, it is not possible to assess long-term loyalty. Other interviewees answered that they observe customer loyalty within the organizations and that the companies seek customer retention through reliable and satisfactory products and services; the result of this can be verified by evidence of maintenance and market share. Furthermore, in the results of the interviews, it was observed that customer retention can be achieved through after-sales services; when developing a new technology, the company holds the exclusive knowledge of the product—in most cases—and are thus exclusively able to provide services, support, maintenance and the supply of parts and pieces during the product's or solution's life cycle.

Furthermore, in most cases, organizations can be positively impacted by technological innovations in their financial results. It is worth noting that success in meeting the requirements that are considered to constitute quality in the market in which the company operates and good financial results will not depend only on technological innovation activities and their outputs (tangible); it will also depend on other aspects, such as business strategies and the economic and financial situation of the market in which the company operates.

7. Conclusions

Technological innovation generates outputs that, as seen in the literature review, can optimize the results that are related to quality in products and services through the following functions: meeting the internal requirements of the technical specifications and/or the external market requirements (legislation); having the potential to improve customer perceptions of the company; retaining customers; generating value, through greater and better visibility for the brand image; leveraging sales; increasing profitability by reducing costs and/or increasing productivity; generating knowledge and ensuring continuous improvement in the organization.

The results obtained during the interviews and document analysis demonstrate that there are possible effects of the outputs of the technological innovation activities on quality: conformity to requirements; performance; customer satisfaction; customer loyalty.

Also, through the interviews and document analysis, the question of whether there are impacts—and what these impacts are—arising from the outputs of technological innovation in the financial results of organizations was evaluated and verified; it was observed that there is a potential influence of the activities and outputs of technological innovation on the financial results of the organization. These are positive or negative, and they are added to other factors, such as the organization's strategies and economic scenario, for example.

Furthermore, corroborating what was seen in the bibliography, other results that were observed during the research show that, as a result of innovation, there is the possibility of errors being made; this is due to the companies having little knowledge about new products, services or processes or new characteristics, which require a maturation curve that can culminate in investments with low or no initial return.

The changes resulting from technological innovation may even leave a customer dissatisfied when the form of use or operation is altered; its relevance is not easily perceived by the user. For example, the eventual need for customers to adapt to the new functionalities or service delivery modality is not easy and may lead to dissatisfaction among customers. Another point that was noted during the research is the need for training professionals to adequately handle the new tools; if there is no adequate training, then companies can be vulnerable to errors because employees are unaware of the new features arising from technological innovation; this can also generate low performance and waste.

Regarding the social and environmental aspects, the impacts of technological innovation were positive in all the organizations, resulting in more efficient products and services, products with fewer emissions, the use of biofuels, the promotion of specialized local

knowledge, and the creation of new positions; but these dimensions were not evaluated in depth and more information could be obtained in future studies or specific surveys around these subjects.

The limitations identified in this research include the low representativeness of the number of companies analyzed (considered as units of analysis) within the number of existing companies. In addition, the cases analyzed—despite being characterized as multiple cases by analyzing different companies—is limited to two countries (Brazil and the United States) and to specific segments in these countries. Another point is that the interviews were conducted only with professionals in the innovation areas. Perceptions of the clients, shareholders, suppliers and partners were not evaluated; this comprises a suggestion for future work to address.

Another limitation is that this work is qualitative in nature and based on the innovation perspective of the professionals from the business units and subsidiaries of the companies evaluated. Therefore, for future research, a quantitative or qualitative investigation should be carried out; this should expand the segments and regions of the analyzed companies and stakeholders to verify the correlation of technological innovation and the results mentioned in this work. Such research should also validate the data obtained in the field research. The possible contexts and inputs of technological innovation were used as a way to identify the processes and the possible outputs and results arising from the technologically innovative activities. However, the chain relationship is not the object of evaluation here and may be the subject of future research. Other suggestions for future research would be to relate the maturity of the organization in innovation activities with the results obtained from technological innovation within these companies; this could be related to the quality and financial results. It would also be useful to analyze different modeling approaches that make it possible to measure the impact of prospective innovations on the future development of companies, such as the application of economic growth models for this purpose, or the application of production functions to measure the specific impact of innovations when they are applied.

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