



## Research Article

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Received: 13 September 2023 / Accepted: 22 December 2023 / Published: 5 January 2024

# Reducing Challenges in Design Thinking Adoption Using Intrapreneurship and a Learning Environment

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DOI: <https://doi.org/10.36941/ajis-2024-0024>

## Abstract

*Design thinking (DT) is increasingly used to develop solutions that identify users' real needs. However, resistance to adopting DT and a lack of knowledge about the tools and activities of this approach are significant challenges in its implementation. Thus, organizations need to create strategies that minimize these challenges. This paper explores an approach focused on intrapreneurship to motivate employees to develop new business ideas combined with a learning environment for exchanging knowledge as a mechanism to overcome resistance to the adoption of DT. In this sense, the research problem addressed here is the lack of strategies to minimize resistance and the lack of knowledge for adopting DT in software organizations. This work was conducted using action research in a Brazilian software development organization. Initially, a call for proposals for new software-based business ideas was launched at the organization. Then, the DT was applied to develop the proposed ideas. In parallel, a learning environment was created to train employees in DT and its tools. A feedback questionnaire and a retrospective meeting were held with the organization's employees to evaluate the action research. Our results suggest that an intrapreneurship approach and the learning environment proved to be effective within the context studied and managed to reduce resistance to the adoption of DT.*

**Keywords:** intrapreneurship, learning environment, design thinking, software conception, participatory action research

## 1. Introduction

Organizations should not just focus on developing software quickly (Pereira et al., 2021). They must develop solutions to solve the real needs of users and customers, i.e., solutions that customers want (Edison et al., 2015; Pereira et al., 2021). Therefore, user-centered approaches are increasingly being applied in the conception of software products in teams of different sizes (Parizi et al., 2022) because these approaches prioritize the identification of needs and the involvement of real users in the product design process (Carrol & Casselman, 2019) rather than just refining previously defined

software requirements (Signoretti et al., 2020). This is important because it is widely recognized that real users should validate business ideas from the very beginning of their conception (Hokkanen & Leppänen, 2015).

In this sense, design thinking (DT) (IDEO, 2022) is one of the most successful and influential user-centered approaches in software conception (Hehn & Uebernickel, 2018; Auernhammer & Roth, 2021). DT aids requirements analysis through problem immersion, solution ideation, and prototype-driven design, which allows for better identification of users and business needs (Carroll & Richardson, 2016).

Despite its advantages, the implementation of DT in a company has several challenges, such as people's resistance to adopting the approach and the lack of professionals with proper knowledge of DT (Pereira et al., 2021). People's resistance to DT is due, among other factors, to the difficulty of proving the value of DT, the mismatch with existing processes and structures, the different communication styles compared to traditional requirements engineering techniques, and the clash between the principles and values of the approach and those of the organization (Carlgren et al., 2016). Meanwhile, the challenge related to the small number of professionals with knowledge of DT can be justified by the difficulty of implementing the ideas and concepts of the approach and acquiring new skills, considering the large number of available tools for DT (Carlgren et al., 2016). Parizi et al. (2022) conducted a systematic mapping of the application of DT in software development, and no studies were identified focusing on establishing alternatives to overcome resistance to using DT.

Our study focuses on understanding and overcoming this resistance. Therefore, we conducted an action research (Stringer, 2013) study in a Brazilian software development organization interested in adopting DT. During the action research, some specific needs were identified in the studied organization, such as (1) the desire to apply DT to design innovative software, (2) the interest in applying intrapreneurship as a form of innovation, and finally, (3) the need to qualify the organization's employees in the use of DT. Based on that, we identified an opportunity to apply intrapreneurship as an alternative to overcome the resistance to the adoption of DT. Intrapreneurship encourages proactive and entrepreneurial characteristics in an organization's employees, with the possibility of creating innovation by promoting a positive scenario for the emergence of new products, processes, and services (Neessen et al., 2019). In addition, intrapreneurship encourages employees to act on their ideas to put them into practice, which generates greater motivation and interest in taking risks (Morais et al., 2021). Meanwhile, the challenges related to the lack of professionals with knowledge of DT and the need for the studied organization to qualify its employees in the use of DT motivated the creation of a learning environment. Learning in the professional context is considered a crucial element in minimizing the lack of knowledge about important concepts in an organization (Fazekas & Field, 2013). In addition, the creation of an organizational learning environment allows employees to be valued and is directly linked to satisfaction in the workplace (Irshad et al., 2021).

In summary, the research problem investigated in this paper is about the lack of strategies to minimize resistance and lack of knowledge for adopting DT in software organizations. Based on this problem, we address the following research question: *How can an intrapreneurship program combined with a learning environment reduce the resistance and lack of knowledge to adopting DT in a software organization?*

The contributions of this work are as follows. First, it presents the definition and application of an intrapreneurship program as a mechanism to motivate the employees of a software development organization to adopt DT, consequently reducing resistance to the adoption of this approach. Second, it proceeds with the definition and usage of a learning environment as a way to help the dissemination of the knowledge necessary for the application of DT in the studied organization. Finally, this study describes a practical example of the application of DT in an organization. This is important because, to the best of our knowledge, there are not many practical examples of the application of DT, as well as the positive and negative results of its use in real software systems

(Canedo & Parente da Costa, 2018; Dobrigkeit & Paula, 2019; Sohaib et al., 2019; Ferreira et al., 2021).

