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A Measurement Strategy for Business Processes in Digital Transformation

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Abstract

Facing the current situation with the correct tools has made the difference between companies that have managed to adapt to current technological and social changes and those that are in serious trouble. Today more than ever it is evident that the digital transformation of companies is the best way to follow and these transformative processes have been streamlined. There has been talk for several years about the need for companies to go through a digital transformation. Today more than ever it is necessary to face this situation of global uncertainty, having the necessary tools so that businesses can adapt quickly to the new reality. Thus, a trend that cannot be ignored in any way is the rapid growth of ecommerce. Therefore, for any organization, it will be of great help to have tools that allow evaluating the pros and cons of carrying out this digital transformation process. Therefore, in this paper we present a strategy for measuring business processes in their digital transformation process.

1 Introduction

In Business Process (BP) definition, a global vision of the organization is presented. This vision allows a better understanding of the dynamics of the company and the relationships that exist within it and with its environment. This occurs both in the field that refers to customers, as well as their suppliers and / or service providers. Thus, through the use of different tools, such as business modeling, developments are aligned with the goals and objectives of the organizations.

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In literature, different conceptualizations of BP can be found, [1, 2, 3] to mention a few. Therefore, and in an attempt to standardize this concept, the Workflow Management Coalition (WfMC) defines a BP as:

> *A set of two or more procedures or linked activities that collectively perform a business objective or a political goal, normally within the context of an organizational structure in which functional relationships and roles are defined.* [4]

However, keeping in mind the various definitions of existing BP, it can be said that, normally, a BP: (i) is associated with operational objectives and business relationships, (ii) it can be contained entirely within an organizational unit or it can encompass different organizations, (iii) have defined conditions that trigger their initiation, (iv) produce defined outputs upon completion, (v) may involve formal or relatively informal interactions between participants, and (vi) may consist of manual and / or automated activities.

In addition to the traditional criteria to consider when analyzing and evaluating the quality and good performance of a BP, new criteria is introduced by the globalization of information and communication must now be added. Due to this, companies are looking towards the management of processes on the cloud and the need to carry out a digital transformation of their processes. In this sense, one must understand what a digital transformation means. In this regard, there are different proposals for its definition. Thus, in [5] the author proposes that a digital transformation can be defined as a *process that aims to improve an entity by triggering significant changes to its properties through combinations of information, computing, communication, and connectivity technologies*. From this, we can say that, from a business point of view, digital transformation is the integration of new technologies in all areas of a company to change the way it operates. The objective is to optimize processes, improve their competitiveness and offer new added value to their customers. To achieve this objective, it is necessary to have an ordered and controlled action plan that ensures the success of the transformation.

With these premises in mind, a study of the literature regarding related works was conducted. Thus, in [6] a methodology for designing a digital business model has been presented by bringing together best practices in digital transformation and business model designs. In [7] a digital transformation framework is proposed. Particular attention is paid to the monitoring system, which provides feedback for managing the processes of digital transformation of large socio-economic systems. Following this line of research, in [8] the authors present a toolkit for assessing the level of digital economy development in a country (Digital Economy Country Assessment, DECA), which can be used at various managerial levels to build and adjust strategies and plans for digital transformation. Closer to the proposal of this work, in [9] the author present a generic model for modeling and evaluating the digital transformation strategy, this work presented a methodology for characterization of the relevant dynamics and for building models to evaluate digital transformation strategies. In this proposal, the authors provide a guide to the steps to follow and what to take into account when developing a strategy to carry out a digital transformation in any BP.

The evolution towards digital is based on four fundamental pillars: technology, customer experience, corporate culture and business objectives. Thus, some entrepreneurs may feel overwhelmed by thinking of digital transformation as a radical change that they do not feel capable to assume in short term. In reality, digitization should be conceived as a gradual process according to the capabilities and needs of each company. It should be kept in mind that its implementation involves the involvement of all members of the organization.

From another point of view, the current and future business model must focus on the customer experience and the digital environment. To do this, the first step is to implement new technologies. In this sense, current software allows defining a digital strategy that involves all departments within an organization.

Some essential actions are the design of a customer life cycle map, the measurement of the results, the correction of errors in real time and the future planning according to the data obtained.

In short, digital transformation is not an objective in itself but is a process that requires an open attitude to change, emotional intelligence and the ability of adapting to a changing environment.

