Resilience in organizations: a case study in a technology cluster

Resiliência nas organizações: um estudo de caso em um cluster de tecnologia.

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ABSTRACT

Organizations aim to stay aligned with their surroundings to navigate frequent changes that can occasionally jeopardize their survival. A convenient way to be prepared for these storms is to use organizational skills and resources to overcome moments of crisis. This way, the effort known as organizational resilience stands out, part of the dual-featured management repertoire. This duality is seen in the preparation to face environmental challenges through routines and processes, as well as the capability to rebound when the repertoire of actions isn't strong enough to ensure success amid contextual fluctuations. Keeping this in mind and firmly betting that strategies and information technology are leading and predominant vectors for the formation of organizational resilience, this study investigated and found factors with this content in scenarios of technology-based companies, immersed in an ecosystem of digital innovation and transformation, known as a technology cluster. The results obtained confirm good omens for a thematic-contextual articulation of the organizational factors outlined here.

Keywords: Resilience; Information and communication technology; Strategy
RESUMO
As organizações buscam se manter alinhadas com seu entorno para navegar por mudanças frequentes que ocasionalmente podem comprometer sua sobrevivência. Uma maneira conveniente de estar preparado para essas tempestades é usar habilidades e recursos organizacionais para superar momentos de crise. Dessa forma, destaca-se o esforço conhecido como resiliência organizacional, parte do repertório de gestão de dupla característica. Essa dualidade é observada na preparação para enfrentar desafios ambientais por meio de rotinas e processos, bem como na capacidade de se recuperar quando o repertório de ações não é forte o suficiente para garantir o sucesso em meio a flutuações contextuais. Mantendo isso em mente e apostando firmemente que estratégias e tecnologia da informação são vetores líderes e predominantes para a formação da resiliência organizacional, este estudo investigou e encontrou fatores com esse conteúdo em cenários de empresas baseadas em tecnologia, imersas em um ecossistema de inovação e transformação digital, conhecido como um cluster de tecnologia. Os resultados obtidos confirmam bons presságios para uma articulação temático-contextual dos fatores organizacionais aqui delineados.

Palavras-chave: Resiliência; Tecnologia da Informação e Comunicação; Estratégia

INTRODUCTION

Organizations are influenced by societal dynamics (MORRIS, 2015), requiring them to adapt for survival during crises arising from diverse existential conditions. In the realm of business, this survival hinges on navigating crisis contexts through novel operational approaches and agile responses to change (SIMPSON, 2017). Thus, organizational resilience emerges as a pivotal element for business continuity. It contributes significantly to fostering sustainable societies at both macro and micro levels (AL SHOBAKI; AMUNA; NASER, 2017).

Thus, it seems natural that modern organizations adopt business continuity measures to anticipate and respond to contextual incidents in a complex environment subject to natural disasters, financial crises and political instability (ABDULLAH; NOOR; IBRAHIM, 2013) that require quick responses. However, not all organizations survive adversity and succumb to crisis (LUO; SHI, 2011), others develop organizational resilience that will influence their long-term performance, so that companies continue to operate in the midst of adversity and significant barriers to change their adaptations (SUTCLIFFE; VOGUS, 2003).

Nevertheless, resilience is not just an organizational characteristic, being better understood as a fundamental quality for individuals, groups and communities (CHU, 2015). Following this perspective, for psychology, the term resilience is understood as the human ability to overcome tension and adversity through the application of adaptive behaviors in response to stressful situations (MALLAK, 1999; KIRMAYER et al., 2009). In this way, a resilient individual has the ability to adapt and strengthen himself in the face of challenges, traumas or stress (BHAMRA; BURNARD, 2013) and this behavior is supposed to be captured by organizational routines, especially those that can enjoy information and communication technology (ICT).

Thus, by relying on the associative premise between the use of ICT and the promotion of organizational resilience, this report aims to outline the strategic variants used by companies
embedded in an information technology cluster, which resulted from the combination of processes, organizational capabilities and skills of its employees, developed in learning environments with the foundation of ICT, to consign organizational resilience to face crises in their operational tasks.

**CONCEPTUAL COVERAGE**

The concept of resilience permeates several disciplines such as physics, sociology and psychology. However, it is common to accept more widely the concept derived from physics, which refers to the mechanical capacity of an object to return to its previous state, after undergoing a change in its environmental context (SALGADO, 2013). However, and with strong emphasis, in the human sciences, the concept of resilience with a psychological bias has flourished, strongly linked to overcoming crises and adversities (YUNES, 2003). In this line, in an evolutionary view, resilience came to be understood as a capacity of complex open systems to change, adapt and transform in response to crisis and stress situations (CARPENTER; WESTLEY; TURNER, 2005).