The rest of this paper is organized as follows. First, the main concepts covered in this paper are presented in Section 2. Next, the research methodology adopted in our study is described in Section 3. Then, Section 4 describes the action research carried out in the studied organization. Section 5 discusses the results of the work. Finally, Section 6 presents the conclusions and suggestions for future work.

## 2. Background

This section presents the concepts of (i) design thinking, (ii) intrapreneurship, and (iii) learning environment.

### 2.1 Design Thinking

Design thinking (DT) is an approach that helps one to understand the real needs of users and customers (IDEO, 2022). In the context of software development, DT helps design systems that emerge through creative ideas that are evaluated through prototypes (Tschimmel, 2012). In addition, it consists of an approach that seeks innovation, placing the human being as a central element of this process (IDEO, 2022).

DT provides tools for defining and solving problems, from divergent to convergent thinking (Hua et al., 2023). These divergences and convergences can be identified using tools that make it possible to identify a wide range of problems, until defining which problems make sense to invest in. It also generates several possible solutions, leading to the definition of a solution to be tested.

Design thinking also brings people closer together, promoting communication, improving cooperation, and the sharing of tacit knowledge (Pereira et al., 2021). It improves the definition of solutions and enables a cultural transformation by promoting a human-centered mentality (Pereira et al., 2021). DT helps business leaders achieve their objectives, define goals, and enable a greater understanding of users' and customers' pains (Clark & Smith, 2010). There are many different approaches to DT, one of the best known being that of the ID FOUNDATION (2022), which divides DT into five stages: Empathy, Definition, Ideation, Prototyping, and Testing. This approach and its respective stages were adopted in this research.

### 2.2 Intrapreneurship

The term intrapreneurship was created by Pinchot (1985). It can be defined as a process that cultivates the proactive and entrepreneurial characteristics of an organization's employees, with the possibility of creating innovation through new products, processes, and services, and, therefore, being able to renew businesses, undertake new businesses, and increase competitiveness and organizational performance (Neessen et al., 2019).

The impact that intrapreneurship has on organizational performance has made it a relevant topic in scientific research (Mohedano-Suanes & Benítez, 2018). In addition, to ensure their survival, generate business opportunities, maintain competitiveness, and mitigate threats (Urban & Wood, 2015; Morais et al., 2021), many organizations are increasingly adopting practices that incite intrapreneurial behavior (Morais et al., 2021).

Encouraging intrapreneurial behavior and implementing intrapreneurial practices are crucial to achieving good innovation results (Marques et al., 2022). In addition, investing in intrapreneurship allows human capital to be valued, which is a strategic advantage since it stimulates intrapreneurial characteristics like innovative behavior, proactivity, creativity, self-confidence, a desire for growth, and a willingness to take risks (Morais et al., 2021).

### 2.3 Learning Environments

Learning in the workplace makes it possible to acquire the skills needed in each context (Fazekas & Field, 2013). Many of these skills are not easily acquired outside the workplace and can complement the knowledge needed by the organization's employees (Fazekas & Field, 2013).

According to Billett (2001), workplace learning strategies need to cover four requirements: (i) identifying the knowledge needed by the organization; (ii) encouraging the commitment of those responsible for facilitating the knowledge, and the employees who need to acquire the knowledge; (iii) preparing learning guides appropriate to the organization's needs; and, finally, (iv) implementing a learning environment appropriate to the workplace.

In this context, a learning environment can be summarized as the set of necessary knowledge, opportunities to use this knowledge, social interactions, and values established in a work environment (Zhao & Ko, 2018). However, according to Bouw et al. (2016), there are no conceptual limits on defining the size of a learning environment: it can involve a small group in a single task or a large group with several tasks over a long period. The learning environment includes a physical and/or digital environment, tools, documents, sources of information, the social environment in which learners carry out their tasks, and the time made available for learning (Carvalho & Goodyear, 2017; Goodyear, 2001; Zitter & Hoeve, 2012).

## 3. Methodology

### 3.1 Research Classification

This work adopted an action research approach (Erro-Garcés & Alfaro-Tanco, 2020). Action research allows scientific knowledge about a topic to be explored through actions that seek to solve problems in a specific place (Sparre, 2020). In addition, introducing changes in a complex social process, as proposed by action research, can generate excellent research results (Baskerville, 1997).

We decided to use action research because of the complex context and the need to propose and evaluate changes in a software organization (Stringer, 2013). Among the types of action research, this work uses participatory action research, in which researchers and professionals share decision-making power and act collaboratively in the study and transformation of the target organization (Sparre, 2020).

