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What soft skills are most valued in software projects? A comparative view of leader and non-leader perspectives

Que soft skills são mais valorizadas em projetos de software? Uma visão comparativa entre as perspectivas de líderes e não líderes

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Abstract. *Soft skills are critical in software projects, but their perceived importance varies by role and experience. This study investigates how leaders and non-leaders value soft skills in a large Brazilian Science and Technology Institute. Using a quali-quantitative survey with 42 professionals, we analyzed ratings for 15 soft skills through descriptive statistics, rank-biased overlap, and open coding. Results show teamwork, commitment & responsibility, and communication are highly valued, but notable differences exist across leaders & non-leaders and seniority. These findings offer reflections for team composition, leadership practices, and professional development, contributing to a deeper understanding of human factors in the development of information systems.*

Keywords. *Soft Skills; Leadership; Experience Level; Human Factors; Software Industry.*

1. Introduction

In any collaborative effort in which a group of individuals must work together to achieve a shared goal, both social and technical skills are critical to successfully execute tasks [Matturro et al. 2019]. To enhance the effectiveness of software development processes, professionals need to improve both their technical skills (often called

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hard skills) and their interpersonal skills (known as soft skills). Both types of skills are equally important, along with the processes, tools, and technologies used in the field [Capretz 2014, Matturro et al. 2019].

Soft skills encompass a range of components, including attitude, abilities, habits, and practices, which, when combined, are leveraged to maximize work effectiveness [Ramesh 2010]. Their relevance in software projects has been increasingly recognized, particularly when assigning individuals to specific roles to build productive teams [Acuña et al. 2006]. This importance is also highlighted as a critical competency that is often overlooked in the Information Systems (IS) educational curriculum [Woodward et al. 2010, Miranda et al. 2021]. This perspective addresses the growing recognition that technical proficiency alone is insufficient, and highlights the need for the holistic development of IS professionals to address the multifaceted challenges of modern workplaces and software projects [Brennan et al. 2023, Litecky et al. 2004]. This need is amplified in the current software development landscape, which is increasingly characterized by agile methodologies, distributed teams in hybrid or remote models, and the need for continuous innovation [Sampaio et al. 2021].

In software projects, it is natural that certain soft skills are more required for specific roles than for others [Acuña et al. 2006]. For instance, roles that require constant communication with stakeholders are expected to place a higher demand on *communication skills* [Prince 2013]. Thus, for software projects to succeed, it can be hypothesized that team members and organizations need to understand the particularities of soft skills importance, including the contrast between the perspectives of those who hold formal leadership positions and those who are led [Araújo et al. 2024].

Therefore, reflecting on this topic is relevant to broaden the understanding of the most important soft skills in the context of software projects. This understanding may enable the development of personal improvement plans as well as the enhancement of processes and team-building strategies within organizations. Furthermore, it can help software engineers gain a better understanding of themselves and others, fostering the development of soft skills that, in turn, can positively influence their work and productivity [Matturro et al. 2015].

Existing literature has primarily focused on identifying key soft skills for the software industry and exploring their relevance to building productive teams. However, a gap remains regarding how the value placed on these skills varies among professionals in different hierarchical roles, such as leaders and non-leaders, within the same organizational environment. Moreover, the influence of professional experience on these perceptions is an area that requires further investigation, as understanding these nuances is fundamental to developing more effective team formation and training strategies in IS projects.

We began investigating perceptions of soft skills in software teams in our previous study [Coelho et al. 2024a]. In that work, through a survey of 42 professionals from the Atlântico Institute, we identified the most valued soft skills from the perspectives of both leaders and non-leaders. The current paper extends this investigation, by expanding the analysis within the original dataset. In addition to re-examining the differences in perceptions between leaders and non-leaders, we now also investigate the impact of the

professionals' level of experience, highlighting how the perceptions of the most relevant soft skills vary among these different profiles. Additionally, we compare the results with those reported in the literature, demonstrating how our findings confirm and expand the body of knowledge on soft skills. Lastly, we offer a heatmap showing the senior and junior perspectives on soft skills.

We focused exclusively on a single organization due to the benefits of approaching in characteristics it offers. In particular, the Atlântico Institute provides a insightful setting where leaders and team members share a common organizational culture and standardized software development processes, supported by decades of experience in diverse projects across various industrial sectors. This approach was chosen to minimize external variables that could influence the results, promoting a more consistent understanding aligned with the research objective. Additionally, the organizational uniformity enables the identification of trends and shared perceptions, making the findings more representative of the studied context.

The findings indicated that the most valued soft skills in software projects are *teamwork*, *commitment & responsibility*, and *communication skills*. These skills were consistently highlighted by senior professionals. Among junior professionals, the most valued soft skills were *commitment & responsibility*, *teamwork*, and *planning skills*. In turn, leaders identified *communication skills*, *commitment & responsibility*, *teamwork*, and *motivation* as essential competencies for the success of software projects. Similarly, non-leaders emphasized *teamwork*, *commitment & responsibility*, *communication skills*, and *eagerness to learn* as the most important skills. We also organize the findings into two heatmaps that support the visualization of soft skills per level of experience and leaders and non-leaders.

This study contributes to both IS practice and research by offering an in-depth understanding of human factors in software development, a context of growing relevance [Hennel and Rosenkranz 2021, Litecky et al. 2004]. For IS practitioners and project managers, our findings provide an empirical basis for improving socio-technical alignment within development teams. By revealing the differing valuations of soft skills between leaders, non-leaders, and professionals with varying experience, the study offers empirical findings for optimizing team composition and communication strategies, which are considered critical success factors for IS projects. For IS researchers, this work contributes to the literature on IS workforce and skills by offering a detailed comparative analysis of soft skill perceptions across distinct professional profiles. The findings serve as a starting point for replicating and extending this research on these human-centric variables in diverse organizational and cultural contexts.

The remainder of this paper is structured as follows: Section 2 presents the background and related work. Section 3 describes the research method. The results and analyses are discussed in Section 4. Section 5 discusses the implications of the findings for academia and industry. Section 6 addresses the study's threats to validity. Lastly, the conclusions and future work are presented in Section 7.

2. Background

The academic literature has reported studies aiming to identify the concept of soft skills and determine which soft skills are most demanded in the software industry. For example, Matturro et al. (2019) compiled over forty definitions of soft skills to clarify the term. Besides, Acuña et al. (2016) cataloged hundreds of job interviews, defining the most critical soft skills for software development companies.

Other authors have explored the definition and characterization of soft skills. However, a clear need remains to establish a singular definition, which adds complexity to the subject [Matturro et al. 2019]. Generally, the term encompasses a broad concept that spans multiple domains, such as personal, emotional, behavioral, and cognitive components [Dell'Aquila et al. 2017]. Thus, soft skills can be interpreted in different ways [Prince 2013]. As mentioned by Ramesh (2010), soft skills comprise a set of components, such as attitude, abilities, habits, and practices, that, when combined, are used to maximize work efficiency. Broadly speaking, soft skills can be considered interpersonal abilities that form an individual's capacity to communicate and build relationships with others in a conducive environment [Ramesh 2010]. Complementarily, Ahmed *et al*. (2013) indicated that soft skills are rooted in psychology, encompassing various characteristics such as personality traits, social interaction skills, communication, and personal habits. Another way to characterize soft skills is by contrasting them with hard skills [Matturro et al. 2019]. Hard skills refer to technical competencies acquired through formal education and practical application [Bhatnaga and Bhatnaga 2012]. Soft skills complement hard skills, enhancing the effectiveness of technical activities [Ramesh 2010].