When analyzing and evaluating any system or process, exist different methods. The final mission of these methods is: *to decide which of all the evaluated systems adapts more to certain requirements and particular needs previously established*. In this sense, we can find different types of decision situations. Therefore, is necessary to have different types from methods to realize the evaluation of studied systems. In this sense, we can mention different proposals from evaluation and decision making methods. Among them, if exist two or more criteria in conflict and two or more alternatives of solution, say that it is before a problem multicriteria. This type of situations is most common in the real life. Diverse proposals of methods can be found to approach these situations. By example: (i) SAS – Simple additive scoring, (ii) MAVT – Multiattribute Value Technique, (iii) MAUT – Multiattribute Utility Technique, (iv) AHP – Analytic hierarchy process, (v) Outranking methods, between these methods stand out PROMETHEE and ELECTRE, (iv) LSP: **L**ogic **S**coring of **P**reference. In this proposal, we have chosen LSP because this method is applicable to different situations from the real life and was developed to support logic operators observed in the human reasoning [10]. This is fundamental in the evaluation of BP since in these processes, the reasoning and the judgment of developer is very important.

Under these considerations, and the study of related works, in this work a strategy that incorporates a quality model and a proposal to measure and compare previous and subsequent situations regarding a digital transformation is proposed. That is, to be able to evaluate the advantages and disadvantages of this transformation, through the use of metrics and indicators and well-established systems evaluation methods widely applied in different areas.

2 The LSP Method.

LSP is a quantitative method that allows establishing a ranking of different kind of systems. The first step in the evaluation process is concerned with: the establishment of the system requirements; the main system attributes and their possible values. These attributes are known as *Performance Variables*. Each one of these variables is mapped into an *Elementary Preference* when applying to him the corresponding *Elementary Criterion.* An Elementary Criterion is a function that transforms the obtained values of a Performance Variable into values in interval [0, 1].

The Elementary Preferences constitute the parameters of the LSP Criterion Function. This function returns a unique global value. It represents the satisfaction degree of the system requirements. The function is built combining the Elementary Preferences. In other words, a group of Elementary Preferences is replaced by a unique Elementary Preference. It indicates the satisfaction degree assigned by the evaluator to the group of Elementary Preferences of input. In order to calibrate the LSP Criterion Function, the requirements of end users must be considered. The calibrated process represents the most complex phase of the evaluation.

The Global Preference *E0* is the Criterion Function output. For obtaining this value, the Elementary Preferences are combined considering their relative importance and one logic relationship among them. This logical relationship is obtained through the creation of the logical aggregation structure. This structure includes the weights and operators available in the Continuous Logic of Preferences and is obtained from the performance variables and their combination with the Aggregation Functions. The aggregation structure calibration is accomplished considering the aggregation functions characteristics. In this context, function C is the minimum (Pure Conjunction) and function D is the maximum (Pure Disjunction). The intermediate values are covered by a sequence of Continuous Logic Operators: C, C++, C+, C+-, CA, C-+, C-, C--, A, D--, D, D-+, DA, D+-, D+, D++, D. Each operator has associated a specific value of *r* (a LSP parameter) used to adjust the function logic properties. The combination of

several aggregation functions produces a tree structure. This structure is employed to obtain the global indicator. Once the aggregation structure was calibrated, each system can be evaluated. The input to evaluation process is a set of Performance Variables *X1,....., Xn*, and its result is a Global Preference. This last value is produced for each evaluated system.

To be able to develop an exhaustive list of the requirements a hierarchical decomposition process is needed. First, the requirement groups must be defined and then each group is decomposed in sub-groups. This process is repeated until the *System Requirement Tree* is obtained. The tree leaves represent the *Performance Variables*.

The *aggregation of preference* can be applied when the Requirement Tree is built. The result of this process is a new tree structure: *Logical Aggregation Structure.* This process begins aggregating elementary preference groups. In this way, the Performance Variables, obtained from the leaves of the Requirement Tree, are aggregated in new preferences. This bottom-up aggregation process continues until obtaining a unique global preference. This preference relates all the partial preferences. The aggregation of the Elementary Preferences, $E_1,\ldots\ldots, E_n$, in a unique preference E is carried out using the average as defined by Dujmovic et. al. in [11, 12]. It is important to notice that this result can be interpreted as the satisfaction degree of all requirements.