Schematically, resilience processes can be qualified as being developed by individuals, groups or organizations (MALLAK, 1999). At the individual level, resilience consists of the human capacity to face and respond positively to experiences that present a high potential for risk for their development or health (SALGADO, 2013). In regards to groups, studies on resilience envision questions about competence, adaptation and challenges experienced by groups (YUNES, 2003). In turn, organizational resilience is linked to risk management, knowledge management and adaptive capacity (SALGADO, 2013).

In the perspectives outlined, the resilient organization is one that manages to overcome the moment of crisis and vulnerability in order to obtain a competitive advantage and learn from the adverse situation (SHEFFI, 2005). Thus, organizational resilience can be defined as the business ability to respond to specific situations, developing autonomous activities to effectively take advantage of and absorb disruptive surprises that potentially threaten the survival of the organization (ABDULLAH; NOOR; IBRAHIM, 2013).

It is, therefore, a capacity that reflects the routines and processes adopted by the organization, which are modeled to be able to “anticipate, respond, adapt and recover from a disturbing event” (SALGADO, 2013, p. 17). Some companies, such as small and medium enterprises (SMEs), face some obstacles to leverage organizational resilience, due to the difficulty in accessing resources and refining skills such as crisis anticipation; however, and in addition, they highlight adaptation characteristics, vital for developing resilience (YOUSSEF et al., 2013).

Still in this line, it is understood that processes and technology enable organizational resilience (EROL; SAUSER; MANSOURI 2010), since they are structural elements that facilitate
the achievement of internal characteristics of resilience, such as adaptability, agility, connectivity and flexibility (CHANG, 2016).

On the other hand, the so-called disruptive events such as changes in the environment and technology and the emergence of new business requirements are characterized as unavoidable external influences for the development of organizational resilience (EROL; SAUSER; MANSOURI, 2010), since they are part of the macroenvironment and, consequently, of the organizational context. Furthermore, because they are in the same context, organization and macroenvironment interact all the time, exerting reciprocal influences as parts of a system full of interactions. In this effort, resilience emerges in a contextual reality guided by practice, particularly in dynamic environments, in which ICT plays a crucial role, which emerges in the provision of connectivity facilitators, information sharing and resources to establish the capacity to resist (EROL; SAUSER; MANSOURI, 2010).

However, Chewning, Lai and Doerfel (2013) argue that the ability to resist is not only in the possession of technological resources, but also in organizations where processes are managed to achieve an expected organizational performance, through the proper use of resources in processes and processes routines harmonized with the organization's strategic planning. Thus, a resilient organization is not one that only has technological resources, but, primarily, one that knows how to strategically take advantage of resources in a crisis situation (CHEWNING; LAI; DOERFEL, 2013).

Furthermore, the ability to resist is not just the responsibility of strategy, process management and the effective use of organizational resources; it also emerges from the organizational learning effort to acquire the organizational capacities necessary for resilience, including those for adapting to and anticipating crises, as advocated by Jimenez and coauthors (2015). In this case, also, the joint conduction of the use of organizational resources in dynamic environments is under the aegis of organizational learning (LI et al., 2014).

Within the organizational context, both the individual and the organization are organisms that learn through means that involve capturing, storing, managing and promulgating knowledge for the development of individual skills and functional capabilities (TURBAN; VOLONINO, 2013; SIEMENS, 2013; SIEMENS, 2014). However, in addition to acquiring, storing and manipulating content, learning is also anchored in experience, situations and practice (BANDURA, 2000; CHIA; CHIA, 2017).

Park et al. (2015) argue that the relationship between organizational learning and ICT can facilitate learning at both the individual and organizational levels, through four learning mechanisms: internal and external electronic communication networks; organizational knowledge repositories and knowledge portals. Such learning mechanisms are commonly used in organizations, especially those that have technology as indispensable for their business model and value generation.
It is also anticipated that this conceptual exercise appears to be more powerful in contextual environments such as a technological cluster and software production that appear to be mutants, sensitive to the market and extremely innovative. In fact, according to the external aspects raised by Erol, Sauser and Mansouri (2010), companies in the field of information and communication technology need to pay attention to the new and versatile business requirements and changes in the environment that reflect the rapid advancement of technological changes.

As stated in the last paragraph, Porto Digital is one of these clusters and corresponds to a center of technological development and innovation, considered as one of the main technological parks in the country, recognized nationally and internationally as one of the most relevant habitats of innovation and which has been located since 2000 in Recife, Pernambuco. This cluster houses about 300 companies, research institutes and accelerators in the area of technology and creative economy, which between 2014 and 2016 earned more than BRL 1.4 billion (PORTO DIGITAL, 2018).