### 3.2 Tools, Methods, and Research Steps

The stages of action research considered in this work follow the proposal by Susman & Evered (1978). In other words, this research was executed in six stages: Select the Studied Organization; Conduct Organization Diagnosis; Plan Action Research; Execute Action Research; Evaluate the Action Research; and finally, Conduct Action Research Learning (see Figure 1). The following subsections describe the steps, tools, and methods of each of these stages.

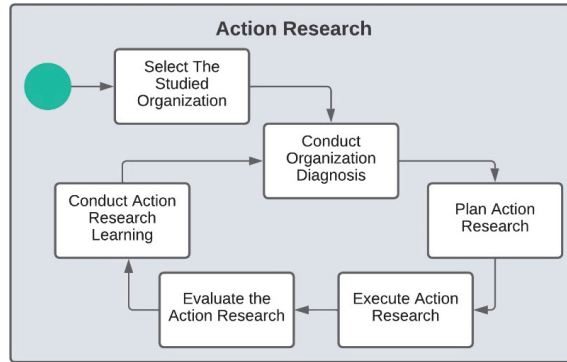


Figure 1: Research Steps adapted from Susman & Evered (1978)

### 3.2.1 Select the Studied Organization

This step means selecting the organization in which the study was applied. In this case, the proposal for this work was presented to three software development organizations located in Brazil. Other companies were contacted, but no replies were received from them. The criteria used to select the organization were: (i) the focus of the organization must converge with the research proposal, (ii) the organization's senior management must support the research proposal, and, finally, (iii) the organization must be interested in applying software conception through design thinking. More details about the selected organization are presented in section 4.1.

### 3.2.2 Conduct Organization Diagnosis

This step assessed the context of the organization selected for this study concerning the topic under investigation. To this end, after the selection stage, a meeting was held between the researchers, the organization's director of the new businesses development, and one of the founding partners of the selected. This meeting served to identify the primary problems that generated the desire for change in the organization under investigation. It was then decided that the diagnosis would be done by reading the organization's documents and interviewing employees selected by its new business development director. For the document analysis, the documentation of its software conception processes was provided.

Two semi-structured interviews (Barriball & While 1994) were conducted with selected employees. The first was with the director of the new business development, and the other was with two employees selected by one of the organization's founders. An interview script was defined to describe and characterize the software conception approach used by the organization studied to create innovative solutions. The following questions were considered: Which approaches are used as a basis for software conception? What are the strengths and weaknesses of the approach adopted? What results have been achieved? What is the status of user-centered software conception in the organization? The interviews took place online using a video conferencing tool. They were recorded, transcribed, and qualitatively coded by qualitative analyses (Gerring, 2017) using the QDA Miner Lite tool, version 2.0.9.

### 3.2.3 Plan Action Research

This step was responsible for planning the activities, defining the execution team, and creating a schedule for the action research. The action research was applied using a collaborative planning

model, which involved the researchers, the director of the new businesses development, and one of the founders of the organization studied. In this case, a meeting was held to define the focus of the project and the responsibilities of the parties involved. In addition, a code of conduct between the parties was defined and signed. Weekly meetings were also held to assess the research progress and identify any changes needed to the initial plan.

In general, the execution team was responsible for defining and conducting the action research by defining the stages and activities to be carried out, the DT tools to be used by the participants, how intrapreneurship would be applied, and defining the learning environment with the learning support material.

#### 3.2.4 *Execute Action Research*

The DT approach used in this work is the model defined in ID FOUNDATION (2022), a definition widely used and well-established (IDEO, 2022). As a result, the design thinking tools selected for the approach were: desk research, personas, empathy map, brainstorming, value proposition canvas, lean canvas, prototyping, and validation meetings with potential users. For more details on these tools, see IDEO (2022). These tools were selected mainly because they were already known to the research team, i.e., their adoption had a negligible impact on the implementation of the research. Also, the organization wanted to conduct the research as soon as possible. It is important to remember that in action research, design decisions are considered collaboratively between the researchers and the organization in which the research was applied (Stringer, 2013).

The DT was applied through an intrapreneurship program. In this case, this program was used as a mechanism for employees to develop innovative software ideas that could be improved by DT activities. In this case, employees were selected to take part in this program through a call for innovative ideas for software solutions. The intrapreneurship program included the following stages: (i) launching a call for proposals, created by the action research team and launched by the organization studied, (ii) submission of ideas for new systems by any employees of the organization interested in taking part in the call, (iii) selection of employees to participate in the program, (iv) implementation of the DT to help conceive the ideas, and, finally, (v) the presentation of the results by the selected employees to the founders of the studied organization.

The intrapreneurship program was launched as an internal call for proposals. The call was aimed at the company's employees, to select software-based business ideas to be conceived. In this case, the aim was to seek innovation and to teach the tools and values of DT in a practical way. The Call for Proposals was drafted by the author of this work and evaluated by the action research team, one of the founding partners, and the company's legal department. The call for proposals set out the objective of the intrapreneurship action, as well as the rules and details for participating in the selection. In this case, employees had to submit software-based business ideas.