Upon reviewing the literature, different studies investigating soft skills in software projects emerge. Acuña *et al*. (2006), for example, explored the need to understand professional profiles and individual skills in order to assign individuals appropriately to productive teams. They also highlighted the importance of this understanding for software development organizations, emphasizing the role of managers as a key component in this dynamic. Furthermore, Ahmed *et al.* (2013) aimed to understand how the software engineering and information systems sectors perceive soft skills and interpersonal abilities. They analyzed 650 job advertisements from various geographic locations to identify the most sought-after soft skills in the sector and correlated them with the different roles in projects. Similarly, Matturro *et al.* (2015) sought to identify, through interviews with software engineering professionals from Uruguayan companies, which skills are considered most valuable by leaders and other team members in software development projects.

More recently, Singh *et al.* (2022) surveyed IT professionals and students in India to understand their perceptions of soft skills in the Information Technology (IT) sector within emerging economies, with a specific focus on the future talent pool. By comparing these perceptions with the soft skills valued by the IT industry, the authors identified a significant gap between the skills reported by professionals and those prioritized by the industry. They also highlighted the importance of academia-industry partnerships to address this gap in the talent pipeline. Lastly, Araújo *et al.* (2024) explored the contrast between leaders and other team members in software projects, specifically focusing on the context of agile leadership. They aimed to assess agile leadership and its principles, such

as shared responsibilities and decentralized decision-making, while investigating whether significant perception differences exist between leadership roles and other team members.

Most of the studies mentioned above concentrate on identifying the most important soft skills for the market and companies. However, it is relevant to gain a deeper understanding of software projects, especially in distinguishing perceptions based on the role of each team member. In this regard, this paper shares similarity with the study by Matturro et al. (2015), as it not only explores the identification of the key soft skills in software projects but also investigates, in a comparative manner, the perceptions of leaders and non-leaders regarding which interpersonal competencies contribute most to the success of a software project. However, this research differs in four key aspects:

1. The research was conducted in Brazil, providing a regional perspective on soft skills in software teams.
2. The study focuses specifically on one of Brazil's largest Science and Technology Institutes, offering insights from a prominent organizational context.
3. Data collection was carried out through a structured survey approach.
4. The survey questions were designed to gather more detailed comparative data from professionals, including their experience at the workplace, roles performed in projects, and other relevant contextual factors.

3. Research Method

We defined the following research questions (RQs) to analyze and compare the key soft skills in software projects and deepen the topic from the perspectives of leaders and non-leaders:

- **RQ1.** *What are the most important soft skills for software professionals?* This question seeks to identify the most important soft skills for professionals in the context of software development projects, as perceived by all team members.
- **RQ2.** *What are the most important soft skills for software project leaders?* This question aims to identify the soft skills most demanded from individuals who hold leadership roles in the context of software development projects, as perceived by all team members.
- **RQ3.** *What are the most important soft skills for non-leaders in software projects?* The purpose of this question is to identify the soft skills most required from individuals who do not hold leadership positions, *i.e.*, the remaining team members in a software development project, based on the perceptions of all project participants.

3.1. Data Collection

To collect data for this study, we designed a survey to gather the perceptions of team members, both leaders and non-leaders, regarding the most relevant soft skills in software projects. A survey is conducted to capture a representation of a specific situation, using a questionnaire to understand a population [Wohlin et al. 2012]. Thus, we employed a survey to capture the perceptions of software team leaders and non-leaders about soft skills.

Table 1 presents the survey questions. The complete survey along with the options for each closed question is available in our repository [Coelho et al. 2024b]. Questions Q1, Q2, and Q3 were designed to capture the professional's overall experience in the software industry, including aspects such as years of experience and educational background. Questions Q4 through Q8 focused on identifying the professional's role in software development projects, specifically capturing their function, experience level, duration in that role, and time spent working at the institution. In Q8, professionals were asked to indicate whether they were performing a leadership role by selecting one of the following options: (i) if they were formally designated as a leader by the company, (ii) if they assumed a leadership role informally based on their function within the project, or (iii) if they did not hold a leadership role in the project. We used data obtained from questions Q1 to Q8 to characterize the participants.

Table 1. Survey questions

ID	Question Description (Q)	Type
Q1	What is your level of education?	Closed
Q2	What is your undergraduate degree?	Open
Q3	How many years of experience do you have in software development projects?	Open
Q4	What is your current role in the software development project?	Closed
Q5	How many years have you worked at your current company?	Open
Q6	What is your level of experience at your current company?	Closed
Q7	How many years of experience do you have in your current role at the company?	Open
Q8	Do you hold a leadership position in your project?	Closed
Q9	Rate each soft skill for a leader in a software development project on a scale from 1 to 5 (where 1 indicates a non-important skill, and 5 indicates an essential skill).	Closed
Q10	List other soft skills you consider relevant for leaders that were not included in the previous question. If possible, justify your answer.	Open
Q11	Rate each soft skill necessary for the rest of the team (non-leaders) in a software development project on a scale from 1 to 5 (where 1 indicates a non-important skill, and 5 indicates an essential skill).	Closed
Q12	List other soft skills you consider relevant for the rest of the team (i.e., non-leaders) that were not included in the previous question. If possible, justify your answer.	Open

Questions Q9 and Q10 aimed to identify the key soft skills required for leaders in a software project. Similarly, questions Q11 and Q12 sought to identify the primary soft skills needed for the rest of the team in a project. The soft skills listed in Q9 and Q11 were derived from the study by Matturro *et al.* (2015): *analytic and problem-solving skills*, *eagerness to learn*, *motivation*, *commitment & responsibility*, *communication skills*, *results orientation*, *teamwork*, *initiative and proactivity*, *autonomy*, *interpersonal skills*, *organizational skills*, *customer orientation*, *planning skills*, *methodic*, and *leadership*. Definitions for each soft skill were also provided to standardize the concepts used in the survey. This step was crucial to ensure that all participants shared a common understanding of each competency, including complex concepts such as *teamwork* and its collaborative aspects, thereby mitigating interpretation bias. To answer Q9 and Q11, professionals were asked to select an option from a Likert scale, ranging from 1 (not important) to 5 (essential). We used data collected from questions Q9 to Q12 to support answering RQ1, RQ2 and RQ3.