Companies embedded in Porto Digital, as well as other organizations in the same sector, in addition to being innovative, flexible, adaptable and creative, need to be resilient given the dynamics of technological changes that bring new market requirements, risk situations and threats to organizations survival (PAL; TORSTENSSON; MATTILA, 2014). Thus, courting the business environment experienced in this cluster, the opportunity for research on organizational resilience in these mutants, thriving and modern ICT companies is evident.

Following such thinking and understanding organizational resilience as indispensable and vital for companies (DERISSEN; QUAAS; BAUMGÄRTNER, 2011), and also recognizing the necessary characteristics of the resilient organization discussed so far, the present research dealt with the essential elements involved in the construction of strategies to survive in the context of companies embedded in Porto Digital, taking into account the processes and functional capabilities allied to individual skills developed according to the competence to learn in these companies, instrumented with the support of ICT.

**METHODOLOGY**

Based on the literature, theoretical constructs were raised that supported the operationalization in the field, serving as support for the construction of the mooring matrix, basis for the elaboration of the data collection instruments, present in the data collection protocol, as well as for the composition of the model for data analysis. In this first phase, the pre-test of the instruments was also carried out and the necessary adjustments were made. After that, the companies and specialists were contacted to schedule the interviews.

The second phase focused on conducting the data collection itself and analyzing the data. Business partners representing companies - eight technology companies embedded in Porto
Digital - and ICT specialists were heard. Then, the interviews were transcribed and data analysis took place, via an adapted thematic content analysis, which covered the steps of familiarizing the data, coding the themes and thematic search.

The last phase consisted of the review of the themes found and the description of the results, which led to the elaboration of the final report of inference and framing of themes vs objectives.

The data collection phase lasted six weeks, taking place in the second half of 2019 and involved interviews, preferably in person, with eight businessmen (partners) and six experts (analysts) - in fact, ten companies were contacted, but only eight confirmed their participation. Each interview followed a specific script, variable by listening group, and lasted between 30 and 40 minutes, generating about 8 hours of audio data, which were transcribed using the Transcribe Wreally® platform and generated about 120 pages of text, material that guided the entire data analysis.

To confirm the participation of the entrepreneurs, a call was made, and then an email was sent to formalize the invitation to participate in the research and schedule an appointment according to the participant's availability. It should be noted that, in these interviews, it was found that there were no women in the corporate structure in the companies reached.

In order to select the specialists, a reference profile was drawn up for the respondent and professionals who were close to the outlined profile were contacted. Among the criteria for adherence to the profile outlined for the specialists, professional training, proximity to the object of study and performance in the area of technology prevailed. For the selection of these profiles, a balance of segmentation was sought among the specialists (experience, training and organizational visibility, gender was also tried, but with no success). The contact took place via WhatsApp® and after adjustment, an email was sent to formalize the invitation to participate in the research.

DATA ANALYSIS

In view of the nature of the data collected, the approach devised for data analysis followed the vision of Braun and Clarke (2006), for operationalization of thematic analysis, which does not follow a linear model with restricted steps; on the contrary, it is a recurring analysis process and comprises six major phases: familiarization, data coding and theme generation, theme agglutination, themes review, designation and composing. Such an interpretative proposal for thematic content analysis is shown in figure 1.
In order to provide a pleasant view of the result of the thematic analysis, it was decided to build thematic maps, a diagram representing the connections established between the data in the light of the analysis model, which subtitles is shown in figure 2.

**Figure 2 – Subtitles used in thematic maps.**

<table>
<thead>
<tr>
<th>ELEMENT</th>
<th>Main Theme</th>
<th>Sub-theme</th>
<th>Strong influence</th>
<th>Weak influence</th>
</tr>
</thead>
<tbody>
<tr>
<td>SEMANTIC</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Elaborated by the authors.

**RESULTS ANALYSIS**

**THEME 1: PROCESSES**

For the organization to achieve its organizational goals, its processes need to be aligned with its strategy (JESTON; NELIS, 2015) and managed to ensure consistent results, taking advantage of opportunities for improvement (DUMAS et al., 2012). Once processes are improved, changes can sensitize the organizational structure through the remodeling of roles and functions performed by organizational actors (VOM BROCKE; ROSEMANN, 2015).

Not far from this reality, experts and entrepreneurs reported verifying the adaptation of business processes in two sub-themes.

Initially, the action of remodeling processes in response to the crisis with a double objective: optimizing the use of resources, reducing the cost of the operation, due to the lack of financial resources; the action of remodeling the structure, so that the organization adapts to the new reality.

“The biggest problem for us was an accounting problem, money in our account because my client took between 75 and 90 days to pay me. So, I changed the way I receive from the client, I started to have a model where the client paid for my service in advance. This change was crucial for us to turn the game around.” (Manager Company 04).
Another common role assigned to process management is to bring flexibility and resource optimization to the organization through process restructuring (CHANG, 2016). In fact, as noted, due to the scarcity of resources, the option of remodeling processes to reduce costs and improve organizational revenue can be a path when there are no alternatives to obtain more assets. At the same time, according to the speech of the specialists, another possibility of responding to the crisis lies in changing the processes that, perhaps, can contribute to the confrontation.