The selection step considered the following questions to be filled in when the employees submitted their ideas: description of the idea, problem to be solved, value proposition, differential, market niche, target audience, competitors, monetization approach, and knowledge of marketing, sales, finance, administration, and team management on the part of the proposers of the ideas. This was adapted from Yin & Luo (2018) and Yusubova et al. (2020). Each question was considered a criterion, and scores were assigned by each member of the action research team. The sum of the scores for each criterion generated an overall score for each idea proposed. In addition, the managers of each employee who submitted an idea were consulted to give their opinion on the collaborative and commitment profile of each employee.

A learning environment was set up containing explanatory materials, external links to articles on the concepts present in the approach adopted, and links to videos on how to use the proposed tools, adding a body of knowledge about the tools and activities to be done. The learning environment materials were selected and produced by the action research team. These materials were presented to one of the company's partners, who approved the content developed. The learning

environment was made possible through online training via the Microsoft Teams tool and by providing support material via the Slack tool (<https://slack.com/>). The Slack tool played an important role, as it was used to make all the support materials available and enabled asynchronous interaction between the action research team and the company's employees. In addition, the Microsoft Teams tool was used as a training environment and for synchronous interactions. The training was also presented by the action research team.

The application of the DT was monitored regularly via weekly meetings, with the active participation of the action research team in clarifying the use of the DT tools and more active participation in tasks such as reviews and feedback on what was produced by the collaborators.

### 3.2.5 Evaluate the Action Research

This step was responsible for evaluating the results of the action research. To evaluate it, feedback questionnaires were sent to employees during the implementation of the proposed approach, and a retrospective meeting was held to evaluate the overall implementation of the intrapreneurship program. Our goal was to evaluate the approach to improve previously planned activities, validate the use of chosen DT tools, and obtain continuous feedback, thereby ensuring that the approach is adjusted to the needs of the organization (Bost, 2018).

The feedback questionnaire was defined collaboratively by the action research team and passed on to the organization's employees. The following questions were defined in this questionnaire: What obstacles prevented you from carrying out these tasks? Do you have any suggestions for improvement? After qualitatively analyzing the answers from the questionnaires, the results of the feedback were grouped into the following codes describing obstacles: Unavailability of employees; Difficulty involving clients in the approach's activities; Difficulty defining the target audience; and Lack of technical knowledge.

In addition to the obstacles, the employees also made suggestions for improvements using the feedback questionnaire. At the end of the approach, a retrospective meeting (Rola & Kuchta, 2020) was held. The retrospective was used because it allows the main problems to be identified and a diagnosis to be generated quickly and consistently, based on the collaboration of the working groups that lead and carry out the actions that need to be evaluated (Rola & Kuchta, 2020). To execute the retrospective, the employees and the research team were involved. This meeting lasted about two hours and was recorded. The meeting generated a retrospective table with the fields suggested by Rola & Kuchta (2020): What was good? What was bad? What is the cause? and What will we improve? These fields were filled in collaboratively during the meeting.

### 3.2.6 Conduct Action Research Learning

Learning from the action research took place through the feedback provided by studied organization employees in the Action Research Evaluation step. In this case, the feedback provided through questionnaires and the results of the evaluation phase served as a basis for taking action to learn from the identified opportunities for improvement. This activity was carried out by the research team and identified how the weaknesses pointed out by the employees would be dealt with.

## 4. Results of Action Research Application

This chapter presents the results of the execution of the action research steps, as well as their respective results. The action research steps follow the steps presented in section 3.2.

### 4.1 Results of the Select Studied Organization step

The organization to be studied was selected through a meeting between the researchers, the director

of the new businesses development, and one of the founders of a software development organization. The purpose of this meeting was to present the focus of the study to the organization and to find out whether it would be interested in applying this study. The meeting lasted approximately 50 minutes and the organization now referred to as Alpha was selected because it presented a set of problems and interests that converged with the proposal of this study according to the criteria presented in section 3.2.1.

Alpha has 11 years of experience in the software market, with offices in the cities of Belém, Florianópolis, and São Paulo (all in Brazil). In addition, Alpha has employees distributed remotely in five other Brazilian states, with a total of 130 employees, serving clients in the public and private sectors. This organization saw the need to invest in innovation. This allowed the organization to set up an innovation office linked to a technology association located in Florianópolis, about 3600 km from its headquarters in Belém. This office further motivated the organization to direct its efforts toward innovation.

#### 4.2 Results of the Conduct Organization Diagnosis step

The diagnosis of the organization began with a reading of the documentation of the user-centered software conception approach initially adopted by Alpha. There was little documentation, so this reading lasted about an hour, including a time to ask questions of Alpha's director of the new businesses development. This documentation was divided into two stages: immersion in the problem and immersion in learning. In this case, the documentation did not go into more detail on how to apply this approach. The interviews with Alpha employees were then conducted to collect additional information. The following codes were identified to help analyze these interviews with approaches adopted; tools used; strengths; weaknesses; results; and status of software conception.

The interviews were conducted with the director of the new businesses development (D<sub>1</sub>) and two Alpha employees (C<sub>1</sub> and C<sub>2</sub>), each lasting approximately 50 minutes. Alpha had already defined a user-centered software conception approach based on design thinking. This approach was created by the director of the new businesses development aiming to develop systems for the organization itself. In this sense, D<sub>1</sub> reported that: *"we were inspired by design thinking, (...), not one hundred percent, but the main objective was linked to the idea of design thinking, with a look at validating the problem and then validating the solution"*.

