ARTICLES

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PROCESS INTEGRATION MODEL AND ARTIFACTS CONSISTENCY ASSESSMENT IN MANAGEMENT SYSTEMS

Modelo de integração de processos e avaliação de consistência de artefatos em sistemas de gestão

Modelo de integración de procesos y evaluación de consistencia de artefactos en sistemas de gestión

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ABSTRACT

This research aimed to develop a management model to increase the capacity of integrating processes in the human resources area in a large Brazilian service organization. The research used a qualitative and quantitative approach to analyze data from the organization's value chain and to evaluate the consistency of integrations and artifacts mapped in light of stakeholder requirements under the theory of constraints. Among the main results, two scales were developed to measure organizational consistency: a) validation of the level of updating of artifacts; and, b) diagnosis of technological adherence. With the model, all 16 organizational subsystems of the context, 142 artifacts and 666 integrations were mapped. The applied model resulted in significant global gains in the processes' integration of the researched value chain.
Keywords: integration, process, artifacts, requirements, validation.

RESUMO

A pesquisa teve como objetivo desenvolver um modelo de gestão da capacidade de integração de processos na área de Recursos Humanos em uma grande organização brasileira que integra uma rede global de prestação de serviços. Utilizou-se de abordagem qualitativa e quantitativa para analisar os dados da cadeia de valor da organização e para avaliar a consistência das integrações e artefatos mapeados diante dos requisitos dos stakeholders, sob a abordagem da Teoria das Restrições. Entre os principais resultados, foram desenvolvidas duas escalas de aferição de consistência organizacional: a) de validação do nível de atualização dos artefatos; e b) diagnóstico da aderência tecnológica. Com o modelo, foram mapeados todos os 16 subsistemas organizacionais do contexto, 142 artefatos e 666 integrações. O modelo aplicado resultou em ganhos globais significativos na integração de processos na cadeia de valor pesquisada.
Palavras-chave: *integração, processos, artefatos, requisitos, validação.*

RESUMEN

Esta investigación tuvo como objetivo desarrollar un modelo de gestión de la capacidad de integración de procesos en el área de recursos humanos en una gran organización brasileña que forma parte de una red global de prestación de servicios. La investigación utilizó un enfoque cualitativo y cuantitativo para analizar datos de la cadena de valor de la organización y evaluar la consistencia de las integraciones y artefactos mapeados a la luz de los requisitos de los stakeholders, bajo el enfoque de la teoría de las restricciones. Entre los principales resultados, se desarrollaron dos escalas para medir la consistencia organizacional: a) validación del nivel de actualización de los artefactos; y, b) diagnóstico de adherencia tecnológica. Con el modelo se mapearon los 16 subsistemas organizativos del contexto, 142 artefactos y 666 integraciones. El modelo aplicado resultó en importantes ganancias globales en la integración de procesos en la cadena de valor investigada.
Palabras clave: *integración, procesos, artefatos, requisitos, validación.*

INTRODUCTION

The organization as an organic system can be understood as a set of interdependent and potentially integrated systems (Scott, 1998; Morgan, 2002; Resende, 2014) for the provision of artifacts to its stakeholders, for example: Marketing System, Human Resources (HR), Finance System, Operations System, Commercial System, Administrative System, Governance System, among others, forming a macro-organizational system. This list of subsystems is not exhaustive and can be expanded or limited according to the complexity of the organization.

Also from this perspective, Resende (2014) adopted the construct "organizational system" as a management system that deals with the application of organizational resources (technological, physical, human, and financial) to transform inputs and data into products, services and knowledge. The organizational system can be composed of subsystems whose activities add different values at each stage of the process, given that the subsystems use specific technologies and generate their own artifacts, in addition to each having distinct gain ratios from the other. Artifact, in this article, is a construct defined as the final product of a given process. This article explored the HR System in a large national organization with more than 50 thousand employees and 100 years of history, with its respective organizational subsystems, whose list is presented in the methodological section. This choice for the case study is due to the fact that the company presents all the necessary aspects that characterize an organization with a high level of complexity for testing the model: large organizational structure; national and regional culture; value chain with national and international impact and intensified management of sectoral processes, projects and people.

Organizations have been dealing with the need to manage increasingly integrated and adaptive processes, whether in terms of the number of functions or the complexity of their relationships (Resende, 2014). Open systems (Scott, 1998) tend to be integrated, as they need to adapt to changes in their environments to guarantee their existence. This adaptability occurs through (a) importing energy, (b) transforming processes and artifacts, and (c) resisting entropy. Furthermore, this integration increases the capacity for innovation (Alegre & Chiva, 2008; Cohen & Levinthal, 1990) and organizational learning.

Resende et al. (2013) stress the desirable characteristics in the environment for organizational innovation and integration efforts to come to fruition, namely: (a) the institutional conditions for their development and diffusion; (b) the cultural conditions that support aspects related to the proliferation of new ideas and the coexistence with tolerable errors; and, (c) the role of managers in the creation and implementation of new management practices. Saunila and Ukko (2012) associate the organization's innovative and integrative capacity with performance. These authors relate the organization's results to the exploitation and exploration of innovation processes.

The processes integration in the organizational ecosystem has been a permanent object of research for several decades in the scientific field of Administration (Scott, 1998), however, there is a gap in the specialized literature regarding the definition of methods for integrating value chain processes and evaluating the consistency of the respective artifacts. It is not uncommon for organizations to have the impression that improvements in organizational processes depend solely and exclusively on generalized investments in people and technologies. In this context there is the motivation to carry out this research.

Castro et al. (2018) point out the importance of integrating the organization's internal processes with those external ones in which there is exchange with the environment to provide multiple analyzes capable of supporting the organization's management. Also, Knapik et al. (2020) indicate the need to adapt and vertically integrate management practices and processes to organizational strategy. This level of integration of organizational processes supports the performance of the implemented management model.

The problem situation is that, when present, the organizational-system processes´ synergy is sometimes diffuse or not integrated into the whole value chain, mainly in large companies. Even in organizations with high maturity management models (Resende & Reis, 2016), measurement gaps can still be found in integration and in relation to the consistency of requirements of the organizational systems' artifacts. Therefore, the following research question is posed: How can the company-system's integration capacity and the consistency of the organizational subsystems' artifacts be managed?

This research has a general objective to present a process integration model and artifacts consistency assessment (ICA) in face to stakeholders´ requirements. It was hypothesized that the integration of value chain processes with artifacts aligned with the needs of the stakeholders can help managers to achieve the organization's performance goals and better employ available resources.

This work has the following structure. The first part brings the theoretical framework, presenting concepts and definitions about the Theory of Constraints. In the second part, the model is presented and brings the context of the research, the methodology, design, as well as the procedures adopted to propose a model to assess the processes integration capability in the value chain, in addition to measuring, through a coefficient of consistency, the adherence of the artifacts of these processes. Finally, the results of the research carried out and the final considerations are presented.

THEORETICAL FRAMEWORK

Applying Theory of Constraints (TOC) concepts

Similarly, the company-system can be seen as a "chain" (flow) where each department or sector corresponds to a link, all of which are interconnected and generate energy exchange among themselves. Their functions are interdependent, and the production of each area influences the whole. In the chain example, the production of each link is related to a certain tensile strength. If the chain is subjected to limit traction, it will break at the weakest point, that is, at its restriction. It is this point that defines the maximum resistance capacity of the system. The same reasoning applies to the operation of the company-system. According to Cox and Schleier (2013), the main purpose of TOC is to provide the management of system constraints since it is known that no other investment in any other "link" of the system will not generate an impact on the global resistance.

In this context, as described by Goldratt and Cox (2014), all efforts to manage processes according to TOC must follow a five-step methodology to focus on continuous improvement in capacities required by the system, aiming at a global gain. Each of them is discussed below.

System restriction identification

The initial step aims to find the primary constraint (the "weakest" link) in the system. In this context, constraint means "any element that limits the organization in its objective of making more money." Restrictions can be external or internal of the most varied types: market, material, capacity, people, competence, directive, norm, or policy.