Before making the survey available, three researchers experienced in human factors in Software Engineering reviewed the survey to ensure that the research goals were met and that the questions were unambiguous. Subsequently, we piloted the survey with three industry professionals to verify whether the questions and their accompanying definitions for each soft skill were easily and correctly understood. The feedback from the pilot confirmed the clarity of all items, providing confidence that the concepts would be interpreted consistently by the main study's participants. The pilot also helped define the average response time. At the end of the pilot, the average response time, based on the participants who completed the pilot, was approximately 7 minutes, and no adjustments or improvements were deemed necessary. This duration was appropriate to maintain the professionals' interest and ensure they could complete the survey without fatigue.

Following the instrument's validation and institutional procedures, participant recruitment was carried out by making the online survey form available in official internal communication groups at Atlântico Institute. This dissemination was directed at channels frequented by both professionals in leadership positions and those not occupying such roles, with the aim of obtaining a balanced number of responses from these two segments for comparative analysis purposes. It is worth noting that, before the questions, the survey presented information about the research and its privacy, along with a Free and Informed Consent Form (FICF), which participants had to accept to proceed with the questionnaire. After validation, the survey was made available online for three days, from March 20 to 22, 2024, targeting professionals allocated to and involved in software development at Atlântico Institute. All results were submitted to the team responsible for Research, Development, and Innovation at Atlântico Institute. The study received a favorable opinion for its conduction, with the assessment that no sensitive data from participants or the institution would be compromised or disclosed in the resulting publication.

As previously mentioned, the survey was applied at Atlântico Institute, a Brazilian Science and Technology Institute headquartered in Fortaleza, focused on software research and development projects. With over two decades in the software industry, it is recognized as one of the best companies to work for in Brazil by the global consulting firm Great Place To Work in the medium-sized category (between 100 and 1,000 employees), employing professionals from across the country. Atlântico Institute operates in sectors such as finance, economics, energy, agribusiness, healthcare, and Industry 4.0, serving both national and international clients. The company has numerous success cases, and its projects are conducted using agile frameworks for software development.

In total, 42 software practitioners completed the survey. Although the exact number of professionals directly involved in software development projects at the Atlântico Institute cannot be disclosed due to institutional policy, the organization employs approximately 600 people across all staff, including operational and administrative teams. Thus, our sample (N=42), which includes a diverse range of roles and experience levels (as detailed in Section 4), is considered relevant for providing findings into the perceptions of soft skills within the specific context of this organization.

3.2. Data Analysis

After collecting the data, we conducted a quali-quantitative analysis. For the quantitative analysis, we used descriptive statistics to investigate how many participants selected each option in the closed-ended questions. To classify and measure the importance of each soft skill, we calculated the total values assigned by team members on the Likert scale. We used question Q8 to segment participants into leaders and non-leaders based on their responses. Participants were categorized as leaders if they selected option (i), indicating a formal leadership role designated by the Atlântico Institute, or option (ii), reflecting an informal leadership role based on their project function. Those who selected option (iii), indicating they did not hold a leadership role, were classified as non-leaders. Further details about the data collection process are provided in Section 3.1. We also classified the participants based on their level of experience. In Q6, participants were asked to indicate whether they were intern/training, junior, mid-level, or senior. This classification allows us to examine whether there are differences in the perception of soft skills based on experience level. Again, we calculated the total values assigned by team members on the Likert scale to support us to classify and measure the importance of each soft skill per level of experience. For comparative analysis by experience level, we focus exclusively on participants at the junior and senior levels. This decision was made to examine the most significant possible contrast between different stages of professional experience, thus highlighting the skills where perception diverges most clearly with seniority.

We also produced ranked lists of soft skills for leader, non-leaders, senior, and junior participants. To investigate whether there are differences between the two subsets (leader and non-leader or senior and junior), we adopted the similarity measure for rankings called RBO (rank-biased overlap) [Webber et al. 2010], which quantitatively measures how similar the ranked lists are. RBO gives a value ranging from 0 to 1. The closer this value is to 1, the greater the similarity between the lists. As RBO supports top-weighted ranked lists, where the first elements of a list have more impact on the similarity index than the last ones. We can configure what elements will be compared by setting the *p-value*, which, differently than the p statistic, refers to a level of overlapping and the degree of top-weightedness. In our analysis, we chose p-value ranging from 0.5 (only the very initial elements of a rank are considered) to 0.9 (almost all elements are considered).

In regard to the qualitative analysis, we applied open coding [Strauss and Corbin 1998] to analyze the open-ended answers given to Q10 and Q12 and identify the main codes contained in those answers. This method involved a review of the responses, categorizing them based on recurring themes, patterns, and insights provided by the participants. The use of open coding facilitated the structured organization of the data, enabling us to uncover connections between participants' perceptions and the study's research objectives. To ensure consistency and reliability in data interpretation, we conducted collaborative discussions of the codes, further strengthening the rigor of the qualitative analysis.

Furthermore, to promote transparency and enable replication of this research, we created a replication package containing all granular data [Coelho et al. 2024b].

