

Soft Skills in Remote Software Development: A Comparative Study between the Demands of the Biggest and the Best to Work IT Companies

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Abstract—This Research Full Paper delves into the competencies essential for remote software development, specifically focusing on the soft skills demanded by Information and Communication Technology (ICT) companies, drawing insights from real-world job market data. In remote work, accelerated by the COVID-19 pandemic, non-technical proficiencies have emerged as pivotal due to the inherent challenges in communication, collaboration, time zone disparities, and project management complexity. The paper emphasizes the significance of technical (hard) and interpersonal (soft) skills for software professionals operating remotely. While technical prowess with software languages and platforms remains crucial, soft skills such as effective communication, collaboration, innovation, business-oriented, and problem-solving are indispensable for navigating the intricacies of remote work environments. Clear communication fosters mutual understanding; collaboration facilitates remote teamwork and problem-solving, and critical thinking enables developers to address challenges creatively. The growing importance of soft skills is evident in global job advertisements within the Software Industry. However, despite their significance, there's a lack of explicit emphasis on soft skills in computing curricula. The study defines the research domain to address this gap by analyzing job demands from leading ICT companies worldwide, referencing Forbes Global 2000 ranking (Forbes, for short) and Good Place to Work (GPTW) companies. Through a detailed analysis of over 700 job vacancies from Forbes and GPTW companies on the LinkedIn platform in March 2023, the study identifies and evaluates the most sought-after soft skills, categorized by company rankings, career paths, and a comparative overview between the two rankings. The research methodology combines a literature review method, thematic analysis, taxonomy synthesis, and data collection through the LinkedIn platform. Overall, the paper sheds light on the evolving landscape of remote software development, highlighting the critical role of soft skills alongside technical competencies, and provides valuable insights for industry practitioners and academia in understanding and addressing the demands of the digital workplace.

Keywords—Software Engineering Education, Competencies Development, Personal and Professional Development, Soft Skills, IT Companies

I. INTRODUCTION

Software development is an activity that requires a set of technical and non-technical skills from computing professionals [1]. In the perspective of global remote modality, whose adoption was accelerated by the COVID-19 pandemic, non-technical capabilities have proven crucial in a

distributed work environment, leading to constant challenges related to communication and collaboration, time zone differences, and the complexity of project management and supervision [2]. Thus, in the remote work environment, the software professional must have skills beyond the capabilities of software languages and platforms (hard skills), including interpersonal skills such as effective communication, self-motivation, adaptability, teamwork, and problem-solving [3]. Called “soft skills,” these capabilities are fundamental to overcoming the challenges of remote work, often associated with difficulty collaborating and communicating with others, staying on top of informal developments, balancing work and life demands, and time management [4]. Effective communication ensures clear understanding between team members, while adaptability and teamwork promote collaboration across distances. Additionally, problem-solving, and critical thinking allow developers to tackle unique challenges creatively. Therefore, as important as hard skills, soft skills are vital for software programmers to stand out in remote environments, emphasizing the importance of interpersonal skills and emotional intelligence in the digital workplace [1][3][4].

The importance of soft skills has grown in recent years, as reflected in job advertisements in the software industry around the world [5]. As these skills are rarely explored explicitly in computing curricula, there is a lack of clarity regarding the soft skills we need to develop and how ICT companies demand them. Understanding these skills is a first step towards making students and teachers aware of the importance of teaching and learning approaches that stimulate and promote soft skills development, considering appropriate practices and learning models [6]. Besides, the results can also support training strategies in software industry [7][8]. Therefore, this study proposes an exploratory investigation based on the demands of companies in this industry for remote software work.

Considering the research domain, this study focused on the most credible Information and Communication Technology (ICT) companies in the global market, referencing the biggest IT companies in the Forbes Global 2000 ranking (Forbes, for short) and the Good Place to Work (GPTW) companies. Forbes analyzes the biggest companies annually, accounting for sales, profits, assets, and market value metrics. GPTW carries out an annual ranking of the best companies to work for in two stages: quantitative research with a minimum sample of employees, listening to those who work in the company; the cultural practices of each company. The choice

of these two rankings was intentional, seeking to investigate whether the company's profile influences the demands for soft skills, highlighting similarities and differences. In this context, the following research question was defined: RQ) *What soft skills are demanded of remote software professionals by the biggest and best IT companies nowadays, and what are the differences between these demands?*

Thus, this study analyzed soft skills demands in job advertisements on LinkedIn in the first two weeks of March 2023 to find an answer. From the extraction of more than 700 job vacancies from companies in the Forbes and GPTW rankings, it was possible to evaluate, analyze, and identify which soft skills were most required by IT companies in each ranking, which soft skills per identified careers, and, finally, a comparative view of the soft skills required by companies in the Forbes and GPTW rankings, highlighting the similarities and differences between them.

We used a combination of research methods to conduct this study, involving an ad hoc review of the literature on works related to the topic, thematic analysis, synthesis of an extensive taxonomy of soft skills, and adaptation of the systematic literature review (SLR) method for data collection, selection, and analysis of data extracted on the LinkedIn platform. It is essential to highlight that publishing job advertisements on this platform is highly dynamic. Still, the type of data we analyzed (demands for soft skills) does not usually vary over short periods. Therefore, we consider the selected data sample to be adequate.

This paper is divided into eight sections. After this brief introduction, Section II discusses concepts related to soft skills and remote software development. Section III presents some related works to this current study. Section IV describes the research methodology. Sections V and VI, respectively, present the results and discussions, followed by Section VII, discussing some limitations. Finally, Section VIII presents the conclusions and future works.