External constraints may be unavoidable as they pertain to the environment; for example, the market naturally constitutes a constraint as it is limited; process management technology is intended to address internal constraints related to capacity or materials.

System restriction exploitation

Since the weakest link in the "chain" defines its resistance, the primary constraint within the company will define its maximum gain. Thus, the company will not be able to exercise the function of the process to a greater degree than it is possible to "navigate" through the restriction. The next step has the role of allocating energy in management to the most precious resources. This step, called "Exploration," seeks to extract the maximum of the constraint capacity in order to maximize the gain; that is, any action that optimizes the constraint is allowed.

Subordination to non-existing restrictions

With the maximum production level established as a constraint function, the next step is to synchronize all other resources so that they work at the constraint's pace, neither higher nor lower than their absorption capacity. Subordination is the step responsible for ensuring a level of activity with the least possible inventory, thus reducing investment and operating expenses. There is a new hierarchy of processes within the company-system, where the relationship between the supporting and main processes is not the focus, but the relationship between the capacity of the restrictive channels and that of the rest of the system, where the first requires the subordination of the second.

Increasing capacity

After defining how to optimize the use of the constraint (exploitation), if there are still capacity constraints, it is possible to carry out interventions in the production process in order to break the constraint, such as the decision to acquire new equipment or contract more people, the introduction of another shift, etc. However, once a constraint is broken, another weaker "link" will inevitably appear, a new constraint. The last step occurs when the system constraint is broken. From there, one must return to the starting point, in a process of continuous improvement, without settling. Again, it is important not to let inertia, by itself, become a constraint.

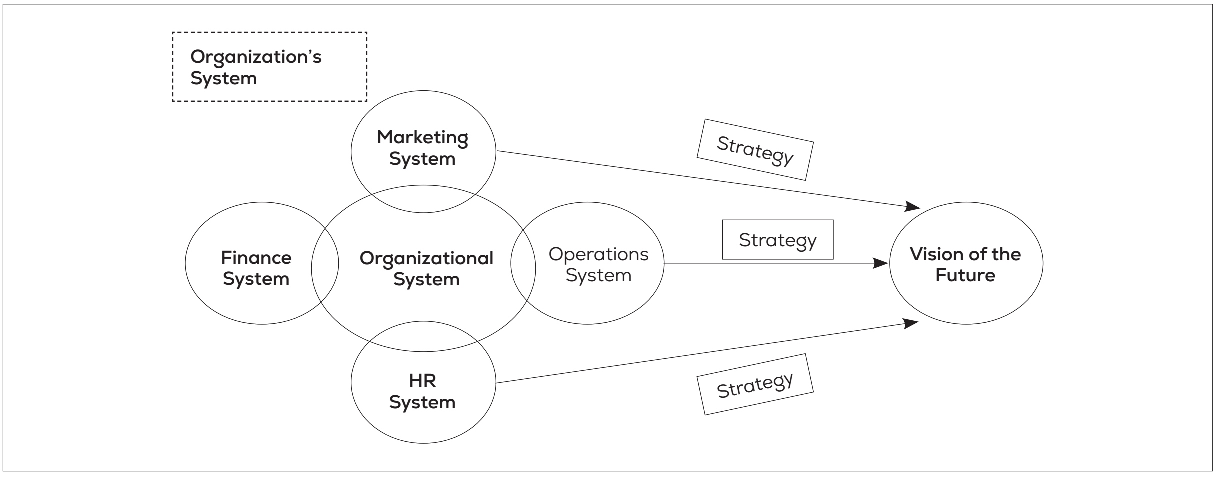
Organizational subsystems

Subsystem identification consists of evaluating the macro-processes and their developments in the organization's value chain (Porter, 1985), which may be encompassed in several activities, depending on the company's functional organization and structure.

There is a direct link between organizational systems and organizational strategy. The organization's strategy is characterized by a set of guidelines and macro-objectives that tend to lead it to a new performance status (Mintzberg et al., 2000) by generating value for the main stakeholders. Often, strategic objectives are accompanied by the mission, vision, and organizational values, which, supported by the cultural traits of the organization, outline their own characteristics of identity and differentiation in the environment in which they operate.

Fundação Nacional da Qualidade (FNQ, 2016) directly correlates strategy and the organization's vision of the future, where the first is defined as the set of choices, efforts, and direction to achieve the organization's macro-objectives, while the vision is the contextual point of arrival. Furthermore, it is necessary to understand the factors that affect the organization, its ecosystem, and the external environment in the short and long term, aiming at its perpetuity. Figure 1 depicts the relationship between these two constructs and the organizational systems that support them.

Figure 1. Relationship between Organizational Systems, Strategy, and Vision of the Future



The ICA is based on scientific model and aims to execute the organization's strategy by increasing capacity and reducing non-conformities in organizational subsystems.

To increase a subsystem's capacity, Slack et al. (2008), Ballou (2006), and Resende (2014) indicate some alternatives in process management, including a) increasing the number of resources in the subsystem itself; b) increasing related domain and productivity in the subsystems; and c) automating the subsystem processes.

Option "a" foresees an increase in costs in the short term, implying the consumption of resources, equipment, and/or people in the processes. Option "b" consists of intensive knowledge development on the phenomenon and productivity management without necessarily increasing costs. Finally, option "c" advocates technological investment in producing subsystem artifacts. According to Goldratt and Cox (2014), when the processes and subsystems are automated in isolation, the "Locally Optimal" is obtained without observing integration and adaptation. However, when firstly adapting and integrating the artifacts of a subsystem with the organizational system, the "Globally Optimum" is obtained, as it generates added value for the entire system, not only for some islands of excellence, acquiring organizational learning enabling the execution of the strategy.

By mapping technological capabilities, the company identifies and assesses whether the technology developed meets the stakeholders' requirements. If not, the company must acquire or develop technologies that meet the needs of the interested areas, aiming at the integration of subsystems. The objective is to increase the integration capacity of the subsystems, reducing cost and rework, corroborating Zuboff's (1994) idea that the applied technology aims to replace efforts and allow processes to be executed at a lower cost, with more control and continuity. Finally, after technological and process integration, the company can remodel or integrate subsystems to optimize processes, reduce costs, and effectively answer the interested parties.

METHOD

The research used a mixed approach: qualitative and quantitative data collection and analysis to propose a model to assess the ability to integrate processes in the value chain, in addition to measuring, through a consistency coefficient, the adherence of the artifacts of these processes. The combination of qualitative and quantitative approaches allows obtaining dense, complex and rich information that could not be obtained with the isolated use of only one type of approach (Creswell & Plano-Clark, 2007). The qualitative approach allowed the evaluation and mapping of all the organization's human resources subsystems, while the quantitative approach allowed measuring the integration of the subsystems. As for the nature and objectives, the research is characterized respectively as applied and descriptive, as it presented the description of the investigated organizational system, subsystems, artifacts and mapped integrations (Gil, 2010). The research is also descriptive as it describes the facts and phenomena of the reality in the human resources area.

This research was developed in 2021 during the development of an organizational capabilities management project in a large Brazilian global services organization. The human resources area is the most important support area of the value chain and was covered in its entirety (16 subsystems). The area's strategic leaders identified the three greatest specialists from each subsystem to join the project. Primary data were collected electronically between January and March 2021, with a sample of 48 respondents for 16 subsystems analyzed. The data analysis was carried out between April and June 2021 with support from Excel 2013 ToolPak statistical analysis package.

Yin (2009) points out that the objective of the case study is to explore, describe or explain the phenomenon, providing knowledge about the facts that compose it, verifying if there are cause and effect relationships between the facts that compose it. The "great" case study, in addition to assessing the context, must still be able to transform it. The ICA model, in the set of its stages, fits these characteristics.