“Suddenly, you have processes that are related to the company's activities, generating a greater expense than the company is able to handle. And then these processes need to be adequate or stopped even to rethink and redesign them”. (Expert03).

The restructuring of processes, in turn, impacts the organizational structure, the size of the company and its staff. As Expert02 argued, the crisis evokes the need to “re-evaluate the team, the hierarchical and organizational structure, in fact”. Ratifying this assertion, it was heard in the field that:

“In 2014, we made a considerable downsizing in relation to the size of the company, because everything indicated that from 2015 onwards, some things would happen and that this would have a negative impact on our company. So, we started to take a series of measures to reduce the size of the company from 30 employees to 18, and then we managed to do that in that moment”. (Manager Company 08).

The elucidated approaches allowed us to hypothesize what is shown in figure 3 in order to undertake the adaptation of structures within the scope of the process in order to achieve resilience.

**Figure 3 – Structural adaptation to resilience within processes.**

![Structural adaptation to resilience within processes](source: Elaborated by the authors)

**THEME 2: INFORMATION TECHNOLOGY AND COMMUNICATION**

Considering the technological context on which the research was focused, it is important to understand ICT and its application in the context of a crisis. In this bias, when company representatives and experts were questioned about the use of ICT, the following sub-themes emerged: the acquisition of new technology, the use of tools to aid in the use of information for decision making and to expand capacities and skills.
Even if ICT resources become more available and homogeneous, companies that have them in line with their business needs can improve their performance (TURBAN; VOLONINO, 2013; CHAE; KOH; PRYBUTOK, 2014).

All things considered, following the need generated by the context, companies provided the opportunity at the moment of crisis to replace their own management tools with tools that presented a better cost benefit, provided more information about the business and adapted to the processes, including those recently modeled.

“We had a very big reorganization in the administrative-financial area... we went back to using Conta Azul®, which is an ERP software, so we managed to reduce the cost and improve the operation and have more information”. (Manager Company 08).

This same scenario was also envisioned to allow the automation of processes aiming at the best use of organizational resources, including the artifact itself.

“We think we used 5% of the solution, we didn't explore the maximum of the solution, and then it added to the crisis, the rise in the dollar. Researching, we found Pipedrive®, which is a much leaner CRM and which for us would be the ideal solution, if we were to compare it with Salesforce®”. (Manager Company 02).

In addition to the support in process automation, the role of technological infrastructure in supporting the organization and decision-making was notorious, aiming at the necessary adaptability to maintain structure and operations during the crisis (WESTERVELD; ABCOUWER, 2014). From this perspective, it was also realized that ICT provides companies with essential tools.

THEME 3: ORGANIZATIONAL CAPACITIES WITH A SPECIAL FOCUS TO RESIST

When respondents were asked about the organizational capabilities that could be mobilized during the crisis, both specialists – in a possible view – and entrepreneurs – in a real view – listed a set of crucial capabilities for organizational survival, which are displayed in figure 4.

<table>
<thead>
<tr>
<th>Capacity</th>
<th>Context Elements</th>
<th>Companies</th>
<th>Specialists</th>
</tr>
</thead>
<tbody>
<tr>
<td>Self-Evaluation</td>
<td>“With this self-assessment, we managed to turn off the taps, generate change, and even when everything led to a demotivation for something more negative, we looked for energy from I don't know where to try to reverse it there” (Manager Company 02)</td>
<td>“Always doing a little self-assessment of the various moments of the company, and I also assess other colleagues” (Expert05)</td>
<td></td>
</tr>
<tr>
<td>Adaption</td>
<td>“I think the important point is that in these moments of crisis, the person has to adapt” (Manager Company 01)</td>
<td>“He makes this adaptation even as a matter of survival” (Expert05)</td>
<td></td>
</tr>
<tr>
<td>Flexibility</td>
<td>“To have resilience, you need to be flexible” (Manager Company 07)</td>
<td>“In a crisis, the person needs to have an open mind and be flexible” (Expert06)</td>
<td></td>
</tr>
<tr>
<td>Reinvention</td>
<td>“To survive, we really need to reinvent ourselves” (Manager Company 02)</td>
<td>“The crisis is a moment of readaptation, but also of reinvention” (Expert02)</td>
<td></td>
</tr>
<tr>
<td>Opportunity</td>
<td>“We have to fit in and be quick to use the possibilities of the moment, with these capabilities” (Manager Company 06)</td>
<td>“A great ability in this sense to reinvent oneself, to always look at the moment of crisis as an opportunity to think differently and what alternatives you have” (Expert03)</td>
<td></td>
</tr>
</tbody>
</table>

Source: Elaborated by the authors.