3 The Proposed Strategy

The proposed strategy is used to monitor business processes and customer loyalty in an organization. To do this, the following actions could be carried out:

Predictive Monitoring: Predict future states, results or properties of one or more instances of a process.

Prescriptive monitoring: Recommend actions in real time to improve process performance.

Thus, to achieve its objectives, the proposed strategy establishes the following actions and elements to follow:

1°) Define a requirement tree that will act as a Quality Model in digital transformation. In this sense, the requirement tree proposed is shown in Figure 1.

1. Customers
    - 1.1. Profits by customers
        - 1.1.1. Period
            - 1.1.1.1. Monthly
            - 1.1.1.2. Quarterly
            - 1.1.1.3. Biannual
        - 1.1.2. Amounts
            - 1.1.2.1. Purchase order
                - 1.1.2.1.1. Wholesalers
                - 1.1.2.1.2. On average
                - 1.1.2.1.3. Minors
    - 1.2. Customer stay period
    - 1.3. Customer satisfaction
        - 1.3.1. Products
        - 1.3.2. Services
    - 1.4. Customer types
        - 1.4.1. Permanent
        - 1.4.2. Habitual
        - 1.4.3. Sporadic
        - 1.4.4. Casual
    - 1.5. Types of Visits
        - 1.5.1. Visit with transaction
        - 1.5.2. Visit without transaction
2. Company
    - 2.1. Investment in Sales in a Period
    - 2.2. Investment in Marketing in a Period

Figure 1: Requirements Tree

2º) Use metrics and indicators (defined and reused). Some of them are presented as example.

Cost of Acquiring a Customer (CAC): This ecommerce metric will serve to obtain the average cost of each ecommerce customer and also to know the profitability of marketing actions.

The **CAC** is calculated by dividing everything **invested in sales** (any action that aims to attract more sales) and **marketing** during a given period by the number of customers that have been achieved during that time.

Metric	Indicator	
CAC= (TIS + TIM)/NCP	100	CAC = 1
Where:	75	0,75 < CAC < 1
TIS = Total Invested in Sales	50	0, 50 < CAC <= 0,75
TIM=Total Inverted in Marketing	25	0, 30 < CAC <= 0,50
NCP = Number of Customers in a Period	0	0 <= CAC <= 0,30

Customer LifeTime Value (CLTV): It is one of the most important ecommerce metrics. The Customer Life Time Value represents the total revenue that the user has generated in an electronic commerce since its registration.

It is determined by multiplying the average profit that the customer has generated in a year by the number of years in which it is a customer, subtracting the cost of acquisition (CAC).

Metric	Indicator	
CLTV = ACPP * CS – CAC	1	CLTV >= ¾ Inversion
Where:	0.75	½ Inversion <= CLTV < ¾ Inversion
ACPP: Average Customer Profits per Period	0.40	Inversion <= CLTV < ½ Inversion
CS: Customers seniority	0	CLTV < Inversion
CAC = Cost of Acquiring a Customer		

Conversion Rate (CR): In general, when someone refers to obtaining buyers from an online store, they usually talk about the **conversion rate**. These ecommerce metrics serve to express as a percentage the **number of visitors** who were converted to buyers.

Metric	Indicator	
CR = NBV / NV	100	CR = 1
Where:	75	0,75 < CR < 1
NBV = Number of Buyer Visitors	50	0, 50 < CR <= 0,75
NV = Number of Visitors	25	0, 30 < CR <= 0,50
	0	0 <= CR <= 0,30

Return of Investment (ROI): At commerce in general, it is said that it is more profitable to keep a customer than to get a new one. For this having a good ecommerce metrics dashboard is a big help. Many online stores make the mistake of calculating the return on investment of their ecommerce by taking as a sample the data of a single sale. To know exactly the economic value that a customer represents for the company, the ROI must be calculated based on all the purchases that the user has made, that is, the customer lifetime value (CLTV) must be taken into account.

Metric	Indicator	
ROI = (CLTV) / (TIS + TIM)	100	ROI = 1
Where:	75	0,75 < ROI < 1
TIS = Total Invested in Sales	50	0, 50 < ROI <= 0,75
TIM=Total Inverted in Marketing	25	0, 30 < ROI <= 0,50
CLTV = Customer Life Time Value	0	0 <= ROI <= 0,30

Conversion rate according to traffic source: The conversion rate for each of the sources and its evolution must be analyzed. For example, variations that, according to ecommerce, produce incentives, depending on time periods or even days of the week.