Although the ICA model can be applied to any organizational system, in this research, it was applied to a human resources system with the following subsystems: Manage Competencies; Manage Health and Safety at Work; Manage Organizational Relationship with People; Administer People Management Services; Manage Career; Manage Remuneration; Manage Corporate Education; Manage Selection Process; Manage Benefits; Manage Labor Relations; Monitor health care and supplementary pension benefits; Manage Performance; Manage Workforce; Manage Organizational Climate; Manage Organizational Culture; and, Manage Organizational Knowledge.

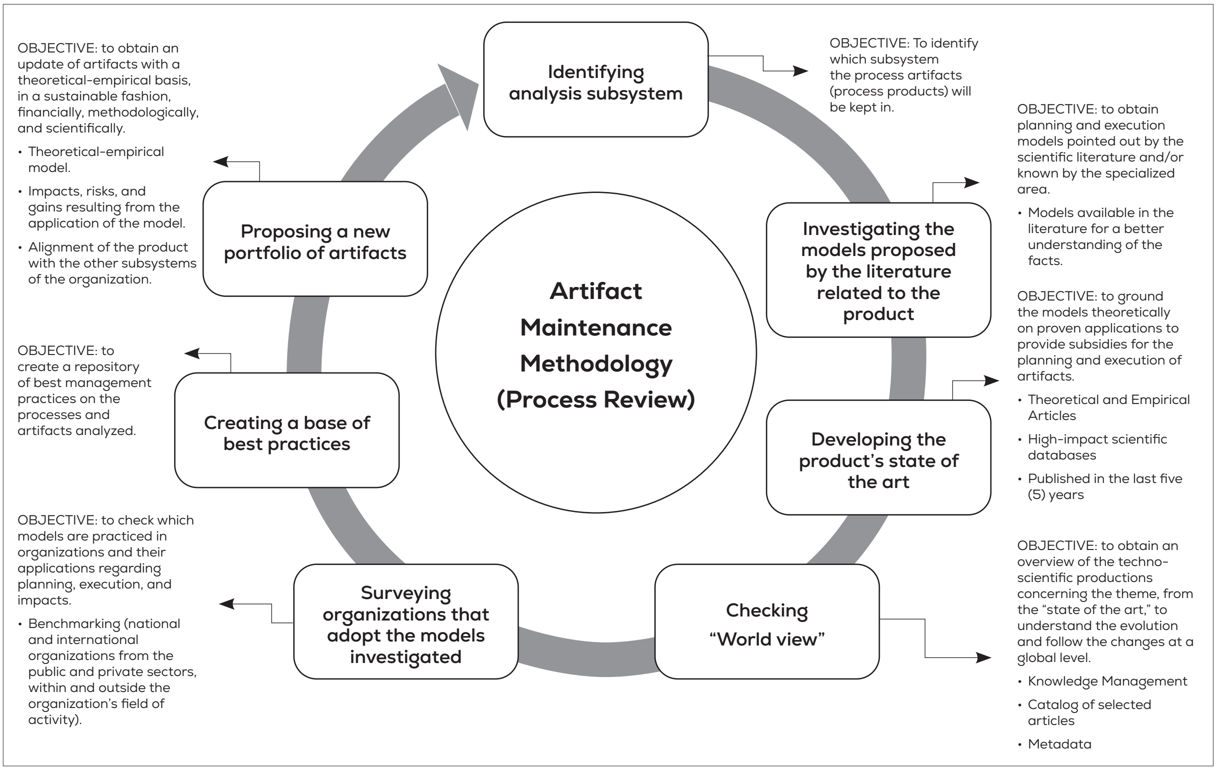
After the research planning and design phase, two experts from each value chain process were selected to act as respondents in both phases: qualitative and quantitative. In the qualitative phase, these specialists identified and described the processes and their respective artifacts, in addition to providing mapping of the other downstream processes that consume such artifacts and also which upstream processes provide inputs for the elaboration of these artifacts. In the quantitative phase, the experts assigned scores to the criteria that define the consistency of the artifacts in two ways: (a) by identifying the percentage degree of compliance of the artifacts with the Stakeholders' Requirements (SR); and (b) by calculating the artifact's consistency coefficient. The products generated in this research stage are presented in the Results section.

In order to reach the research deliverables (integration assessment, artifacts service assessment, and artifacts consistency level), two previous steps were carried out: (a) validation of the artifacts update level; and (b) technological adherence diagnosis.

Update-level validation of "people" organization subsystem artifacts

Each subsystem has its respective processes and artifacts (products). To facilitate the delivery of services established in each subsystem, the application of the artifact update methodology is suggested in order to ensure that the assessment of integration and consistency is carried out with the state of the art of the processes' products, as shown in Figure 2.

Figure 2. Artifact Update Method



The first step of the model consists of identifying the subsystems of the company-system and the portfolio of products/services (artifacts) that meet the organizational needs.

The second step of the model deals with the investigation of the models, as proposed by the scientific literature related to the subject in question, to evaluate the models proposed by the literature, from inception to the latest model, regarding the artifacts of the analyzed subsystem. This allows benchmarking and comparison with models previously developed and discussed in the academic world.

Then, the state of the art is developed; it is the third step of the process. According to Romanowski and Ens (2006), the state of the art allows for the identification of paths taken in the discipline and what aspects have been discussed and addressed, in addition to contributing to the constitution of the discipline's theoretical scope. According to Rodrigues et al. (2019), in state-of-the-art studies, important comparisons are made about changes in the construction scenarios of the discipline under analysis.

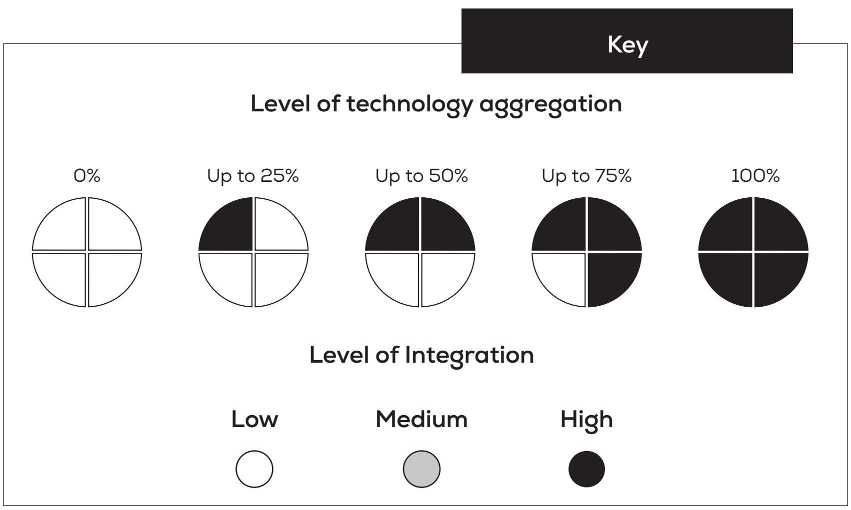
State of the art is the survey and evaluation of all studies and research carried out over the years and allows the completion of the fourth stage: the verification of the analysts' and the external researchers' perspectives. The next step is to survey organizations that adopt the models found in the research and develop an analysis of the benefits and challenges of each practice, consisting of the fifth step. This task allows the completion of the sixth stage, which concerns the identification and organization of the best practices in the market, thus making the connection between theory and practice.

After identifying and analyzing the best practices, the organizational culture's necessary adequacy is evaluated to update the portfolio. At this stage, variables, organizational characteristics, and resources are evaluated to revitalize the process in the organization. Then the connection between the artifact, the subsystem, and the organizational strategy is made. Finally, all strands must be integrated to obtain an updated portfolio of value chain artifacts, closing the cycle shown in Figure 2.

Diagnosis of the subsystems' technological adherence

Technological adherence diagnosis can be performed using the quadrant methodology, as developed by this paper's authors. The methodology consists of two dimensions: degree of technological aggregation and degree of integration (Figure 3). The degree of adherence measures how much the technology adds to the investigated process in each artifact, and the degree of integration indicates how much the processes are integrated through technological systems. This mapping makes it possible to indicate gaps in the integration of subsystems. For Araújo and Scafuto (2019), system integration helps to improve the standardization of an organization's Knowledge Management.