However, faced with a disturbing event, the company can choose between not acting or facing the situation in order to survive. By choosing the second path, the company can carry out a self-assessment seeking to understand the context in search of new alternatives to combat the negative context. At times like this, coping strategies are essential for the development of resilience (BARLACH; LIMONGI-FRANÇA; MALVEZZI, 2008).

Self-assessment, in addition to being important for learning, consists of the organizational process that searches for internal strengths and weaknesses to identify opportunities and limitations linked to the environment. Therefore, it is through self-assessment that the organization understands where it is and which paths it can take to achieve its goals, outlining the strategic redirects needed to overcome the crisis. Furthermore, it is this capacity that allows the organization to “recognise its mistakes and design solutions based on this analysis” (Manager Company 07). At its end, the experts argued that for companies to overcome the crisis, it is not only necessary to carry out an internal evaluation, but also to seek to understand the macro-environment and how other companies in the sector and in the cluster are doing.

As for adaptation, a characteristic aligned with the contingency perspective and mentioned as essential for resilient companies, consists of the company's ability to identify and capitalize on emerging market opportunities (MEIRELLES; CAMARGO, 2014), through the need to adapt to the context of crisis, as reported by the manager of company 08, notifying that “the context is changeable, so if the business goes to one side or the other, we need to adapt to this demand”.

From the experts' perspective, as argued by Expert05, adaptation is something that reveals flexibility and accommodation to the scenario of uncertainty, “the company adapts even for the sake of survival”, being stronger the greater the crisis. In this way, both through adaptation and through self-assessment, companies are able to see opportunities, even in the period of crisis, as stated by the experts. Thus, the crisis can have a positive side, in which the company reinvents...
itself and innovates using the creativity and available resources to continue its operations and, consequently, achieve its survival.

As for the specialists, such capabilities seem to be common to ICT companies, where “the staff and their managers are very versatile, creative, in short, I think this helps a lot because they can often see opportunities in the crisis”. (Expert03).

Due to having to adapt, being flexible is essential to achieve this ability in the context: “you have to remain flexible over time to have resilience, even if you grow you need to remain a startup” (Manager Company 08). In addition to this statement, flexibility was seen as a common point between companies “the great motto of the small company is precisely this flexibility and, I dare say that the great motto of the large company that is already consolidated is the rest of flexibility that the owner has been able to maintain” (Manager Company 07).

Assuming that there is a positive side to a crisis, companies have agreed that it is possible to seize opportunities in the face of uncertainty by responding quickly to the changes and demands that the context presents through the vision of opportunity.

**Figure 5** – Testimonials that corroborate the ability to see opportunities.

<table>
<thead>
<tr>
<th>Company</th>
<th>Testimony</th>
</tr>
</thead>
<tbody>
<tr>
<td>Company 03</td>
<td>“I see that these changes are positive because of the opportunities that arise in the period of change”</td>
</tr>
<tr>
<td>Company 04</td>
<td>“We have to fit in and be fast enough to use, with these capabilities the possibilities of the moment”</td>
</tr>
<tr>
<td>Company 07</td>
<td>“It was a world class problem, and that interested us a lot because a problem like this when it gets solved they have a chance to turn into big business”</td>
</tr>
</tbody>
</table>

Source: Elaborated by the authors.

At the same time, experts declared that the company needs to be alert to market trends, being “proactive and looking for new opportunities” (Expert04). However, in this moment of taking advantage of opportunities, individual skills are required to find alternatives and solutions using creativity and the actors' knowledge repertoire.

"It's a moment when we stop and reinvent ourselves, we're going to put together a team to understand the way out, what options we have to recover something". (Expert02).

**THEME 4: INDIVIDUAL SKILLS FOR FACING CRISIS**

In addition to organizational capabilities and resources, facing and overcoming a crisis invites organizational actors to exercise their individual skills to contribute to the company in the face of difficulties. So, a series of individual, innate, developed and learned skills were listed, necessary for the organization to conquer resilience, which, combined with the group's skills and the leader's skills, formed the pool that must be persevered to acquire the ability to resist.
The exercise of these skills has in cooperation its key element (PIMENTEL et al., 2012), ratified in the field, as “fundamental for overcoming the crisis to happen” (Manager Company 04). It was also captured that through cooperation there was a “contribution of each person by sharing their knowledge” (Manager Company 03).