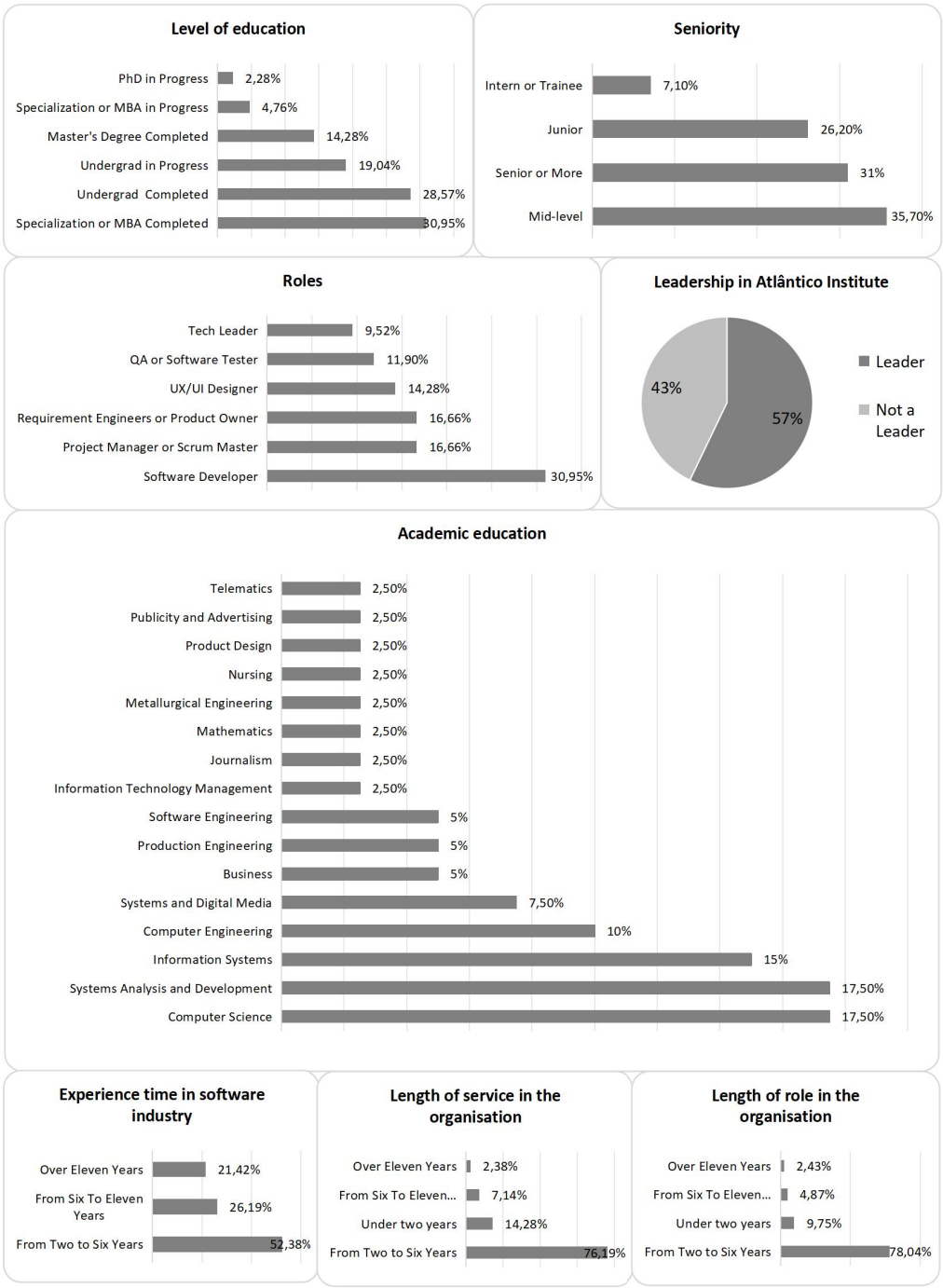

Figure 1. Overview of participant's characteristics.

3.3. Characterization of the Participants

A total of 42 software development professionals answered the survey and accepted the FICF. Figure 1 synthesizes the data characterizing the participants.

Figure 1, under *Level of Education*, displays the academic background of the survey respondents. Most of them completed an undergraduate degree (28.57%) or a specialization (30.95%), but the survey also received responses from professionals currently pursuing an undergraduate degree (19.04%) or a specialization (4.76%), as well as those who had completed a postgraduate program (16%), with one respondent currently pursuing a doctoral degree (2.28%).

The respondents come from various fields, as shown in Figure 1 under *Academic Education*. Most of them hold degrees in information technology-related areas, such as Systems Analysis and Development, Computer Science, Computer Engineering, Software Engineering, IT Management, Information Systems, Digital Media Systems, and Telematics, representing 75.60% of the total. The other 24.40% correspond to degrees in other fields, including Business, Advertising and Publicity, Product Design, Nursing, Production Engineering, Metallurgical Engineering, Journalism, and Mathematics.

About the participants experience in the information technology field (Figure 1 under *Experience Time in Software Industry*), 22 professionals (52.38%) reported having between two years and six years and 11 months of experience, followed by eleven professional (26.19%) within the range of six years to 10 years and 11 months, and nine professionals (21.42%) with more than 11 years of experience.

Figure 1, under *Roles*, shows that most of the participants identified themselves as software developers (30.95%), followed by project managers and/or scrum masters (16.66%), requirements engineers and/or product owners (16.66%), UX/UI designers (14.28%), quality assurance and/or test analysts (11.9%), and technical leaders (9.52%).

Regarding experience in their roles (Figure 1 under *Length of Role in the Organization*), most of the respondents had between 2 and 6 years (78.04%), followed by participants with less than 2 years (9.75%), between 6 and 11 years (4.87%), and over 11 years in their current roles (2.43%).

As for the respondents' experience as employees at Atlântico Institute, most are mid-level professionals (35.7%), followed by senior-level or higher positions (31%), junior-level professionals (26.2%), and, finally, trainees or interns (7.1%), as shown in Figure 1 under *Seniority*. With respect to the participants' experience in leadership roles, presented under *Leadership in Atlântico Institute*, 42.85% reported not holding any leadership role within their project and were categorized as "non-leaders." Meanwhile, 57.15% indicated that they had a leadership role in their project, regardless of whether it was formally recognized by the organization. This group was categorized as "leaders."

In summary, although the survey's participants are from the same organization, our data set is composed of answers given by software professionals with different levels of education and experience, performing distinct roles, and having some experience in leadership.

4. Results

This section presents the results obtained for the three research questions explored in this study.

4.1. RQ1. What are the most important soft skills for software professionals?

Table 2 presents the most valued soft skills in software projects, according to the perspective of team members. The soft skills *teamwork*, *commitment & responsibility*, *communication skills*, *analytic and problem solving*, and *initiative and proactivity* occupied the top five positions.

Table 2. Ranking of the most important *soft skills* in software projects

Position	*Soft Skill*	Score*
1º	Teamwork	401
2º	Commitment, Responsibility	398
3º	Communication Skills	386
4º	Analytic, Problem Solving	373
5º	Initiative, Proactive	369
6º	Interpersonal Skills	367
7º	Planning Skills	362
8º	Autonomy	359
9º	Motivation	355
10º	Organizational Skills	353
11º	Customer Orientation	344
12º	Eagerness to Learn	338
13º	Results Orientation	337
14º	Methodic	311
15º	Leadership	300

Legend
The Score represent the sum of the participants' choices based on the Likert scale.

Regarding these soft skills, Matturro *et al.* (2019) explained that *teamwork* relates to an individual's ability to collaborate closely with others, while *commitment & responsibility* refer to being accountable for one's work. *Communication skills* involve the ability to communicate orally and in writing in a simple, concise, unambiguous, and easily understandable manner. In addition, *analytic and problem solving* encompass the ability to understand, articulate, and solve complex problems, whereas *initiative and proactivity* represent the capacity to propose and/or perform actions without the need for others to request or initiate them.

Our results are aligned with the academic literature. For example, González-Morales' *et al.* (2011) work highlights skills such as *teamwork*, *commitment & responsibility*, and *communication skills* as essential in software projects. These competencies are important for the activities performed by systems analysts, directly impacting the expected outcomes and contributing to project success [González-Morales et al. 2011].

Key finding 1. Most of the participants indicated that *teamwork*, *commitment & responsibility*, and *communication skills* are the most critical soft skills for software professionals.

We also analyzed the perception of the participants, considering their experience level[1], as shown in Table 3. For senior professionals, the five top soft skills are: *teamwork*, *commitment & responsibility*, *communication skills*, *analytic & problem solving*, *initiative & proactive*, and *interpersonal skills*. For junior professionals, the list is quite similar, except *planning skills* and *interpersonal skills*. It is important to say that *planning skills* represent the ability to organize, prioritize, and manage the execution of tasks according to a plan and the resources under one's responsibility [Matturro et al. 2019].

Individual differences have been widely recognized as one of the key paradigms in investigations into human factors. The literature highlights that individual-level competencies are essential for modern organizations, directly influencing productivity at the organizational level and often determining the success or failure of projects. Moreover, the experience levels of professionals also emerge as a significant factor impacting organizations. Thus, we can relate the importance of our findings to the literature, understanding that differences in the perceptions of professionals with varying seniority levels can directly influence the success or failure of software projects [Colomo-Palacios et al. 2010].