Among the tools used by Alpha for user-centered software conception, D<sub>1</sub> indicated that:

*"we had a block of immersion in the problem (...), we went on to immerse in the solution. Then we'd start brainstorming (...), and all the ideas had to be based on the problems that had been discovered, (...) on the empathy map, (...) and then we'd come up with solutions based on the problem we'd studied, (...) in the end we'd come up with the product idea."*

C<sub>1</sub> reported the following DT tools being used: "problem analysis, market research (...), focus groups, we used a survey with a form (...) and brought several customers together, interviewed them and understood what they needed most". The adopted tools were known to D<sub>1</sub>, C<sub>1</sub> and C<sub>2</sub>. However, it is important to mention that these tools were not known by most of the rest of Alpha's employees.

Alpha's user-centered design actions had some strengths, such as increasing the maturity of the team involved and the synergy between the team. For instance, C<sub>2</sub> reported that:

*"a strong point was the maturity of us as a team, I think that's the strongest point"*.

C<sub>1</sub> reported that:

*"one of the greatest strengths we have is the synergy of the group"*.

The maturity that the team involved has acquired has made it possible to take a different look at



software conception. However, these strengths were concentrated in D1, C1, and C2 and, more importantly, only D1 remained at Alpha since C1 and C2 were temporary employees. Considering the code weaknesses, D1 explained that:

*"I think a weak point is that although the tools of the software conception approach were tools for co-creating the software, we didn't think much about how to stimulate this co-creation". C1 explained that: "Maybe we didn't dedicate ourselves as much as we should have, I think that was one of the weak points. We should have dedicated ourselves more, and made it a bit more regular, for example, every week".*

As the main results of the software conception actions at Alpha, D1 identified that:

*"(...) we used things that have already been validated in the market, that are used by other organizations. (...) All of this helped us to have this knowledge about methodologies and processes for building businesses, products".*

However, no new products were created using the DT-based software conception approach at Alpha. The approach created initially became just a knowledge base and fell into disuse.

Considering the status of the software conception approach at Alpha, C1 explained that:

*"Actually, the organization discontinued it (...), for internal reasons, and then we're not going to continue".*

D1 indicated that:

*"Today it's stopped (...). Anyway, it's no longer being used (...) and I think the problem with that was the focus of the management (...) and resistance from the development team".*

He also reported that:

*"we intend to focus more internally on intrapreneurship also to seek innovation".*

#### 4.3 Results of the Plan Action Research step

During the planning of the action research, which took place in a meeting lasting about an hour, the research team was created. As a result, the authors of this paper and Alpha's director of the new businesses development joined this team, which was called the organization's innovation team. This team was responsible for carrying out the action research activities. The defined schedule considered the following activities: (1) defining the stages of the new approach, (2) defining the DT tools for the new approach, (3) defining ways of monitoring the selected employees, (4) implementing the new approach in the organization and, finally, (5) evaluating the proposed new approach. In addition, the objective, research question, and the expected outcome of the action research were defined and are presented in Table 1.

**Table 1:** Action Research Elements

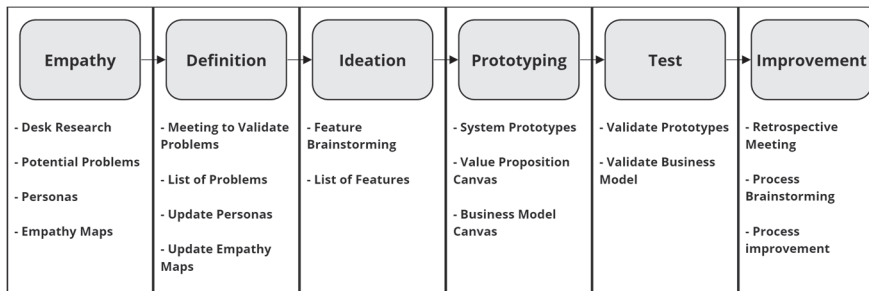
Research Elements	Research Elements Description
Aim of action research	Define and implement an intrapreneurship program and a learning environment to minimize resistance to the adoption of Design Thinking for software conception in a Brazilian software organization.
Action Research Question	How can an intrapreneurship program and a learning environment reduce resistance to adopting DT in a Brazilian software organization?
The expected result of the action research	By including an intrapreneurship program and a learning environment, we hope to reduce the employees' resistance to using DT in software conception in a Brazilian software development organization.

#### 4.4 Results of the Execute Action Research Step

This section presents the main results obtained during the actual execution of the action research. It is composed of a section to present the DT approach used, a section to present the intrapreneurship program, and, finally, a section to present the learning environment created.

##### 4.4.1 The Adopted Design Thinking Approach

As mentioned in section 3.2.4, the DT approach defined was based on the model presented by ID FOUNDATION (2022). Figure 2 shows the specific DT phases and tools adopted.