In this route, emotional intelligence was mentioned by the manager of company 03 as a way of “professional's persistence in not losing focus in the moment of crisis, in not letting himself be shaken by internal or external conflicts”. This intelligent facet was also related to the entrepreneur's role as important in building resilience, both in the speech of the manager of company 06 [“a manager who despairs at the slightest sign of crisis and passes it onto the team, and contaminates the team in a negative way: It’s like shooting himself in the foot”]; as for specialists, [“having emotional intelligence, taking certain risks and not panicking in the face of crisis” (Expert03)].

When associated with emotional intelligence, resilience is related to the individual's adaptive capacity to face stressful situations, understanding such situations as less threatening and more challenging (MATTHEWS; ZEIDNER; ROBERTS, 2004).

In the organizational scenario, interpersonal relationships are being more valued, so much so that the look at human capital has become differentiated, as it has been realized that people are the competitive advantage of organizations, and the results and productivity itself have consequences for the well-being of people being in the work environment (BRONDANI, 2010).

“Certainly, this ability to deal with people was essential to help the company overcome this moment of crisis, being able to solve several difficult situations, always trying to keep people motivated”. (Manager Company 02).

The specialists also perceived the interpersonal relationship as necessary for the entrepreneur, to seek, in the context, new alternatives and solutions.

“During the crisis, I think we have to look for these connections, use these connections that we can create alternatives, even change, if you are only working in Pernambuco, the guy makes a bridge to work elsewhere to bring more income from elsewhere”. (Expert05).

In turn, in the understanding of the field, technical skills are the specific knowledge of the work and provide the conditions to perform it efficiently. These skills tend to be more important for first-line managers, as they manage employees who use tools and techniques to produce the organization's products or serve the organization's customers (JUDGE; ROBBINS, 2017).

Technical skills in the context of technology are essential for the progress of operations and, therefore, need to be present somehow in the organizational context.

“We had very competent people here, including in the corporate structure, the partners were the backup. If there was a problem with the operation and there were no people, the partners could handle it”. (Manager Company 05).
However, according to the experts, there is, in the context, a problem of discrepancy in the training of these human resources, since “our universities are not training students with the skills that companies so need” (Expert05).

Within this context, it is common for companies to hire an employee whose profile “requires investment in training and preparation” (Manager Company 02). To solve this problem, the need to develop technical skills within the organizational environment emerged, using technology tools, according to the reports announced in figure 6.

**Figure 6 – Needs to develop technical skills within the organizational environment.**

<table>
<thead>
<tr>
<th>Profile</th>
<th>Report</th>
</tr>
</thead>
<tbody>
<tr>
<td>Expert 05</td>
<td>It's easier to hire someone a little less experienced than a ready-made guy, this will stop</td>
</tr>
<tr>
<td></td>
<td>someone from your organization for a while to train that newbie. This is the way</td>
</tr>
<tr>
<td>Company 07</td>
<td>We use our platforms to train our employees, for example, the project management course</td>
</tr>
<tr>
<td></td>
<td>is used by our team</td>
</tr>
<tr>
<td>Expert 03</td>
<td>It is possible to develop some skills through training using technologies based on simulations</td>
</tr>
<tr>
<td></td>
<td>or games, this can permeate the individual's daily life</td>
</tr>
</tbody>
</table>

Source: Elaborated by the authors.

In addition to the technical skills developed, critical thinking is another relevant individual skill so that the problem is understood and alternatives to solve it are outlined during decision making. Even though the individual's rationality is limited, it is important that technology tools and management tools are used to increase the individual's skills in the face of the problematic context.

Furthermore, entrepreneurship is a process that requires leadership to guide the group to achieve organizational goals. Therefore, experts declared that leading is “bringing the culture that it has of creativity and innovation to employees” (Expert04), being “the leader's posture is essential to bring confidence that the company will overcome the crisis” (Expert06).

In connection with leadership, assertiveness in decisions proved to be strong to maintain the firmness and direction of the organization, as the managers argued. One of them said that leadership was an “ability to design and signal that from now on this is what this is and if we hadn't managed to do that, the company would die” (Manager Company 04). It was noticed in the field, therefore, that the skills required were listed in figure 7.

Examining the capacities, organizational resources and abilities of individuals in the context of coping with crisis, the combination of all these items in strategies to achieve organizational resilience was studied.
Figure 7 – Individual skills listed by companies and specialists.

<table>
<thead>
<tr>
<th>Team’s Individual Skills</th>
<th>Team and leader’s Individual Skills</th>
<th>Leader’s Individual Skills</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cooperation</td>
<td>Emotional intelligence</td>
<td>Leadership</td>
</tr>
<tr>
<td>Technical Skills</td>
<td>Interpersonal relationship</td>
<td>Assertiveness in decisions</td>
</tr>
<tr>
<td>Critical Thinking</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

Source: Elaborated by the authors.