Figure 3. Nonononon



Technological adherence aims to provide a snapshot of the development stage of each subsystem in the variables "applied technology" and "integration with other subsystems," mapping all the technology used in the planning, execution, and control of the organizational subsystem processes, such as spreadsheets, sectorial and corporate systems, assigning a value between 0% and 100% referring to the degree of technological aggregation, which will be presented in the form of quadrants. After this initial analysis, the degree of integration of the mapped technologies is calculated with the other subsystems, using the scale (low, medium and high) to demonstrate the level of each subsystem. The degree of integration will be superimposed on each quadrant in the mapping, allowing a visual assessment of the two variables analyzed.

Assessment of integration capacity between subsystems

After diagnosing the technological adherence of the processes, the potential integration between subsystems is verified, evaluating whether there is an exchange of inputs, upstream and downstream, and the impact and interrelationships between these. This diagnosis encompasses both processes and technological aspects linked to systems. For example, in the HR system, there is a strong historical relationship between the subsystems of competency management, knowledge management, and corporate education management (Carbone et al., 2009; Esteves & Meiriño, 2015). Other subsystems also present relationships with these three mentioned subsystems, for example, performance management and career management. In addition, Lima and Rowe (2019) and Carbone et al. (2009) show that competency management is linked to classic HR processes, such as selection, compensation, training, and performance evaluation.

Based on the relationship between the inputs and the outputs of each process of the respective subsystems, it is possible to verify whether there is an exchange of energy through inputs and artifacts (value 1) or not (value zero), according to the matrix in Table 1.

Table 1. Subsystems Integration Matrix

	Subsystem (A)	Subsystem (B)	Subsystem (C)	Subsystem (D)	Subsystem (E)	Subsystem (F)
Subsystem (G)		0	0	1	1	1
Subsystem (B)	0		0	0	1	0
Subsystem (C)	1	1		1	1	1
Subsystem (D)	1	1	1		1	1
Subsystem (E)	0	0	1	0		1
Subsystem (F)	1	1	1	1	0	

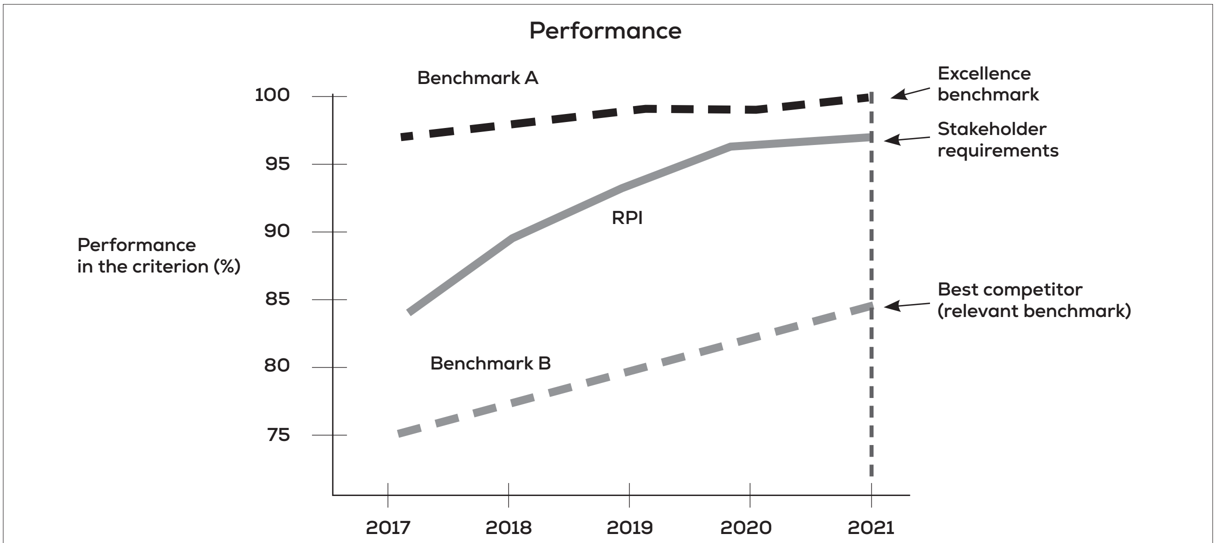
Source: Prepared by the authors.

Artifact assessment against stakeholders´ requirements

After identifying the existence of procedural dependence between subsystems, each subsystem's portfolio of artifacts is defined to measure capacity. In this article, the concept of capability draws on Slack et al. (2008), referring to the output that a process can deliver with the required compliance in a defined time unit. In ICA, conformity results from all the attributes that characterize the product of a process (artifact). According to FNQ (2015), such attributes are translated into Stakeholders´ Requirements; that is, those who define the specifications of each artifact are the respective stakeholders of the other subsystems that consume their artifacts. The subsystem under analysis must answer whether it can produce artifacts consistent with the stakeholders' requirements or indicate the restrictions that prevent it from doing so and the respective treatment plan, if applicable.

The Stakeholders´ Requirements (SR) of each artifact is made up of three variables: quantity, term, and compliance criteria. In addition, in organizations with high management maturity, the ICA model provides for the use of other references in addition to the SR, as shown in Figure 4.

Figure 4. Stakeholder Requirements Model



Source: Prepared by the authors based on FNQ (2016).

For each declared requirement, the customer must establish a service grade: a) meet with excellence (excellent); b) meet almost all requirements; c) meet many requirements; d) meet few requirements; and e) do not meet the requirements (insufficient). These grades are converted into a scale from 1 to 5, with 1 being the lowest and 5 being the highest, after which the compliance indicators are calculated for each evaluated product and for the subsystem as a whole (Table 2).

At the end of this stage, it is verified which requirements are being met and, depending on the result, the model follows different paths. In case of reaching the requirements in percentage (%), it proceeds to the "Process Optimization and/or Integration" stage. If the required percentage is not reached, restrictions are dealt with in order to increase capacity.

Table 2. Stakeholder Requirements Model Analysis

		Subsystem (B)					
		Artifact (H)					
		Attrib_1 – Time		Attrib_2 – Number		Attrib_3 – Consistency	
Subsystem (A)	Artifact (X)	Mar/21	Excellent	1	Meets many requirements	80%	Meets almost all requirements
	Artifact (Y)	Dec/21	Meets almost all requirements	1	Meets many requirements	75%	Meets almost all requirements
	Artifact (Z)	Feb/21	Meets almost all requirements	2	Insufficient	100%	Meets almost all requirements
	Artifact (W)	Apr./21	Meets many requirements	1	Meets few requirements	100%	Meets few requirements

Artifact consistency coefficient assessment

To refine the assessment of the value generated by HR subsystems for the management system, a consistency coefficient was generated for each artifact, adapting Hernández-Nieto's (2002) proposition entitled Content Validation Coefficient (CVC). Indeed, this allows the content validity of each product to be calculated individually for the following criteria: number, time, and consistency. Each criterion received a score from 1 to 5 from the experts of the downstream subsystems in relation to the upstream subsystems.

The calculation of the adapted version of CCV was performed according to the following steps (Hernández-Nieto, 2002):

a. The average of the scores for each ARTIFACT (Mx) is calculated from the judges' scores:

$$M_x = \frac{\sum_{i=1}^{5} X_{ij}}{j} \quad (1)$$

where i = 1 means the sum of the judges' scores and J means the number of judges.

b. (From the average, we obtain the initial CVC (CVCi) for each ARTIFACT:

$$CVC_i = \frac{M_x}{V_{max}} \quad (2)$$

where Vmax means the maximum value that the variable could receive.

c. (c) The error is the same for each ARTIFACT and is calculated as follows:

$$P_{e_i} = \left(\frac{1}{j}\right)^j \quad (3)$$

d. (d) Next, the final CVC of each ARTIFACT is obtained (CVCc):

$$CVC_c = CVC_i - P_{e_i} \quad (4)$$

e. (e) Finally, the total CVC of the ARTIFACTS (CVCt) for each one of the evaluation criteria (NUMBER, TIME, and CONSISTENCY) is calculated:

$$CVC_t = M_{CVC_i} - M_{P_{e_i}} \quad (5)$$

where, M_{CVC_i} means the average of the content validity coefficients of the ARTIFACTS and $M_{P_{e_i}}$ means the average of the errors of the evaluated criteria of the ARTIFACTS.