**Figure 2:** Design Thinking Approach adapted from (ID FOUNDATION, 2022)

The *empathy* step provides a deeper insight into the context of the idea to be conceived. In this case, desk research should be applied so that teams of collaborators can delve deeper into the application areas, competitors, needs, and pains faced by potential users and customers of the new software being proposed. A list of potential problems should be created, as well as the ideal customer profile through personas and empathy maps. It is worth noting that other DT tools can be applied, but they must be selected according to the context of the organization in which the approach is applied. This stage was carried out in two weeks, considering that the employees continued with their other duties within Alpha.

The *definition* step should confirm the real problems faced by potential users and customers of the new software. In this context, meetings should be held to validate whether the potential problems raised in the empathy stage are real problems. With this in mind, each employee responsible for the proposed ideas held meetings with potential users and customers, and a list of problems was defined for each new software idea. In addition, the personas and empathy maps created in the previous stage were updated. This step also lasted two weeks.

The *ideation* step is responsible for brainstorming the creation of features for each new software. In this case, the employee responsible for a system idea must conduct brainstorming, considering the creation of features without making judgments about what is presented. From there, the features should be refined, with the possibility of grouping, editing, or excluding features by consensus or voting. Employees can involve external people in the brainstorming, such as potential users and clients, when possible. This step should create a minimum set of features that provide value to users and customers. A deadline of one week was set for this step. However, employees spent additional time to define the participants, which could include other employees, potential customers, and people from each idea's business area. They also needed to set an agenda, finishing the task in two weeks.

During the *prototyping* step, the employees create a value proposition canvas and a lean canvas (IDEO, 2022), which focus on the solution and definition of the business model and are more suitable for the early stages of a new business rather than the Business Model Canvas. At this point, business

model issues such as the software's main selling point, sales channels, costs, and capitalization, among others, are analyzed and defined. In addition, prototypes are developed. These prototypes can be functional or non-functional, depending on the time available and the capacity of each employee. In this work, the teams developed non-functional prototypes of the systems. Considering the prototyping and business model tasks, the employees were able to complete the prototyping step in four weeks.

The *testing* step is responsible for validating the prototypes and the business model devised for the new software. This validation should be performed through meetings with potential users and customers. In this work, the employees carried out the validation by presenting the prototypes and details of the business models and were able to complete this testing in two weeks.

Finally, the *process improvement* step is responsible for identifying and implementing improvements to the proposed approach. In this case, a retrospective meeting (Rola & Kuchta, 2020) was held by the innovation team together with the employees. The goal of this meeting was to identify opportunities to improve the approach adopted and how actions were executed. Next, a brainstorming meeting was held to identify ideas on how to make improvements to the problems identified. Finally, the approach was modified by the innovation team. The retrospective meeting was also used as a way of evaluating the action research. More details on the retrospective activity are given in section 4.5.

#### 4.4.2 The Intrapreneurship Program

To minimize resistance to adopting design thinking and promote a more innovation-oriented approach, it was decided that DT would be applied within an intrapreneurship program at Alpha. The implementation of the intrapreneurship program was supported by the organization's human resources department. The possibility of making the intrapreneurs partners if their ideas were in line with Alpha's objectives. The internal marketing department provided all the communications support, such as the release of news and preparation of promotional materials, videos promoting the program, and the launch event. Finally, there was the support from senior management, which encouraged the program and financed the actions, providing resources for the execution of the intrapreneurship program. However, as we will discuss again later, the organization did not deallocate the selected employees from other organizational tasks.

The innovation team proposed launching an internal call for proposals focusing on the Alpha's employees. This allowed employees to submit their ideas for software applications that would be designed through DT. The selection stage, as mentioned in section 3.2.4, considered criteria adapted from Yin & Luo (2018) and Yusubova et al. (2020), which more broadly considered elements that made it possible to evaluate the ideas submitted, the characteristics of the idea's target market and the profile of the intrapreneurs.

As a result, five ideas were selected, with the participation of six Alpha employees, since one of the ideas was proposed by two employees as a team. However, at the start of the intrapreneurship program, two of the selected employees had to leave the program because they had been assigned to projects for important Alpha clients. Therefore, three ideas for new software applications went on to be conceived through DT.

The three new ideas selected in the intrapreneurship program were able to complete the steps of the DT approach presented in the previous section, even considering the short time Alpha provided for the participants. In this case, the employees carried out many of the activities outside of working hours. This was only due to their motivation to develop their ideas. All the employees reported that the ideas they had initially come up with were able to evolve significantly with the use of the DT. Furthermore, after the presentation of the results of the software conception approach with DT, one of the ideas presented got the interest of Alpha's founders. However, for strategic reasons, Alpha prevented the disclosure of details about the selected ideas and which ideas they would invest in.

#### 4.4.3 The Learning Environment

As a learning strategy, the innovation team identified the need to implement a learning environment to help Alpha's employees better understand the ideas and tools from Design Thinking. Billett (2001) presents a list of requirements to characterize workplace learning strategies, adopted in this paper (see section 2.3). This section describes how we addressed that.