Table 3. Professionals' perception of soft skills by level of experience

#	Senior	Junior
1º	▲ Teamwork (124)*	▲ Commitment, Responsibility (103)
2º	▼ Commitment, Responsibility (123)	▼ Teamwork (103)
3º	▲ Communication Skills (122)	▲ Planning Skills (102)
4º	● Analytic, Problem Solving (117)	● Analytic, Problem Solving (101)
5º	▲ Initiative, Proactive (115)	▼ Communication Skills (100)
6º	▲ Interpersonal Skills (115)	▼ Initiative, Proactive (99)
7º	▲ Motivation (113)	▼ Interpersonal Skills (98)
8º	● Autonomy (113)	● Autonomy (97)
9º	● Organizational Skills (107)	● Organizational Skills (94)
10º	▼ Planning Skills (107)	▲ Eagerness to Learn (92)
11º	▲ Results Orientation (106)	▲ Customer Orientation (92)
12º	▼ Customer Orientation (106)	▲ Methodic (92)
13º	▼ Eagerness to Learn (103)	▼ Motivation (89)
14º	▼ Methodic (98)	▼ Results Orientation (89)
15º	● Leadership (93)	● Leadership (84)

Legend
● *Soft skill* in the same position in both level of experience
▲ *Soft skill* in a higher position in relation to ones of the other level of experience
▼ *Soft skill* in a lower position in relation to ones of the other level of experience
∗ The values in parentheses represent the sum of the participants' choices based on the Likert scale.

Looking at Table 3, we can see that *leadership* stood out as the least valued regardless the level of experience, even though a considerable portion of respondents held leadership roles, either formally recognized by the organization or informally within their

[1]The comparison did not consider intern/trainee and mid-level participants, as it support us to investigate a great contrast among participants related to experience.

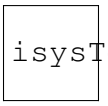

Figure 2. RBO of soft skills rank per level of experience

software project responsibilities. This result is particularly relevant because leaders are fundamental in software projects [Bhatti et al. 2021]. These projects, inherently characterized by a complex and unpredictable environment, benefit from effective leadership, which enhances both team and project performance. Matturro *et al.* (2019) defined *leadership* as the ability to lead, manage, or supervise, suggesting that while this competency is essential for managerial roles, it may not be perceived as a priority by the participants.

Regarding the primary differences, the soft skill *planning skills* appear in the 3rd position for junior professionals, while it appears in the 10th position for senior ones. Another difference is the soft skill *motivation* that ranked differently among senior and junior professionals, occupying the 7th and 13th positions, respectively.

To further investigate the differences between the two lists, we performed the RBO analysis, as explained in Section 3.2. Figure 2 shows the results of comparing the ranked lists of soft skills identified for each experience level. The RBO analysis revealed a clear difference in how senior and junior practitioners perceive the most important soft skills. The graph indicates that the similarity between the ranks is only around 40% for the top-ranked soft skills. This value increases as additional soft skills from both ranks are considered. However, the perception gap at the top is significant, as these soft skills have the highest values, indicating they are seen as most important by professionals.

Key finding 2. Regardless of the experience level, the participants indicated that the soft skills *teamwork* and *commitment & responsibility* are the most important for software professionals. However, considering the entire list of soft skills, the experience level affects the professional's perception of soft skills.

4.2. RQ2. What are the most important soft skills for software project leaders?

Table 4 presents the perception of important soft skills for leaders, according to the views of Leaders and Non-Leaders, respectively. In both perspectives, the soft skills *communication skills*, *commitment & responsibility*, and *teamwork* occupy the top three positions, differing only in their order.

Table 4 also reveals minimal differences in the perceptions of soft skills, except for *organizational skills*, which ranked 12th for leaders and 4th for non-leaders. As defined by Matturro *et al*. (2019), *organizational skills* represent an individual's ability to assess, organize, and prioritize tasks, ensuring they are completed in a timely manner.

For leaders, the least prioritized soft skills for software projects are *results orientation*, *eagerness to learn*, and *methodic*, as perceived by both leaders and non-leaders. [Matturro et al. 2019] described *methodic* as the ability to use a set of organized steps, defined by methods, to solve an issue or problem.

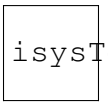

Figure 3. RBO of leader's soft skills per leaders and non-leaders

Beyond the soft skills listed in the survey, participants suggested the following additional soft skills: *resilience* (mentioned twice), *emotional intelligence* (twice), *active listening* (once), *patience* (twice), *didactics* (once), *business vision* (once), *empathy* (once), and the *ability to inspire* (once). One of these soft skills has been discussed in the technical literature. Santos *et al.* (2023) indicated that software teams need resilience to maintain their performance in the face of adverse situations, such as disruptions to their usual workflow. For them, *resilience* is defined as the ability of a team to withstand or recover from unfavorable events.

We investigated the differences by applying the RBO analysis. The result is shown in Figure 3 and indicates that the similarity between the ranks is only around 30% for the top-ranked soft skills, but this value increases as all soft skills are considered in the analysis. This indicates a difference in how leaders and non-leaders perceive the most important soft skills for leaders.

Key finding 3. For leaders and non-leaders, the soft skills *communication skills*, *commitment & responsibility*, and *teamwork* are the most important for leaders. However, the level of importance of these skills is different for these groups.

4.3. RQ3. What are the most important soft skills for non-leaders in software projects?

Table 5 presents the perception of important soft skills for non-leaders, according to the views of Leaders and Non-Leaders, respectively. In both perspectives, the soft skills *teamwork* and *commitment & responsibility* occupy the top two positions, differing in their order. Completing the top three, *motivation* ranks third in the view of Leaders, while *eagerness to learn* ranks third according to Non-Leaders. Matturro *et al*. (2019) emphasized that *eagerness to learn* refers to an individual's interest in learning and the ability to acquire new knowledge quickly.

By analyzing Table 5, we can see the contrast between the perceptions of Leaders and Non-Leaders, indicating some differences regarding the soft skills of non-leaders, such as *planning skills* (ranked 13th by Leaders and 7th by Non-Leaders), *eagerness to learn* (8th and 3rd), and *motivation* (3rd and 14th). For non-leaders, the least prioritized soft skills in software projects are *leadership*, *methodic*, *motivation*, *planning skills*, and *customer orientation*. *Customer orientation* is defined as the ability to identify and meet customer needs [Matturro et al. 2019].

Furthermore, participants mentioned the following additional soft skills: *emotional intelligence* (twice), *active listening* (once), *continuous improvement* (once), *adaptability* (once), *time management* (once), and *empathy* (once).

Table 4. Professionals' perception of the *soft skills* of leaders.