Percentage of new versus recurring visitors: A healthy ecommerce must grow in recurring users. Recurrence is one of the keys to the profitability of an ecommerce, in addition to managing affordable CAC for the business. If users do not return or you do not have a CRM system in place, there will be

problems to survive.

Evolution of direct traffic: An increase in direct traffic means **greater brand recognition**. *Users who already know me should buy more from me*. If there is a low conversion rate in this section, you may have usability problems.

Average Order Value: It is very important to see the evolution of the Average Order Value (AOV). For example, discounts can drop the average ticket; However, it is possible for buyers to add more than one product in the same transaction, by working well with cross-selling and recommendations.

3°) Use LSP to carry out the evaluation and comparison of the preceding and following business state after the digital transformation is done.

4 Case Study

It is no secret to anyone that, as a result of the current health situation, the way of living day to day has changed. This affected all sectors of the economy and new processes and new ways of doing things had to be developed.

Resilience in the current situation has been a key, it has led us to adapt and develop new routines and ways of living day to day. The governments of the countries have implemented new sanitary processes, so the import and export of different materials has seen an evolution in its chain of operation.

In this reality of global confinement, it was necessary to adapt business processes to the new reality. A company in the middle had to adapt to the new model of digital transformation in order to keep its products on the market. There was a large amount of data, but in addition to analyzing and studying it for decision-making, the organization had to be completed and perfected with regard to the digital world. The data is useful, but sometimes we can be looking at some irrelevant metrics and losing sight of the most important ones. With the application of the proposed strategy, this problem could be addressed. With the use of metrics and indicators suitable for ecommerce and the use of a quality model focused on the customer and the company, comparisons of the instantiation of the quality model could be made to the same period in previous years and with the current reality.

To do this, as a first step, the quality model had to be instantiated keeping in mind the two characteristics of the requirement tree proposed by the strategy that establish the customer-company relationship, and the collection of data and information through the metrics that constitute the metrics dashboard of the proposed strategy.

The strategy allowed an organized measurement and analysis process. The quality model defined and reflected in the requirement tree (Figure 1), allowed to individualize the characteristics and sub-characteristics that were of interest for the application of the metrics and indicators of the metrics board that is part of the proposed strategy.

Within these characteristics, one of the most important for the organization is represented in item “1.5. Types of visits”, as it refers to customer visits to the company, and one of the main interests of the company was to know the degree to which new visitors became new customers with the digital transformation. To get an idea of this, with the available digital tools, the indirect metric CR was calculated. For this calculation, the NVC and NV metrics were used.

These metrics are directly applicable. But it was not enough just to know the number of each type of visits, but it was necessary to have a clearer idea of how these visits affected the organization. Therefore, it was necessary to differentiate between visitors or potential customers. By having a modality adapted to the circumstances of the pandemic, it was possible to carry out after the first months, a study or analysis of the situation with respect to the customer portfolio. For this, the entire organization had to be adapted with all the resources and tools and implemented new techniques or strategies to face the new market reality. At this point, digital channels began to be used to continue

with the organization's operations.

In 2019, the customer portfolio was 5,000 customers. The current business requirements make it essential to be able to categorize customers by period of permanence in the company and by amounts of operations with the company. These characteristics can be viewed in item “1.1. Profits by customers” and the sub-items “1.1.1. Period” and “1.1.2. Amounts” from the requirements tree (Figure 1).

Actually, with the use of the CR metric, it has been possible to simplify the traceability work through the sales department and the cross-linking of customer inquiries. With the registration and / or individualization of each of the visitors, it was possible to observe the degree of return to the company's website. In addition, the use of the sales application, through a counter of visitors to the site, allowed keeping track of customer loyalty.

As for the company's customers, in the first two months of the pandemic it was observed that their purchase levels fell. Thus, it was thought that the new business modality could be complicated when faced with a new paradigm that made transactions difficult. With the implementation of a specifically dedicated phone, some of the customers were recovered. Meanwhile the number of visits rose, but not the conversion to new customers. If customers did not buy more and, in a high percentage, did not maintain the amount of usual purchases, it could be because *"the problem must be ours"*, or that at the competition level they were proposing a better offer or that the digital channel had certain faults or problems.