The learning environment was made entirely online since the organization adopts hybrid, but mostly remote, work. To this end, synchronous online training sessions were held. In addition to the training sessions, feedback from the innovation team on the activities executed by the employees in previous weeks was made available. Asynchronous guidance was also provided to the employees via the Slack tool.

Regarding the knowledge needed by the organization, the innovation team identified Alpha's need to focus on knowledge about DT and the tools needed to apply DT in the organization, as defined in section 4.1.1. It is worth noting that this was due to the need to qualify Alpha's employees who lacked knowledge about this approach and were resistant to its adoption (see the comments about the diagnosis in section 4.2). In this case, support materials in the form of guides, training materials, articles, and videos were made available to employees to help them learn about DT. These materials were defined and made available according to the needs of the employees, considering the necessary knowledge identified by the innovation team. The support material was made available on the Slack tool.

The commitment was encouraged with intrapreneurship since the employees were interested in developing their software ideas (Morais et al. (2021). In this case, intrapreneurship proved to be an important factor, as the organization's employees were motivated.

In summary, the learning environment also met Zhao & Ko's (2018) definition, presenting a body of knowledge, the practical use of this knowledge, and social interactions between the innovation team and employees, as well as the established values that focused on collaboration, empathy with users and customers, the pursuit of innovation, and entrepreneurial vision.

#### 4.5 Results of the Evaluate the Action Research step

Alpha's employees presented the obstacles they faced (see Table 2) and suggestions for improvement (see Table 3) regarding the DT approach used, through a feedback questionnaire. This questionnaire was sent to employees nine different times during the action research, at the end of each week.

**Table 2:** Obstacles faced by employees

Code	Obstacles
Employee unavailability	<ul style="list-style-type: none"><li>• Little time was made available by the organization to implement the intrapreneurship activities.</li></ul>
Difficulty involving customers in activities	<ul style="list-style-type: none"><li>• Difficulty finding users/customers to validate problems.</li><li>• Difficulty in getting people with a specific profile to take part in the brainstorming.</li></ul>
Difficulty defining the target audience	<ul style="list-style-type: none"><li>• Difficulty in narrowing down the target audience for one of the business ideas.</li></ul>
Lack of technical knowledge	<ul style="list-style-type: none"><li>• Lack of knowledge of how to develop prototypes by one of the employees.</li></ul>

Table 3: Improvement suggestions

Theme	Suggestions
Lack of experience with DT tools	<ul style="list-style-type: none"> <li>It would be quicker if you could send links to the templates for each task.</li> </ul>
Way of validating problems	<ul style="list-style-type: none"> <li>It would be interesting to execute a structured survey with an online questionnaire to reach more people.</li> </ul>
Definition of software features	<ul style="list-style-type: none"> <li>There could be an activity that can generate user stories or requirements before moving on to the prototype.</li> </ul>

By the end of the DT approach, a retrospective meeting was held involving the employees and the innovation team. In this context, Alpha's employees were able to identify positive points in the execution of the action research. These included the shared knowledge during the research, the importance of the innovation team monitoring the activities, and the time flexibility for the execution of tasks, as reported by employees about difficulties in meeting deadlines. On the other hand, there were negative points. In this case, the lack of activity to better clarify the requirements of the solution, as well as the time available by the organization for employees to complete the tasks, were generally considered to be the main negative points (see Figure 3).

The employees were also able to identify the main causes of the problems raised. In addition, they defined, by voting, which problems should be considered as points for adjustments to the adopted DT approach and the execution of the research (see Figure 4). The brainstorming allowed them to identify ideas on how to solve each improvement opportunity identified in the retrospective meeting. In the end, a list of proposed solutions was generated, leading to a new version of the DT approach and the execution of the research. The improvements were made by the innovation team and this new version is currently being implemented at Alpha.

The list of proposed solutions generated was as follows: (1) identify internal (within the organization) and external experts in the areas of the ideas developed; (2) reschedule task deadlines; (3) include more examples in employee training material; (4) monitor employees more closely when they are executing the activities; and finally, (5) include an activity for defining user stories.

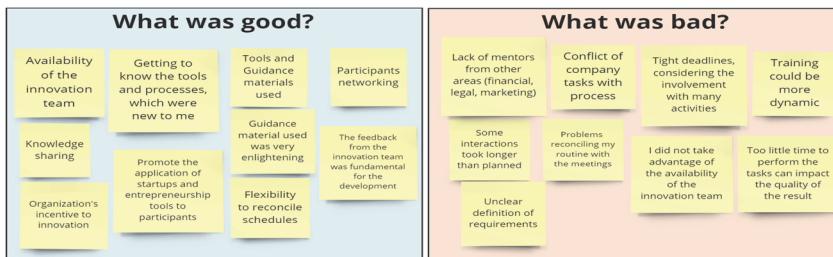


Figure 3: Strong points and weak points (author's translation).



Figure 4: Causes and adjustment points (author's translation).