THEME 5: STRATEGIES FOR RESILIENCE

Cleden (2017) argues that an organization must be able to detect and respond quickly to unexpected events in order to be resilient, outlining strategies that imbue companies with greater resilience. Corroborating this conjecture, in the field, based on the data collected with the two audiences, the organizational strategy proved to be essential to the task of resilience.

Initially, it was noticed in the speech of the specialists, the need that the organization has to anticipate crises through the design of a strategic plan, visible in “we learn preventive measures in administration of what will come, even the strategic planning itself must be designed to overcome contingencies” (Expert02).

Also, the manager of company 08, observing the changes in the macro-environment that could affect its operations, started to make immediate adjustments to its structure, so as not to suffer from such changes or incur losses that could cost its survival.

“Sometimes we can do it, sometimes we can't have this whole perception. Because we don't know everything, but in general we manage to anticipate more macro factors that are happening and that will affect the business”.

(Manager Company 08).

In this same company, the entrepreneur also highlighted the importance of the anticipatory strategy for the longevity of the company as being “what made us exist until today” (Manager Company 08).

Continuing in this perspective, the use of information to provide the business strategy was also presented as fundamental, not only for preventive purposes, but also for monitoring changes and events in the macro environment, so that the company does not have to face the crisis in fact, as mentioned by Expert03: “measures also to go after information to provide business intelligence to predict possible crisis and develop preventive measures to deal with the crisis”.

In order to seek such responsiveness, a recurrent system was noticed in these organizations. In fact, at the first sign of adversity, companies carry out a self-assessment, examining their objectives, paths, portfolio (products and services) and target audience.

Thus, as a result of this self-assessment, there is a strategic redirection resulting from an adjustment strategy, a fact declared by the leader of company 05 “we had a lot of strategic planning meetings to know what we wanted as a company and what was our new direction, everything”. Reiterating this thought, the opinion of the CEO of company 04 revealed that:
“We looked at what we were doing, rethinking it, together with everyone involved, and then we verified some changes that could help in this moment of crisis”. (Manager Firm 04).

Also following the path to seek to respond to the moment of crisis, there was a demand for the organization to review its operation, its planning and its business model with a view to decision making, adopting strategies for diversification and survival. This action even led to the formation of specific working groups for decision-making during the crisis. Such decision moments sometimes raised recommendations for adjustments through process restructuring and organizational structure remodeling.

“It is a time to review and this also impacts how these activities are going to be carried out, even the projects that sometimes, at that first moment, it is not clear what the purpose is, etc. then you will visit it back”. (Expert02).

These recommended changes, as Expert06 said, were established via adaptive strategies and aimed to create beneficial organizational adaptations in the short and long term aimed at business sustainability, allowing the company to survive the crisis. The purpose of the adaptation strategies was to trace a route that would give “energy in the moment of crisis that allows you not to succumb to the pressures of the crisis, so to speak” (Expert03).

In addition to the structural changes, strategic decisions that impacted the business' performance, through the search for financial resources made possible through investments and promotion notices, were also revealed; sometimes as a suggestion given by a specialist to gain resilience, feasible in “but there is a possibility of obtaining resources elsewhere, or having capital that is previously saved to solve some crisis” or highlighted in reality by diversification or search for momentary success solutions, as in the excerpt below.

“This turned on the light for us to 'let's analyze our portfolio, let's start working with second-line solutions', at least momentarily so that we can at least keep these customers in our base”. (Manager Company 04).

However, the leader of company 02, which is guided by only one entrepreneur, unlike the other companies investigated, admitted that there was no specific moment for planning, but strategic decisions took place along the way during the confrontation of the crisis. Thus, emerging strategies flourished from the context.

“There were some attitudes that we took along this path, it was nothing like thinking 'let's make a strategy for this next year that we will focus on how to dribble this crisis', it was nothing that planned”. (Manager Company 02)

In regards to contingency measures, the entrepreneur of company 05 considered the importance of organized financial management and financial reserves for emergency situations, in case the company needs to be closed, including. However, when the company cannot maintain a contingency reserve and lacks financial resources, the alternative is to seek investments through sources of fostering innovation and the development of startups, as one of the partners of company 01 argued: “what we did at that moment was to seek investments. Not that it's the best possible
strategy, but that's what we did at the time. We looked for some sources of investment, both funding sources, from public notices, and private sources, from investors”.

The same manager of company 01 had signed that the funding was essential for the sustainability of the business and for the maintenance of operations.

“If we hadn't managed to get the investments, we wouldn't have stopped operations, but we would have been slower. With the investments, people were able to meet the financial need to improve cash flow and run operations”.

(Manager Company 01).

Finally, a sub-theme that emerged from the speeches of the specialists was the adoption of transparent management that informs employees about the organizational situation during the period of crisis to prevent insecurity from taking place within the business environment. This threshold was then mapped into a participatory strategy focused on “opening up information, explaining what is happening or what the positive perspectives are too, because along with the crisis, opportunities are also created” in the expression of Expert01 consultant. Finally, the relationships between the central theme of strategy and its sub-themes are described in Figure 8.