Using the item “2. Companies”, and with regard to the subitems “2.1. Investment in Sales in a period” and “2.2. Markenting Investment” in a period, the TIS and TIM metrics were calculated in the period of the first quarter of the year 2020. An investment in terms of sales of $1,500,000 and the investment in marketing of $15,000 are obtained.

Using the item “1.4. Customer Types” it was intended to study the exact number of customers achieved in the first quarter of 2020. Items 1.4.1. to 1.4.4. of the requirements tree (figure 1) allowed accounting, through the metrics NPCp = 6500 (NPCp: Number of Permanent Customers per Period), NRCp = 1900 (NHCp: Number of Habitual Customers per Period), NSCp = 1100 (NSCp: Number of Sporadic Customers per Period) and NCCp = 2500 (NCCp: Number of Casual Customers per Period) the total number of customers for the period. Therefore, the indirect metric NCP = NPCp + NHCp + NSCp + NCCp yielded a value of NCP = 12000. With this information, the cost of acquiring a customer was calculated through the metric CAC = (1,500,000 + 15,000) /12,000 = 126.25.

Taking into account the requirements of “1.5. Types of visits” and more precisely using the indirect metric: NV = NVWT + NVT; Where: NVWT: Number of Visits Without Transaction – NVT: Number of Visits with Transaction, it was observed that, in 2019, NV = 8600 given that NVWT = 4600 and that NVT = 4000. The number of visits without transaction (NVST = 4600) was striking. At this point, consultations with marketing professionals and computer equipment were made and the conclusion was reached that usability with regard to the understandability and comprehensibility of digital operations, according to how these properties are defined in the quality model of ISO 25010 [13], it was not clear enough. The metric of the evolution of direct traffic corroborated that there was a usability problem. Once the problem was solved with the improvement of the software and the adequacy of its usability, the following result was reached when the measurement was carried out during the same period of 2019, 2020 y 2021.

2019			2020			2021		
Visitors (NV)	**Customers (NVT)**	**CR = NVT/NV**	**Visitors (NV)**	**Customers (NVT)**	**CR = NVT/NV**	**Visitors (NV)**	**Customers (NVT)**	**CR = NVT/NV**
8600	4000	0,465	12000	7500	0,625	13858	9375	0,676

Visits increased in 2020 by 39.53% compared to the same period in 2019. This was verified with statistics of sales carried out and inquiries to the public service section in 2019. In 2020 and Even with a reserved health status, the number of clients has increased by approximately 87.5%. In the year 2021 compared to the year 2020, the clients have increased by 15.48% while the visits in the periods 2019-

2020 and 2020-2021 are increasing. This glimpses a substantial improvement in operations with customers.

After the digital transformation of the business, with the data and information collected, it was possible to complement what, at the time, was recorded as profit only, that is, now it could be carried out, through indicators such as ROI, the measurement and evaluation of the amount consumed or spent by each of the customers and how it corresponded to the investment made by the company in terms of advertising and operating expenses in general. This precision contributed to the possibility of sectoring customers with regard to their expenses, and being able to give them a more precise treatment by amounts and quantities of operations, which in previous periods was only carried out in a general way.

By having the categorized customers (Figure 1: 1.4 Customer Type), the company wanted to implement a business policy that would focus on each of the customer categories. Therefore, it was necessary to compare the ROIs of each category. For this, the ROIc metric was applied to each customer category:

ROIc = $\sum$ (CLTVi) / (TIS + TIM)
Where: TIS = Total Invested in Sales – TIM = Total Invested in Marketing
CLTVi = Customer LifeTime Value for Customer i

Obtaining the following results:

	2019				2020				2021			
C. type	**Perm.**	**Hab.**	**Spo.**	**Cas.**	**Perm.**	**Hab.**	**Spo.**	**Cas.**	**Perm.**	**Hab.**	**Spo.**	**Cas.**
ROIc	0,56	0,20	0,026	0,013	0,66	0,165	0,26	0,19	0,73	0,18	0,34	0,23

In order to determine the degree of improvement from the established changes, the LSP method was applied to carry out the comparison of the results obtained in the measurement process. Thus, taking the aggregation structure defined in the strategy for the requirements tree, he focused on the evaluation of preference 1.4. Customer Types (Figure 2).