Position	Leaders	Non-Leaders
1º	▲ Communication Skills (117)*	▲ Teamwork (88)
2º	● Commitment, Responsibility (113)	● Commitment, Responsibility (87)
3º	▼ Teamwork (112)	▼ Communication Skills (87)
4º	▲ Planning Skill (109)	▲ Organizational Skills (86)
5º	● Interpersonal Skills (108)	● Interpersonal Skills (85)
6º	▲ Analytic, Problem Solvings (108)	▼ Planning Skills (85)
7º	▲ Autonomy (105)	▼ Analytic, Problem Solvings (84)
8º	● Initiative, Proactive (104)	● Initiative, Proactive (84)
9º	▲ Motivation (102)	▼ Autonomy (84)
10º	▲ Customer Orientation (102)	▲ Leadership (84)
11º	▼ Leadership (102)	▼ Motivation (83)
12º	▼ Organizational Skills (100)	▼ Customer Orientation (81)
13º	▲ Results Orientation (97)	▲ Eagerness to Learn (76)
14º	▼ Eagerness to Learn (86)	▼ Results Orientation (74)
15º	● Methodic (81)	● Methodic (71)

Legend
● *Soft skill* in the same position in both lists
▲ *Soft skill* in a higher position compared to the other perception
▼ *Soft skill* in a lower position compared to the other perception
∗ The values in parentheses represent the sum of the participants' choices based on the Likert scale.

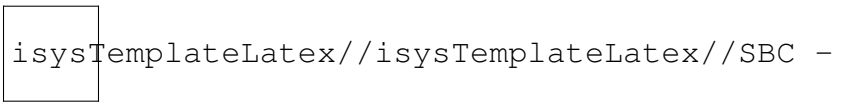

Figure 4. RBO of non-leader's soft skills per leaders and non-leaders

The literature aligns with the perceptions of the survey participants regarding the importance of *emotional intelligence* for members of software projects. Rezvani and Khosravi (2019), for example, identified that the ability and competence of developers can be negatively affected by stress and lack of confidence. Therefore, the presence of *emotional intelligence* is important to mitigate adverse situations and enhance performance. For Rezvani and Khosravi (2019), *emotional intelligence* is the ability to manage, understand, and control one's own emotions.

Figure 4 shows the RBO considering the comparison between the perception of leaders and non-leaders in relation to non-leader's soft skills. We can see that the similarity between the ranks is only around 40% for the top-ranked soft skills. Although the value increases as all soft skills are included, a noticeable difference in perception remains for the most important soft skills for non-leaders.

Key finding 4. Although there is a difference of perception of non-leaders' soft skills, *teamwork* and *commitment & responsibility* are the most important soft skills for non-leaders in the point of view of leaders and non-leaders.

Table 5. Professionals' perception of the soft skills of non-leaders.

Position	Leaders	Non-leaders
1º	▲ Commitment, Responsibility (115)*	▲ Teamwork (86)
2º	▼ Teamwork (115)	▼ Commitment, Responsibility (83)
3º	▲ Motivation (103)	▲ Eagerness to Learn (82)
4º	▲ Communication Skills (102)	▲ Initiative, Proactive (81)
5º	● Analytic, Problem Solving (100)	● Analytic, Problem Solving (81)
6º	▼ Initiative, Proactive (100)	▼ Communication Skills (80)
7º	▲ Interpersonal Skills (96)	▲ Planning Skills (80)
8º	▼ Eagerness to Learn (94)	▼ Interpersonal Skills (78)
9º	● Autonomy (92)	● Autonomy (78)
10º	▲ Customer Orientation (90)	▲ Organizational Skills (78)
11º	● Results Orientation (89)	● Results Orientation (77)
12º	▼ Organizational Skills (89)	▼ Methodic (75)
13º	▼ Planning Skills (88)	▼ Customer Orientation (71)
14º	▲ Methodic (84)	▼ Motivation (67)
15º	● Leadership (63)	● Leadership (51)

Legend
● *Soft skill* in the same position in both lists
▲ *Soft skill* in a higher position compared to the other perception
▼ *Soft skill* in a lower position compared to the other perception
∗ The values in parentheses represent the sum of the participants' choices based on the Likert scale.

5. Discussion

This section delves into the results obtained in the study. Firstly, we compare the findings with those reported in the literature. Then, we present and discuss two heatmaps that facilitate the data visualization of the differences between soft skills from the perspective of leaders and non-leaders and the influence of level of experience. After that, we present a summary of the obtained findings. Lastly, we discuss the implications for practitioners and researchers.

5.1. Comparison with Related Work

Our study aligns closely with the study performed by Matturro *et al.* (2015) , which identified the most in-demand interpersonal skills in the field through interviews with software engineering professionals. In this regard, Table 6 compares our study's results and Matturro's findings, highlighting the Brazilian software industry's convergences and contextual specificities.

In both studies, the soft skills *teamwork*, *commitment & responsibility*, *communication skills*, and *analytic and problem solving* ranked among the top five positions, albeit in different orders, demonstrating a similarity between the results. The main difference lies in the classification of *initiative and proactivity*, which ranked 4th in our study but was classified 6th in Matturro's work. Conversely, *eagerness to learn* was more valued in Matturro's study, ranking 4th, whereas it appeared only in the 12th position in our study, reflecting possible contextual variations and specific priorities of the analyzed environments.

Table 6. Comparison with Matturro's study [Matturro et al. 2015]

Position	Our work	Matturro's work
1º	▲ Teamwork	▲ Analytic, Problem Solving
2º	● Commitment, Responsibility	● Commitment, Responsibility
3º	▲ Communication Skills	▼ Teamwork
4º	▼ Analytic, Problem Solving	▲ Eagerness to Learn
5º	▲ Initiative, Proactive	▼ Communication Skills
6º	▲ Interpersonal Skills	▼ Initiative, Proactive
7º	▲ Planning Skills	▲ Motivation
8º	▲ Autonomy	▲ Results Orientation
9º	▼ Motivation	▼ Autonomy
10º	▲ Organizational Skills	▼ Interpersonal Skills
11º	▲ Customer Orientation	▼ Organizational Skills
12º	▼ Eagerness to Learn	▼ Customer Orientation
13º	▼ Results Orientation	▼ Planning Skills
14º	● Methodic	● Methodic
15º	● Leadership	● Leadership

Legend
● *Soft skill* in the same position in both lists
▲ *Soft skill* in a higher position than the others in the other perception
▼ *Soft skill* in an inferior position compared to the others in the other perception

Additionally, Table 6 highlights other relevant differences, such as *interpersonal skills*, which ranked 6th in our study compared to 10th in Matturro's study, and *planning skills*, which was classified 7th in our research but only 13th in Matturro's study. On the other hand, *results orientation* was more valued in Matturro's work, reaching 8th place, while it ranked 13th in our study. These discrepancies underscore distinctions in the priorities and contexts analyzed. *Results orientation* refers to the ability to achieve and/or exceed sales, targets, and/or objectives [Matturro et al. 2019].