Table 3 shows an example of how the consistency coefficients calculated by CVC are presented. Hernández-Nieto (2002) argues that in the evaluation scale between 0.0 and 1.00 of CVC, values less than 0.80 show unacceptable validity and concordance; values equal to or greater than 0.80 and less than 0.90 are considered to have satisfactory validity and concordance; and values equal to or above 0.90, up to the limit of 1.00, show excellent validity and concordance.

Table 3. CVC of the Stakeholder Requirements Model

Artifact	Number	Time	Consistency
1	0.800	0.833	0.767
2	0.800	0.967	1.000
3	0.700	0.800	0.767
4	0.800	0.967	0.900
...	...	...	...
119	0.633	0.867	0.900
120	0.633	0.833	0.867
121	0.633	0.700	0.833
122	0.667	0.767	0.833
123	0.600	0.667	0.633
...	...	...	...
129	0.733	0.933	1.000
130	0.733	0.800	0.867
...	...	...	...
142	0.733	0.867	0.933

According to the ICA model, to maintain correlation between the evaluation of section 3.4, five evaluation ranges were considered as showed in table 4.

Table 4. Service Status Interval

Rating = 1.0	Excellence
0.99 ≤ rating ≤ 0.75	Meets almost all requirements
0.75 < rating ≤ 0.50	Meets many requirements
0.50 < evaluation ≤ 0.30	Meets few requirements
rating < 0.30	Do not meet

Transformation of SR from the application of the model

The application of the proposed model allows a better understanding of the requirements (deadline, quantity and consistency) expected by stakeholders regarding the deliveries made through the artifacts produced by the "upstream" subsystems.

Furthermore, the analysis of the capabilities of corporate subsystems from the perspective of the Theory of Constraints can be used, given the stakeholders requirements (SR), to support the transformation of artifacts, from the allocation of corporate resources and to establish a balance between the demands and the capacity of enterprise subsystems.

In this context, the actions defined among the areas involved contribute to the corporate subsystems integration, increasing the capabilities of the deliveries (results) and catalyzing the achievement of the corporate strategy.

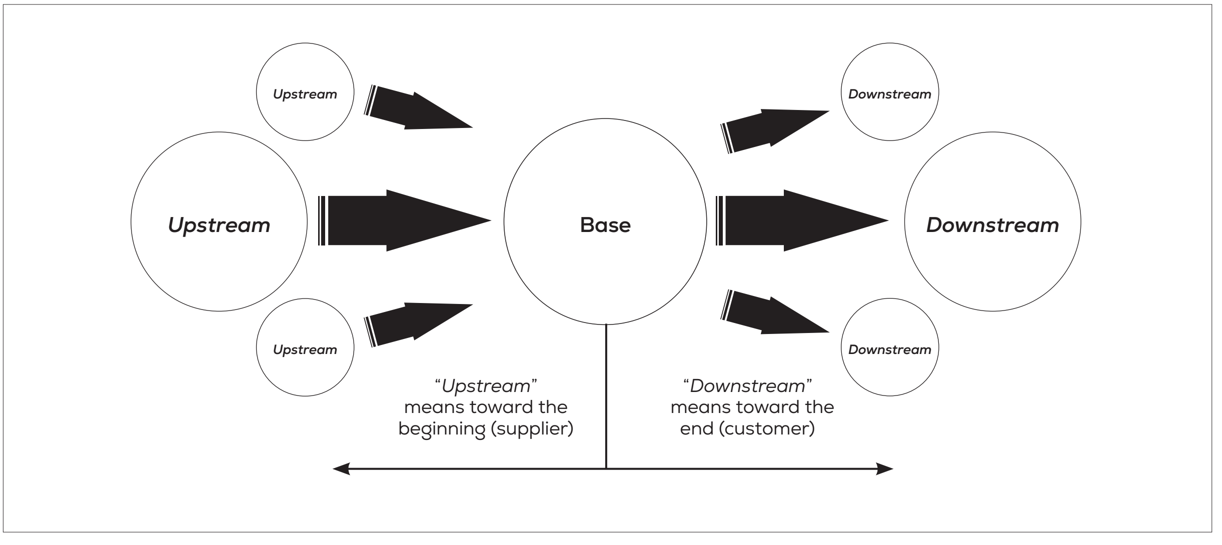
RESULTS AND DISCUSSION

The investigated institution is a Brazilian logistics company and has an organizational structure composed by Presidency, Board of Directors, and Executive Boards. The integration of value chain processes was evaluated with the process in People Management area to assess the consistency of the respective artifacts in the face of the stakeholders' requirements.

The sample was mapped from an aspect of corporate subsystems and is composed of: (a) sixteen subsystems; (b) one hundred and forty-two artifacts; and (c) six hundred and sixty-six integrations between subsystems.

The subsystems were identified and classified into "downstream" and "upstream," considering the dynamics of production and consumption of artifacts produced by the base subsystem (Figure 5).

Figure 5. Mapping of Integrations between Subsystems



The Table 5 shows the number of integrations of each subsystem, considering these categories:

Table 5. "Downstream and Upstream" Subsystems

Subsystems	Downstream	Upstream
Competency Management	157	127
Workplace Health & Safety Management	89	71
Organizational Relationship Management	69	56
People Management Services	68	55
Career Management	51	53
Compensation Management	40	52
Corporate Education Management	31	36
Selection Process Management	28	34
Benefits Management	23	33
Labor Relations Management	23	31
Monitoring health and welfare benefits	22	25
Performance Management	17	23
Workforce Management	16	20
Organizational Climate Management	11	20
Organizational Culture Management	11	19
Organizational Knowledge Management	10	11
Total	666	666

After identifying the capabilities in the subsystems, the next step consisted of evaluating the artifacts according to criteria of time, quantity, and consistency considering the Stakeholder Requirements to increase the capabilities in the subsystems. The data resulting from the application of the Content Validation Coefficient (CVC), considering the criteria used (quantity, consistency, and term), can be seen in Table 6.

Table 6. CVC Artifacts Average

Organizational Climate Management		Career Management		People Management Services		Monitoring health and pension benefits	
Variable	CVC	Variable	CVC	Variable	CVC	Variable	CVC
Number	0.72	Number	0.94	Number	0.91	Number	0.96
Time	0.72	Time	0.94	Time	0.89	Time	0.96
Consistency	0.69	Consistency	0.91	Consistency	0.87	Consistency	0.90
Competency Management		**Benefits Management**		**Organizational Knowledge Management**		**Labor Relations Management**	
Variable	CVC	Variable	CVC	Variable	CVC	Variable	CVC
Number	0.90	Number	0.86	Number	0.88	Number	0.86
Time	0.89	Time	0.82	Time	0.87	Time	0.77
Consistency	0.93	Consistency	0.84	Consistency	0.85	Consistency	0.87