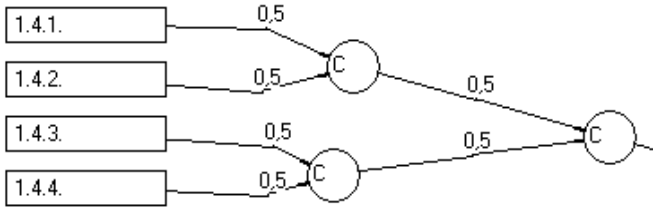

Figure 2: Logical Aggregation Structure of Preference 1.4.

Thus, the results obtained for 2019, 2020 and 2021 during the same period were compared. In Figure 3, the results of this evaluation are shown.

From the observation of the results obtained, it can be seen that, during the period studied in 2020, a higher score was obtained, which indicates that the changes and improvements introduced produced the expected results, in terms of the new customer acquisition strategy. In the year 2021, although the variation is positive, it is lower with respect to the variation of the index of the year 2020. This reflects a stabilization of the indicators and, therefore, improvement of the business processes.

In conclusion, it can be said that an ecommerce manager can boast the number of visits or page views, a classic in Analytics. However, if actionable metrics in ecommerce are needed, it is necessary to go further, due to that it was necessary to define a strategy that considered attributes, metrics and indicators, thinking about the success criteria established by the organization.

Preferences	Weight	Year		
		2019	2020	2021
1.4. Customer Types				
1.4.1. Permanent	0.5	0.56	0.66	0,73
1.4.2. Habitual	0.5	0.20	0.165	0,18
C	0.5	0,33466	0,33	0,36249
1.4.3. Sporadic	0.5	0.026	0.26	0,34
1.4.4. Casual	0.5	0.013	0.19	0,23
C	0.5	0.01838	0.22226	0,27964
C		0.07843	**0.27082**	**0,31838**

Figure 3: Evaluation of Item 1.4.

The number of visits if it is not crossed with the conversion rate is meaningless. It is possible to have poor quality affiliate traffic and believe that important branding work is being done. Once the products that arouse the greatest interest have been identified, a personalization system for ecommerce can also be implemented that will help offer products and services related to their purchases.

Data is nice, but sometimes this can cause some metrics that are not relevant to be analyzed and the most relevant indicators for our business are lost from sight. The strategy allowed, as presented in the case study, to evaluate part of the requirement tree to make decisions regarding the interest of management, such as where the marketing campaign should be directed to improve sales, considering the type of client, purchase amount, etc. Having the requirements of the market, company and business policies grouped in a strategy together with a set of metrics and indicators with the possibility of comparative evaluations, is a small contribution for companies in the environment that are looking for the much desired and necessary digital transformation.

5 Conclusions

Continuous improvement of processes is a fundamental tool for all companies because it allows them to renew or improve their BP. This implies a constant update that makes organizations more efficient and competitive. Therefore, designing and creating a profitable business model was one of the keys to the success of any ecommerce, but to know its profitability it was essential to always measure the results and know where to put the efforts; know, in short, the main metrics in ecommerce. Running an ecommerce store can be a very hard work. Many times a lot of money and time is invested in increasing the number of visits. The problem was, how are these results measured? To do this, a strategy was defined that consists of creating a quality model, applying metrics and indicators from the ecommerce measurement dashboard and using a multi-attribute evaluation method that would allow to understand better the users of the online store and optimize the sales.

With this strategy, the characteristics and sub-characteristics that conditioned the company were captured. Also the technological advances and market needs were taken into account. The socio-economic moment of pandemic modified the business rules, the goals and objectives of the organization had to be redefined in order to adapt and remain competitive in the current market. This made it necessary to update and/or redefine some criteria for success, expected benefits, inconveniences or unforeseen, costs and risks with the digital transformation strategy. As well as taking into account the characteristics of other corporate policies and tools that supported the digital transformation strategy.

Regarding the benefits of its use in the company, interesting things emerged such as being able to evaluate customer status, sales, orders, etc. at different times and periods of time. In addition, through the aggregation functions of the evaluation method proposed in the strategy, changes could be made in the restrictions to analyze certain success criteria. This facilitated the monitoring of processes through metrics and indicators, and being able to act in a predictive or prescriptive way to continuously improve the organization's business processes.

In the continuation of this research, work is being done about the incorporation of characteristics that allow measuring the sustainability of the impact of the digital transformation of business processes.

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