Acuña *et al.* (2006) emphasized the importance of understanding professional profiles and individual skills to form productive teams in software projects. In line with this study, our results demonstrate that skills such as *teamwork* and *commitment & responsibility* are essential for team success. This issue reinforces the importance of understanding interpersonal competencies as a critical factor for composing effective teams aligned with organizational goals. The authors also highlighted the role of managers as key components in team dynamics, which directly relates to our findings on the value of *communication skills* for leaders. This connection suggests that developing these skill in managers can positively impact team performance, especially in agile and collaborative environments. Furthermore, Ahmed *et al*. (2013), explored the job market's perspective on soft skills, identifying them as a competitive advantage for IT professionals. Our findings complement this view by showing that skills like *eagerness to learn* are highly valued by non-leaders, indicating a convergence between market expectations and internal perceptions within software teams.

We also compared our findings with those reported in Singh *et al.* (2022). Both studies converge in identifying *problem-solving* as a highly valued skill for IT professionals. However, Singh *et al.* (2022) found that skills facilitating a novice's acclimation to the industry (e.g., *learning ability/willingness to learn* and being *self-motivated*) were more highly valued, while our participants emphasized *teamwork* and *commitment & responsibility* as the most critical skills. This difference may stem from the fact that Singh *et al.* (2022) investigated what is necessary to enter and adapt to the industry, whereas our study focuses on what is valued within an established organization. This issue reinforces the idea that the valuation of soft skills is highly contextual, depending not only on hierarchical role but also on career stage and the specific operational environment.

In summary, the literature highlights that the key soft skills identified in our study (*teamwork*, *communication skills*, and *commitment & responsibility*) are fundamental in driving the success of software projects [Qureshi et al. 2014, Defranco and Laplante 2017, Gotterbarn 2017]. Studies indicate that collaborative teams learn more effectively, share knowledge more efficiently, and develop more creative solutions compared to those working in isolation or competitive environments [Qureshi et al. 2014]. Additionally, teamwork promotes collaboration and builds trust and alignment among team members, which are vital for achieving shared goals. These skills are even more critical in Agile methodologies, such as Extreme Programming (XP), where constant interaction among team members is fundamental for iterative development and continuous product improvement [Qureshi et al. 2014]. Communication, in particular, has a direct impact on various aspects of a software project. For instance, a team with strong communication tends to be more effective and achieve better outcomes. Conversely, poor communication is often cited as one of the main causes of failure in complex projects [Defranco and Laplante 2017].

As mentioned by Gotterbarn (2017), responsibility is a key aspect of computing as an emerging profession. On the technical side, professionals are expected to adhere to proper standards and procedures, such as software development models and software engineering curricula. However, this basic compliance is not enough to distinguish technicians from professionals. The true differentiator lies in moral responsibility, which demands an ethical commitment from professionals to benefit society. This perspective includes ensuring that developed products meet users' needs, going beyond merely fulfilling client demands [Gotterbarn 2017].

5.2. Comparing soft skills by level of experience

Professionals involved in software development projects can use the findings of this research to understand the expectations associated with each level of experience, considering the perceptions of other software development professionals. To promote the practical application of these findings, we defined a heatmap, as shown in Figure 5. The heatmap depicts the perceptions of junior and senior software development professionals using the following color scheme: green (representing the lowest values, i.e., below the 50th percentile), yellow (representing median values, i.e., at the 50th percentile), and red (representing the highest values, i.e., above the 50th percentile).

Professionals at mid-level or lower positions can, by observing the heatmap in Fig-

Soft Skills by level of experience	Senior or more	Junior
Analytic, Problem Solving	117	101
Autonomy	113	97
Commitment, Responsibility	123	103
Communication Skills	122	100
Customer Orientation	106	92
Eagerness to Learn	103	92
Initiative, Proactive	115	99
Interpersonal Skills	115	98
Leadership	93	84
Methodic	98	92
Motivation	113	89
Organizational Skills	107	94
Planning Skills	107	102
Results Orientation	106	89
Teamwork	124	103

Figure 5. Heatmap of soft skills in the perception of seniors or more and juniors.

ure 5, identify that soft skills such as *teamwork*, *commitment & responsibility*, and *communication skills* are highlighted as key by senior-level professionals. This demonstrates that these skills are highly valued at this level, which can guide professionals aiming for career advancement to focus on developing these competencies, thereby improving their project performance.

The findings from the heatmap can also support researchers interested in understanding how the experience level impacts the perception of soft skills. For instance, the heatmap reveals that most of the soft skills analyzed in our study are considered critical for senior professionals. This observation opens avenues for further research to investigate how these soft skills are applied in daily activities and to identify the practices senior professionals use to cultivate and enhance these competencies.

5.3. Comparing the views between leaders and non-leaders on the importance of soft skills

Professionals involved in software development projects can leverage the findings of this research to enhance their personal performance by considering the perceptions of leaders and non-leaders regarding soft skills. To facilitate the practical visualization of these findings, we designed a heatmap in Figure 6.

Project leaders, when analyzing the heatmap in Figure 6 (a), can observe that the soft skills *commitment & responsibility* and *teamwork* are critical in both perceptions, while *communication skills* is particularly critical from the leaders' perspective. Thus, leaders could focus on developing these soft skills to enhance their performance and improve interactions with other team members.

Team members without formal leadership roles, upon examining the heatmap in Figure 6 (b), can see that *commitment & responsibility*, *communication skills*, and *team-*

Leaders' soft skills	Leaders	Non Leaders
Analytic, Problem Solving	108	100
Autonomy	105	92
Commitment, Responsibility	113	115
Communication Skills	117	102
Customer Orientation	102	90
Eagerness to Learn	86	94
Initiative, Proactive	104	100
Interpersonal Skills	108	96
Leadership	102	63
Methodic	81	84
Motivation	102	103
Organizational Skills	100	89
Planning Skills	109	88
Results Orientation	97	89
Teamwork	112	115

(a)

Non-leaders' soft skills	Leaders	Non Leaders
Analytic, Problem Solving	84	81
Autonomy	84	78
Commitment, Responsibility	87	83
Communication Skills	87	80
Customer Orientation	81	71
Eagerness to Learn	76	82
Initiative, Proactive	84	81
Interpersonal Skills	85	78
Leadership	84	51
Methodic	71	75
Motivation	83	67
Organizational Skills	86	78
Planning Skills	85	80
Results Orientation	74	77
Teamwork	88	86

(b)

Figure 6. Heatmap of soft skills in the perception of leaders (a) and non-leaders (b).

work are critical from the leaders' perspective. Therefore, team members could develop these skills to improve their productivity and better collaborate with leaders to achieve project goals.

The heatmap can also be utilized for the formation and proper allocation of professionals in software development projects. By understanding which soft skills are most valued, teams can be formed with professionals who possess the desired soft skills as well as complementary abilities. Researchers may also use these findings and the heatmap to further studies that seek to identify the impact of soft skills improvement on software projects. Additionally, strategies can be proposed to help both team members and leaders develop their soft skills.

5.4. Summary of findings

In response to **RQ1**, we found that *teamwork*, *commitment & responsibility*, and *communication skills* are the most highly valued soft skills among the software practitioners surveyed. However, our in-depth analysis revealed that experience significantly influences these perceptions. For example, *planning skills* were ranked third by junior professionals but only tenth by seniors, highlighting distinct priorities at different career stages.