#### 4.6 Results of the Conduct Action Research Learning

As mentioned in the previous section, opportunities for improvement made by Alpha's employees were identified (see Figure 4). These opportunities are points that allow the innovation team to learn and evolve the DT approach used, to better reflect the needs of Alpha's employees. In this case, the process of brainstorming present in the improvement step (see Figure 2), performed by the innovation team, identified which actions should be carried out on the improvements considered to be the highest priority according to a voting approach during the retrospective meeting (see section 4.5).

The first point was the need for specialists from other areas. As this does not depend solely on the innovation team, Alpha's founders had to be consulted since it requires investment from the part of the organization. In this case, Alpha was unable to address this issue immediately and considered it to be a future demand.

As for rescheduling the deadlines for carrying out the activities, this was accepted, with an average increase of 30% on the time previously planned. This increase was based on the employees' deadline suggestions.

Regarding the proposal to improve the training material, adjustments were made to it with the inclusion of new examples and a reduction of the theoretical part.

About the need to monitor employees' activities more closely, members of the innovation team began to encourage employee participation in weekly meetings and increase asynchronous interaction to reduce doubts about how to implement the tasks.

Finally, concerning the need to clarify requirements before the construction of prototypes, an activity to define user stories was added to the ideation step, providing greater clarity for developing prototypes.

## 5. Discussion

Pereira et al. (2021) describe some challenges in using design thinking (DT), most importantly, resistance to DT and the lack of professionals with experience in this approach. These challenges were indeed perceived at Alpha and were studied during this action research.

Considering employees' resistance to adopting DT, we argue that we had a positive response to this problem. In this case, everyone involved, including the director of the new businesses development, founders, and employees, perceived the value of applying DT and how much it allowed their ideas to evolve. This can be identified, for example, in the words of one of the employees during the brainstorming meeting:

*"(...) I started with just one idea, and I didn't know where to go. I didn't know where to start, I had no idea what to do. Then every week I followed the activities, where to go, which way to go and today I can see the evolution very well, by the way".*

As a result, we can conclude that our approach helped to positively disseminate a mentality of innovation and user-centered software conception to Alpha's employees, and the resistance previously identified in the organization was not perceived, since the employees even carried out their activities outside of working hours. We are aware that the employees who participated in the action research were strongly motivated to do so. So, our approach does not address resistance from other Alpha's employees. This will require further research. We are informally aware that the employees who participated in this research improved their ways of working due to the knowledge they learned, which positively affected other employees in the organization.

In addition, the lack of professionals with experience in DT was minimized by implementing a learning environment for the employees. This environment was promoted by the innovation team, which had experience in DT. To overcome bad experiences with DT, practices, improvements,

experiences, and the search for knowledge are recommended (Pereira et al., 2021). Thus, Alpha's employees identified the importance of the knowledge obtained, which was also evaluated as an essential factor in overcoming resistance to adopting DT. The words of an Alpha employee can confirm this during the implementation of the approach adopted:

*"(...) sometimes we have an idea, but you gave us this direction, with this learning, every week a mentoring, so this was very good".*

In summary, our research presented promising results since it described a way of minimizing the resistance to adopting design thinking through an intrapreneurship program. It also presented a way of implementing a learning environment to qualify the employees of a software organization. However, there are still points that could limit the results of the work, such as Alpha's inability to free up more time for the intrapreneurs to develop their ideas and the lack of professionals from other areas who could provide more specific feedback on different market niches. We are currently conducting another round of action research addressing these limitations.

## 6. Conclusions and Future Work

We defined the goal of our action research as to *"define and implement an intrapreneurship program combined with a learning environment to minimize resistance to the adoption of DT for software conception in a software organization."* We argue that this research has achieved promising results with the definition and application of a software conception approach with DT in the context of an intrapreneurship program. This approach makes use of a learning environment to support the intrapreneurs. The activities that are part of the approach succeeded in motivating collaboration and co-creation, and the weekly follow-ups enabled employee cooperation. Furthermore, the employees showed no resistance to adopting DT. They could carry out the planned activities even with limited time, recognized the importance of using DT to develop their ideas, and indicated that they had acquired essential knowledge for the future conception of new software applications.

This study was also able to benefit from the knowledge of employees. This was carried out through feedback and the retrospective meeting, which allowed adjustments to be approached according to the context of the organization studied. In fact, Alpha created a new service to be sold to clients interested in developing their ideas. In the context of action research, we believe this is a significant indicator of the success of our approach.

Furthermore, the implementation of intrapreneurship and the learning environment has allowed the company's employees to feel a greater interest in learning new knowledge to develop their ideas. As a result, the company has cultivated an environment that is more conducive to learning, more receptive to behavioral changes, more supportive of employee development, more open to innovation, and more committed to a strategy that encourages voluntary learning and knowledge-building without imposition.

It is worth noting that the focus of this work is not on software coding, but on testing strategies to minimize resistance and increase knowledge about DT in a Brazilian software development organization. The artifacts generated for each system idea were not detailed here due to the ideas' confidentiality. This was a request from Alpha.

Finally, future work includes applying this research approach with other employees of the studied organization and other software development organizations. We also plan to use other DT tools in similar contexts to the one studied.

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