continue

Table 6. CVC Artifacts Average

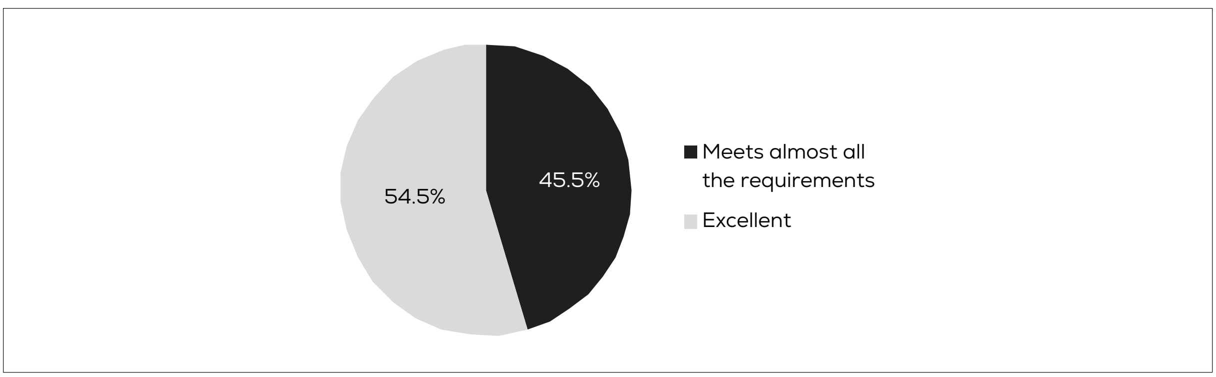
concludes

Organizational Culture Management		Workforce Management		Performance Management		Compensation Management	
Variable	CVC	Variable	CVC	Variable	CVC	Variable	CVC
Number	0.79	Number	0.87	Number	0.94	Number	0.83
Time	0.76	Time	0.77	Time	0.93	Time	0.84
Consistency	0.76	Consistency	0.76	Consistency	0.90	Consistency	0.82
Selection Process Management		**Corporate Education Management**		**Organizational Relationship Management**		**Workplace Health & Safety Management**	
Variable	CVC	Variable	CVC	Variable	CVC	Variable	CVC
Number	0.93	Number	0.81	Number	0.83	Number	0.70
Time	0.93	Time	0.82	Time	0.83	Time	0.75
Consistency	0.91	Consistency	0.78	Consistency	0.85	Consistency	0.69

The results of Table 6 present a consolidated view of the final assessments of the human resource (HR) subsystems, from the perspective of the judges involved. In these evaluations, the criteria of quantity (number), timing (time) and consistency were considered. After applying the content validation coefficient, it appears that most evaluations were above 0.75. This result denotes that the artifacts consumed by the subsystems, for the most part, meet almost all the requirements of the respective evaluators. Some specific cases (for example, the artifacts consumed by the Organizational Climate Management Subsystem and the Manage Health and Safety at Work subsystem) had a grade of "Meet many of the requirements". In these cases, it is recommended that managers of the subsystems meet with each other in order to adapt the subsystem managers' needs to the productive capacity of the subsystems with which they interact.

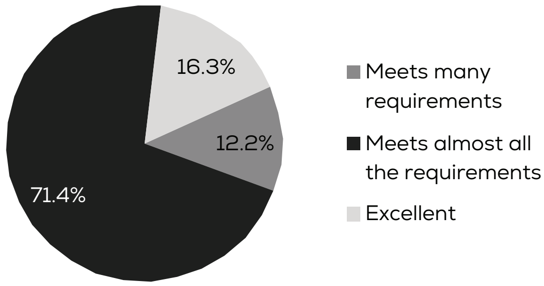
The following charts (Figure 6 to 21) present the results of the evaluations for each of the subsystems in the sample:

Figure 6. Career Management



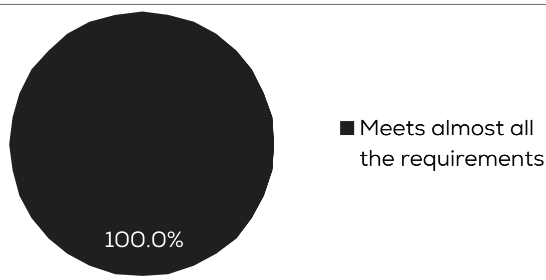
The Manage Career subsystem obtained excellent results for the criteria (quantity, time and consistency) with 0.94, 0.94 and 0.91 respectively. With all indexes above the limit of 0.90, which is considered excellent. The subsystem demonstrates a high level of compliance.

Figure 7. People Management Services



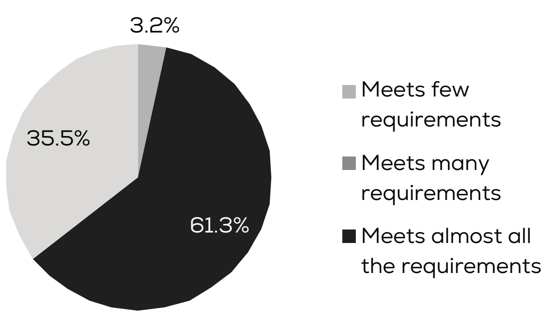
The People Management Services subsystem obtained satisfactory results for the deadline and consistency criteria, being 0.89 and 0.87 respectively, and an excellent result (0.91) for the quantity criterion, according to the artifact consistency coefficient intervals, presented in section 3.5. The subsystem demonstrates a high level of compliance with the SR, as assessed by the downstream subsystems.

Figure 8. Monitoring Health and Pension Benefits



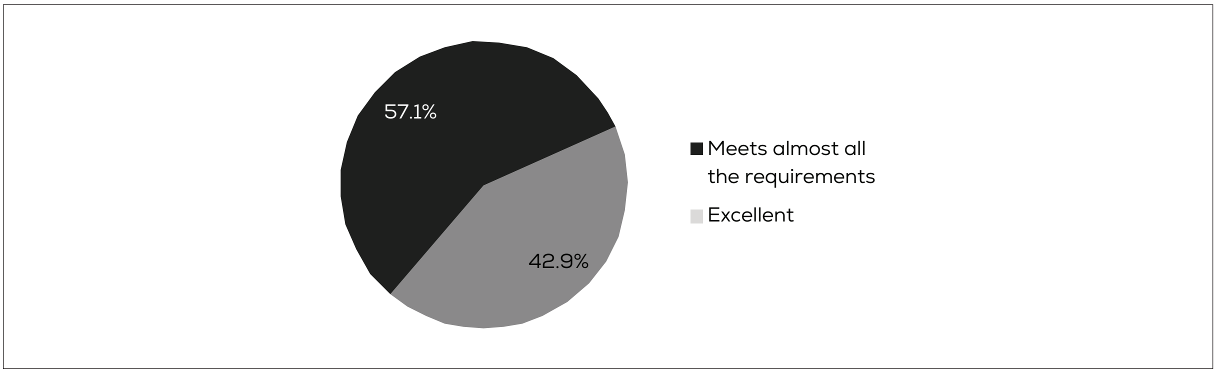
The subsystem Monitoring health care and supplementary pension benefits obtained excellent results (Table 6) for the three criteria quantity, deadline and consistency, with 0.96, 0.96 and 0.90, respectively.

Figure 9. Competence Management



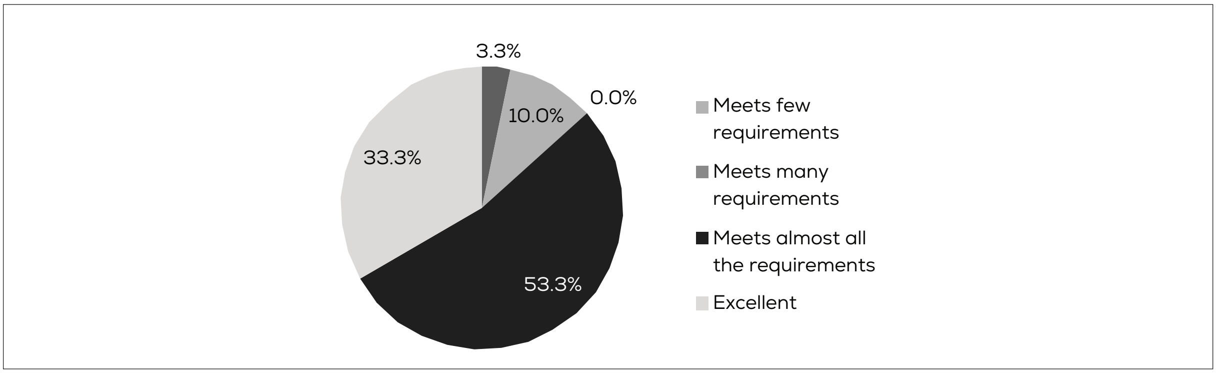
The Manage Competencies subsystem obtained a satisfactory result (0.89, Table 6) for the deadline criterion, and excellent results for the quantity and consistency criteria, with 0.90 and 0.93 respectively.