Also, the soft skills highlighted in this study are fundamental for navigating the main operational and collaborative challenges of modern software development [Sampaio et al. 2021]. The high valuation of *teamwork* and *communication skills* identified in our study aligns directly with the principles of the Agile and DevOps movements, which dominate the industry and depend on intensive, daily collaboration. In the era of remote and hybrid work models, the ability to *communicate* clearly and maintain team cohesion without physical proximity becomes even more critical. Similarly, skills such as *commitment & responsibility* and *autonomy*, which also ranked highly in our analysis, are essential for the success of self-managing agile teams and for professionals working with less direct supervision in distributed environments.

Regarding **RQ2**, we found that *communication skills*, *commitment & responsibil-*

ity, and *teamwork* are considered the most critical skills for leaders. Our analysis also revealed a perception gap between leaders and non-leaders, exemplified by *organizational skills*, which was ranked 12th by leaders but 4th by non-leaders. This divergence was quantified through the RBO analysis, which showed a similarity of only about 30% among the top-ranked leadership skills.

Concerning the skills valued for non-leaders (**RQ3**), *teamwork* and *commitment & responsibility* were evidenced as the most important skills for this group. However, the analysis revealed even greater perception misalignments: for example, *motivation* was ranked as the 3rd most important skill for non-leaders from the leader's perspective, but only 14th by the non-leaders themselves. In contrast, *eagerness to learn* showed the opposite trend, ranking 3rd for non-leaders but only 8th for leaders.

In summary, our findings demonstrate that, beyond a core set of universally valued soft skills, the importance assigned to each competency is both contextual and multifaceted. The perceived value of a soft skill is not absolute; rather, it is a complex function of professionals' hierarchical roles and levels of seniority within the software development environment, which is a central finding of this work.

5.5. Implications for software practitioners and researchers

Our findings benefit software practitioners by enabling targeted self-development and the strategic enhancement of competencies such as *teamwork*, *commitment & responsibility*, or *planning skills*, as valued by different professional segments.

Through this work, project leaders and managers may gain an understanding of soft skill perceptions, allowing them to tailor mentorship, delegate tasks more effectively, and cultivate an environment where valued skills can flourish, particularly in light of differing views on aspects like *organizational skills* or *motivation*. These results can inform project leaders' perceptions and refine their management practices, ultimately contributing to more effective team dynamics and project outcomes. Leaders can make more informed decisions regarding team composition and role allocation by considering the soft skill profiles most valued by various groups. The study highlights where perceptions of soft skill importance diverge (such as *planning skills* for junior professionals) guiding targeted training initiatives, supported by visual aids like Figure 5 and Figure 6. Skills such as *commitment & responsibility* can also be integrated into performance feedback. Understanding the different hierarchies of valued soft skills enables leaders to adapt their communication strategies. Additionally, insights into how leaders' soft skills are perceived can catalyze leadership self-reflection and further development. For researchers, this study provides empirical evidence on soft skills in a Brazilian context, offering a foundation for comparative studies and deeper investigations, supported by detailed analyses as presented in the heatmaps in Figure 5 and Figure 6.

In summary, this study's data-driven understanding of valued soft skills empowers stakeholders to make informed decisions, fosters professional growth, and provides project leaders with tangible ways to enhance management practices for more cohesive and productive software development teams. Researchers can also design new investigations into soft skills by considering factors that influence their importance, such as the

role of the software practitioner and career stage.

6. Threats to Validity

We apply the framework proposed by Wohlin et al. (2012) to discuss the threats to the validity of this study. Concerning the **construct threats**, the research questions were formulated based on a research gap identified through a review of related work. Additionally, the selection and implementation of the survey followed best experimental practices. To mitigate threats related to subjective interpretation, standardized definitions for each soft skill were provided to all participants, ensuring a common understanding of concepts like teamwork and collaboration. The survey included a predefined set of soft skills, which could introduce bias into the responses. However, the list of soft skills was adapted from an important related study [Matturro et al. 2015]. While this provided a validated foundation, we acknowledge that this list, originating from a 2015 study, may not fully encompass competencies that have gained prominence with the evolution of modern software engineering practices. The inclusion of additional soft skills and an extension of the survey are planned as future work.

Regarding **conclusion threats**, the results presented may not fully support the conclusions drawn. To mitigate this threat, all inferences were thoroughly discussed among the researchers involved, ensuring the minimization of potential confirmation biases. In addition, potential errors in processing the survey responses may introduce **internal threats**. To address this issue, all responses were stored in secure infrastructure with version control. The data were processed and validated by the co-authors. Furthermore, the survey responses are available in our replication package [Coelho et al. 2024b].

The fact that the survey was conducted in only one organization limits the generalization of the results, contributing to **external threats**. Additionally, the sample size (N=42), while providing rich data for a contextualized analysis, may not be large enough for broad statistical generalization across the entire industry. Furthermore, other contextual factors not controlled in this study, such as the specific industry sector, business objectives, or the organization's software development maturity, could also influence the perceived value of soft skills. However, this study does not aim to provide a definitive answer regarding the importance of soft skills. Instead, it adds to previous efforts [Matturro et al. 2015, Matturro et al. 2019, Acuña et al. 2006, Ahmed et al. 2013] to enhance the understanding of soft skills and inspire future studies with similar objectives.

7. Conclusion

This paper investigates the most valued soft skills in software projects, exploring the perceptions of leaders and non-leaders by surveying 42 professionals from a large research and development institute in Brazil. The paper also demonstrates the differences in the perception of soft skills, considering the participants' experience level and whether the participants are leaders or non-leaders. A set of heatmaps was designed to support the data visualization of these differences.

The primary contributions of this study lie in providing a detailed empirical analysis of soft skill perceptions within a Brazilian technological institute, thereby offering

a regional perspective. We extend previous research by presenting a comparative analysis across distinct professional profiles (leaders versus non-leaders), and junior versus senior professionals. A methodological contribution is the presentation of these nuanced perceptions through heatmaps, which facilitate data visualization and support an analytical reflection on the importance of specific soft skills. These insights provide a valuable framework for practitioners to enhance discussions on team composition and competency development strategies, and offer a foundation for researchers to conduct further investigations in diverse organizational and cultural contexts.

Regarding future work, there is an opportunity to expand the application of our survey to other software organizations, enabling comparisons with the results of this study. The survey could also be enhanced with additional questions to enrich the findings. This perspective includes expanding the list of soft skills to investigate emerging competencies relevant to modern software engineering and considering questions to capture the project context, such as its complexity level (e.g., based on team size or requirements uncertainty) and application domain (e.g., FinTech, HealthTech, or embedded systems). Furthermore, future work could investigating gender-based perceptions of soft skills between different genres or analyzing perceptions by role within a project. Another avenue for future research is to explore and understand why specific soft skills, such as *leadership*, were deprioritized in software projects, examining their impacts and professionals' perceptions of the relevance of this competency. Lastly, employing alternative data collection methodologies, such as interviews or mining information from question-and-answer platforms in the information technology domain (e.g., Stack Overflow), can further enhance knowledge about the importance of soft skills in the software industry.

Acknowledgments

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