Once these new strategic directions were traced and put into practice through strategies and new actions strongly based on ICT, it was noticed that there was a direct impact of the choices in the operational routines and this was reflected in the restructuring of processes, in the organizational structure, in organizational capabilities, in the skills of individuals and in the organization's ability to learn from the crisis, as well as fostering the search for the ability to resist.
OUTLINING OUTCOMES

Aiming at understanding the foundations for the construction of organizational resilience in technology companies embedded in Porto Digital, in order to consign the resilient contexts of each organization, having access to the strategies used to resist.

Based on the data found in the field, it was possible to perceive that the role of ICT in the construction of resilience followed two distinct strands. The first followed the argument that ICT served as a facilitator to face the crisis, providing informational tools for decision-making and business management. The second strand, in turn, followed the role of ICT as a moderator of organizational learning, providing resources for employee training and knowledge repository.

Thus, rescuing the interviewees’ speech, ICT was a means that enabled the process of building resilience in the organizations studied, since it influenced decision-making processes, restructuring of processes and organizational structure, mobilization of resources, development of functional capabilities and individual skills.

Regarding the ability to cope with crises, it was noticed that it was related to the organizational structure and the degree of flexibility maintained by the organization. In association with the aforementioned capabilities, others emerged in the field that are strongly present among the characteristics of resilient companies, such as self-assessment, adaptation and flexibility, reinvention and the vision of opportunity, to face the positive side of the crisis.
When verifying how organizations adapted their structures to achieve resilience, the analysis found similar responsive actions in the organizations studied:

- At first, the companies carried out an organizational self-assessment analyzing the micro and macro environment, opportunities and threats;
- Then, they carried out a re-planning aimed at formulating strategies for resilience, which required a high degree of agility and flexibility to respond to the crisis.

Finally, it was still possible to obtain information about the strategies used to face the crisis. It is noteworthy that strategies for building resilience in these companies were common as a result of learning cycles anchored in ICT. However, in general, it was noted that as a company faced a crisis, it responded to the context, undertaking deliberate, anticipatory, emerging and containment strategies aimed at adapting, redirecting and diversifying the business.

And not only that, but these companies also showed that it was essential to follow the path of learning through reflective practice in order to be more resilient in future situations. This does not mean that when overcoming a crisis the company will be eternally resilient, but it will be able to create layers of resistance that bring more longevity to its operation. Briefly, such strategies were compiled in figure 9.

![Figure 9 – Strategies used to build resilience.](image)

<table>
<thead>
<tr>
<th>Type</th>
<th>Strategy</th>
<th>Companies</th>
</tr>
</thead>
<tbody>
<tr>
<td>Deliberate</td>
<td>Search for investments through fostering innovation</td>
<td>1 e 7</td>
</tr>
<tr>
<td>Of containment</td>
<td>Process management: process optimization, resources; organizational structure remodeling</td>
<td>1, 2, 3, 4, 5, 7 e 8</td>
</tr>
<tr>
<td>Of containment</td>
<td>Business diversification: modification of the portfolio of services and products, redirection of the target audience</td>
<td>1, 4, 5, 7 e 8</td>
</tr>
<tr>
<td>Emergent</td>
<td>Negotiation with collaborators</td>
<td>2 e 3</td>
</tr>
<tr>
<td></td>
<td>Use of partners as operational labor</td>
<td>1, 2 e 5</td>
</tr>
<tr>
<td></td>
<td>Innovation and transparent management</td>
<td>2, 5 e 6</td>
</tr>
<tr>
<td>Anticipatory</td>
<td>Macro-environment analysis and anticipation</td>
<td>3, 5 e 8</td>
</tr>
</tbody>
</table>

Source: Elaborated by the authors.

The research presented some research limitations, including the lack of effective contact with companies during the reported moments of crisis; the time effect, since the research consisted of a one-off study, without longitudinal character and relying only on the partners’ view, losing sight of other organizational actors. Also the fact that the specialists did not experience deeper situations, as well as the non-uniformity of the companies’ performance in the same segment of services and products.

As means of adding to the research, it is suggested the possibility of its deepening from the organizational and technological perspectives, aimed at validating the strategies found with another group of companies, in other clusters, looking at the ethical perspective as an influencer...
in the construction of organizational resilience and to deepen the influence of inter-organizational collaboration on the resilience of companies.

Finally, it is evident that the correlation conjectured at the beginning, which is that strategies and information technology are leading and predominant vectors for the formation of organizational resilience, at least in technology-based companies, immersed in an ecosystem of innovation and digital transformation, known as a technology cluster, was achieved.

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