Figure 10. Benefits Management



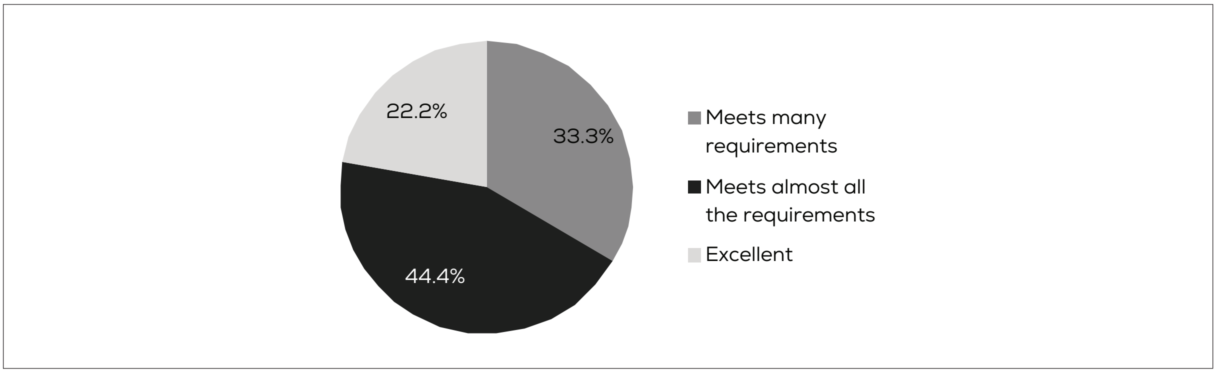
The Manage Benefits subsystem obtained satisfactory results (Table 6) for the three criteria quantity, deadline and consistency, being 0.86, 0.82 and 0.84, respectively.

Figure 11. Organizational Knowledge Management



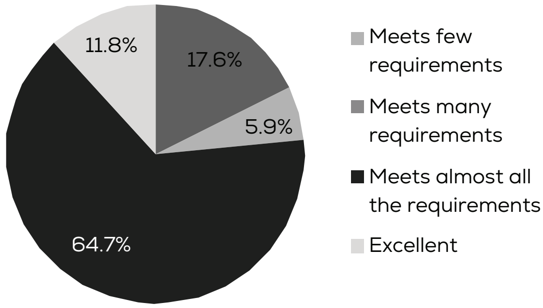
The Management Organizational Knowledge subsystem obtained satisfactory results (Table 6) for the three criteria quantity, deadline and consistency, being 0.88, 0.87 and 0.85 respectively.

Figure 12. Labor Relations Management



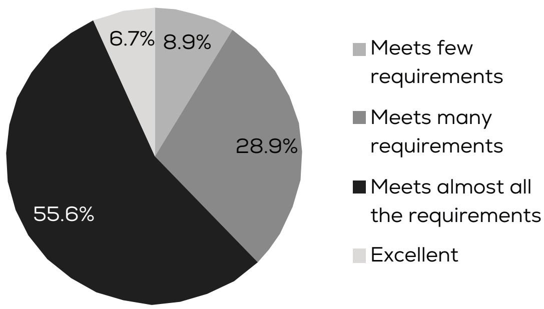
The Labor Relation Management subsystem obtained satisfactory results (table 6) for the quantity and consistency criteria, being 0.86 and 0.87 respectively, and an unacceptable result (0.77) for the deadline criterion.

Figure 13. Organizational Culture Management



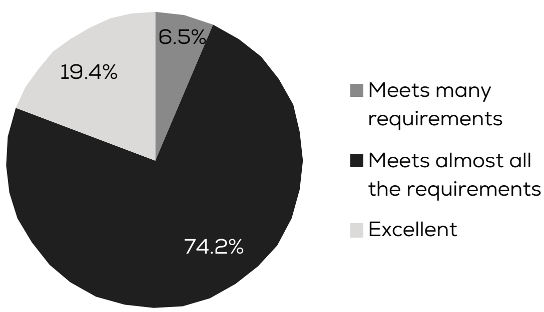
The Organizational Culture Management subsystem obtained unacceptable results for the three criteria quantity, deadline and consistency, being 0.79, 0.76 and 0.76 respectively. All indexes are below the limit of 0.80 considered unsatisfactory.

Figure 14. Workforce Management



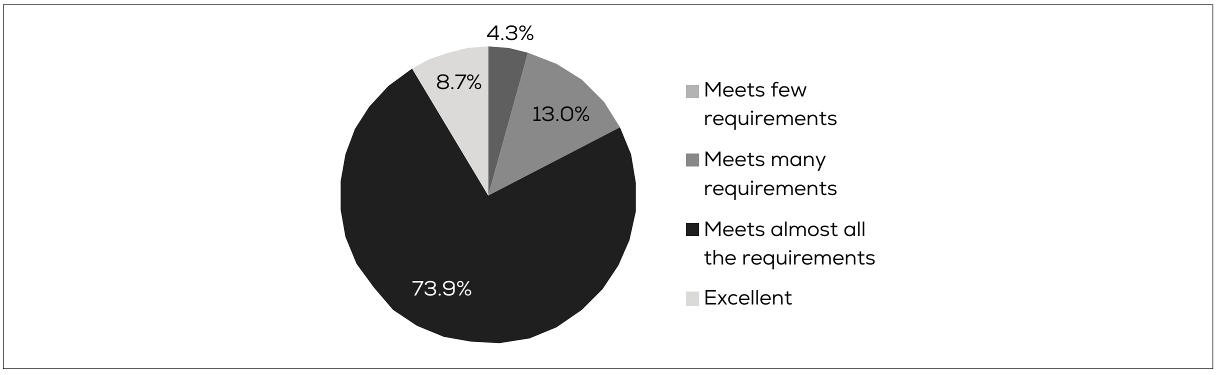
The Workforce Management subsystem obtained unacceptable results (table 6) for the deadline and consistency criteria, being 0.77 and 0.76 respectively, and a satisfactory result (0.87) for the quantity criterion.

Figure 15. Performance Management



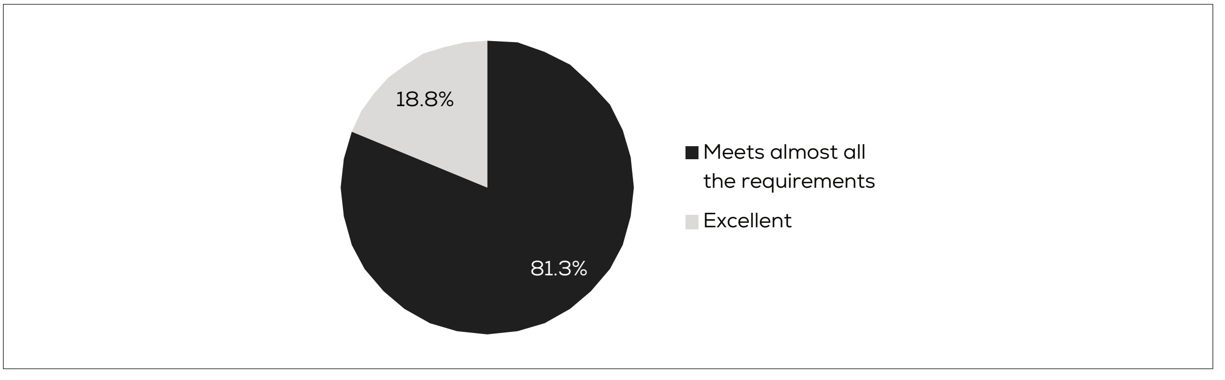
The Performance Management subsystem obtained excellent results (Table 6) for the three criteria quantity, deadline and consistency, being 0.94, 0.93 and 0.90 respectively.

Figure 16. Compensation Management



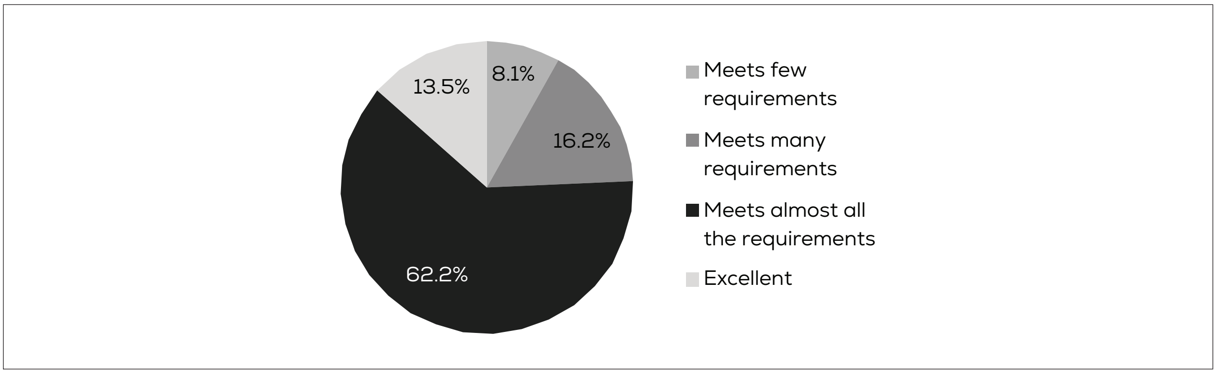
The Compensation Management subsystem obtained satisfactory results (Table 6) for the criteria quantity, deadline and consistency, with 0.83, 0.84 and 0.82, respectively.

Figure 17. Selection Process Management



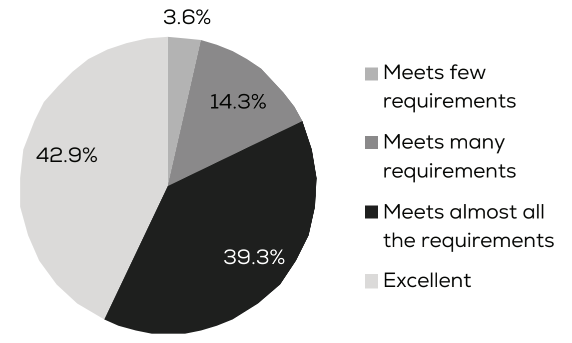
The Selection Process Management subsystem obtained excellent results (Table 6) for the criteria quantity, deadline and consistency, being 0.93, 0.93 and 0.91, respectively.

Figure 18. Corporate Education Management



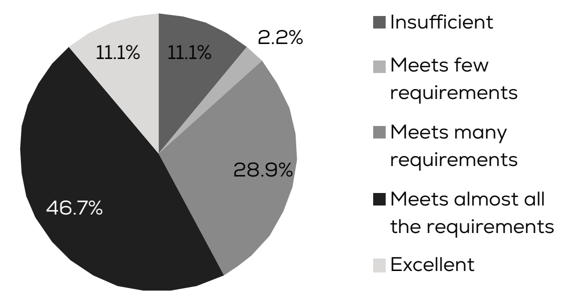
The Corporate Education Management subsystem obtained satisfactory results for the quantity and deadline criteria, being 0.81 and 0.82 respectively, and an unacceptable result (0.78) for the consistency criterion.

Figure 19. Organizational Relationship Management



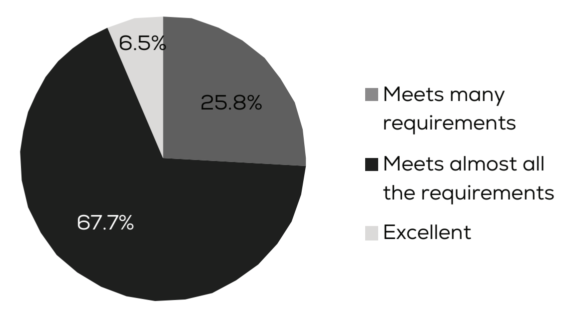
The Organizational Relationship Management subsystem obtained satisfactory results for the three criteria (quantity, deadline and consistency), being 0.83, 0.83 and 0.85 respectively.

Figure 20. Workplace Health & Safety Management



The Workplace Health & Safety Management subsystem obtained unacceptable results for the three criteria (quantity, time and consistency), being 0.70, 0.75 and 0.69 respectively. The subsystem demonstrates a low level of compliance with the SR, according to the evaluation of the downstream subsystems.

Figure 21. Organizational Climate Management



The Organizational Climate Management subsystem obtained unacceptable results for all criteria (quantity, deadline and consistency), being 0.72, 0.72 and 0.69, respectively, presenting a low level of compliance with the SR, according to the evaluation of the downstream subsystems.

In general, the evaluated subsystems partially meet the SR. So there is a need to evaluate the gaps and draw up actions to increase their capacity. By analyzing the subsystems individually, it is possible to identify subsystems with unacceptable assessments for the three criteria Organizational Climate Management, Organizational Culture Management, Workplace Health & Safety Management). On the other hand, the subsystems Carrer Management, Performance Management, Selection Process Management and Monitoring health and pension benefits showed excellent results for the three criteria evaluated.

This scenario showed in the charts and CVC table allows the management and improvement of the processes of the human resources subsystems involved. Organizations in the logistics sector and with intensive technology bases have a significant part of their performance based on the internal processes integration and the supply chain of inputs (Bueno et al., 2020; Machado et al., 2018).

CONCLUSIONS AND IMPLICATIONS

This study aimed to present a process integration model and artifacts consistency assessment in in an organizational value chain from the stakeholder's requirements. Through the results obtained, it is observed that the study fulfilled its objective, making it possible to identify the integration of human resources processes and assess the consistency of the management artifacts identified in the research.

Ramos et al. (2019) point out that the main difficulties identified for the achievement of strategy in organizations are the lack of alignment between strategic and operational interests and the integration of the processes that support them, in addition to resistance to change.

Abreu (2018) points out that the revolution organizations are going through imposes a need for transformation that requires the integration of the entire organization in order to maximize the probabilities of achieving results. Ratifying the context, as Kaplan and Norton (1997, 2006), Diogo et al. (2019) indicate that the local and global competitiveness imposes an integration of production processes, which is essential for digital transformation in organizations.

Integrated processes and artifacts tend to strengthen the integrative organizational vision, not only by sharing tools and resources, but by increasing the alignment and efficiency of their use in order to fully raise the quality of the product in the development of a more fluid organization (Gallouj & Savona, 2009; Goldratt & Cox, 2014; Ikeziri et al., 2020; Raposo & Silva, 2017).

Summarily, the article presented the development and execution of the ICA model, which measures the integration of processes of a given organizational system, evaluating the consistency of the artifacts, allowing their transformation in 5 steps: a) validation of the level of updating of the artifacts; b) technological diagnosis; c) evaluation of integration; d) evaluation of the quality of artifacts by RPI; e) calculation of the coefficient of consistency of the artifacts, using the CVC.

Even opting for a case study with highly complex characteristics, a limitation of the article is that the results cannot be generalized. But the model tested can be replicable and extrapolable to other contexts, despite having been applied in a case study with particular characteristics.

The main results point to the development of two scales for measuring organizational consistency: (a) validation of the level of updating of artifacts; and (b) diagnosis of technological adherence. In addition, 16 organizational subsystems, 142 artifacts, and 666 integrations were plotted with the model.

As a future research agenda, the application of the ICA model can be carried out in organizations from other sectors and with different cultural assumptions to assess the orientation and resistance to organizational change.

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CONFLICTS OF INTEREST

The authors have no conflicts of interest to declare.

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Pedro Carlos Resende Junior: Conceptualization; Data curation; Formal analysis;Investigation; Methodology; Resources; Supervision; Validation; Writing – original draft; Writing – proofreading, and editing.

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