II. BACKGROUND

A. Soft Skills

Long after the emergence of the "soft skills" term in 1972, the vast literature on soft skills still presents little consensus on its definition and taxonomy, despite their versatility and opposition to hard skills [9]. However, we can consider some definitions.

Joie-La Marle et al. [10] define soft skills as *"transversal, non-technical intra- and interpersonal skills that are essential for performance or excellence."* For Chiavenato [11], soft skills are not considered in isolation but as dimensions of the concept of "competencies," defined as *"the fusion of knowledge, skills, and attitudes that can be defined to integrate and converge in a given task."* In this definition, the dimensions of skills and attitudes are associated with "soft," and the dimension of knowledge with hard skills [12]. Considering the definition used as a reference in the Computing Curricula 2020 [13], the attitude dimension gains greater scope when called "dispositions," which, together with skills, are also associated with soft skills. Nagarajan and Prabhu [14] align with Chiavenato [11]'s definition of competence, which states that *"competence can include a combination of knowledge, basic requirements, skills, abilities, behavior and attitude."* Considering the purpose of this study, which is to extract soft skills in current job

opportunities, we chose to use the term "be able" to describe soft skills, considering that these are related to the dimensions of skills and attitudes of the concept of competence [12].

In addition to being difficult to define, soft skills are usually called in many ways. As shown in [15], these abilities are not necessarily described following a standard or a single term. They can come in more subjective and abstract forms, for example, using terms such as "interaction with system users" and "work involving various sectors of the company" to represent the ability to collaborate. The soft skill of communication is another example of how complex its description can be, often related to written and oral communication, knowing how to listen, give feedback, and defend ideas, among others.

Despite the complexity of soft skills, their identification is crucial for understanding their demands, with "job advertisement analysis" and "use of surveys of software engineers" being the two most commonly used methods [16].

Collecting soft skills is even more complex when analyzing job vacancies, as they need to be extracted from unstructured texts. Another critical point is that there is a range and diversity of classifications present in job vacancy advertisements, which also reflects people's different understandings of the topic, thus justifying the need for a taxonomy to assist in analyzing soft skills in vacancies [17].

Soft skills are also difficult to communicate to people—some are so inherent to demand performance that they are impossible to speak. This aspect creates a big problem for a company, as training carried out for employees can be ineffective given this lack of clarity regarding the necessary capabilities. As pointed out in [18], the most problematic type of capability transfer is related to soft skills training.

B. Soft Skills and Remote Software Development

Remote work in the software development industry has become increasingly common, especially since the COVID-19 pandemic, which forced many companies to adopt this model [2]. While remote work can offer many benefits, such as flexibility and saving time and money on commuting, it also presents significant challenges. Effective communication between team members, especially when geographically distant, is essential but not always easy to achieve [19]. This aspect is also reflected in positions requiring constant communication at higher levels (for example, senior programmers) and beginners (such as interns). Furthermore, collaboration can be hampered by the lack of face-to-face interaction, which can negatively affect productivity and quality of work, among several other abilities that affect remote work and become even more critical in this scenario.

Therefore, when adopting this work model, soft skills began to have equal or even greater importance than technical knowledge. Skills such as communication and collaboration have become a priority, as they are fundamental to success in a virtual environment [20] [21][22].

Even though technical skills have had a substantial weight and focus for a long time, the importance of soft skills for the job market has become evident. As pointed out in [8], through interviews with small business owners, consultants, team leaders, and HR managers, all interviewees were emphatic when addressing the importance of soft skills, citing that these abilities allow for faster integration of happier and more productive staff and teams, as well as being vital for creating

relationships, building customer trust and generating constant business.

This aspect is also explicitly noticed within software development teams. As shown in [1], analytical ability, problem-solving, commitment, responsibility, willingness to learn, motivation, and teamwork are the five most valued soft skills for team members other than the leader.

Furthermore, the industry looks for entry-level technical skills, considering recruitment decisions based on candidates' more personal qualities, leaving the more in-depth development of technical skills to be carried out in the workplace [8]. The results of the study in [5] indicate that a considerable number of job advertisements mentioned at least one non-technical skill, with an average of 6.30 non-technical skills per job advertisement posted, showing the importance that soft skills have for the job market, especially in the context of software development.

Given this, the first step to ensuring that academic education and industry training provide adequate competencies development is to identify the most relevant [7]. From this, it is possible to understand the job market's needs, understand which capabilities are most relevant to companies and most attractive to software professionals, and support the planning of efforts to ensure a more appropriate combination of skills to be developed.

III. RELATED WORKS

This section comments on seven works related to the current study. These studies were selected based on a literature review (non-systematic) in the Google Scholar database, considering the keywords “*soft skills*,” “*software engineering*,” and “*software development*.” The objective was to find initial references that could indicate research methods to be used and justifications about the importance and usefulness of the research. Table I shows an overview of the related works.

TABLE I. RELATED WORKS

Ref	Method	Primary results	Year
[7]	Surveys, interviews, focus group	Essential skills, Support to academic and industrial training	2001
[23]	Data extraction from job postings	Essential skills per software development positions	2012
[1]	Interviews	Soft skills for team members and leaders.	2015
[16]	Systematic Mapping Study	Soft skills for software engineers.	2019
[15]	Data extraction from job postings	Demands of soft skills by general IT companies.	2021
[5]	Data extraction from job postings and interviews	Soft skills for junior developers.	2022
[3]	Data extraction from job postings and interviews	Soft skills in software engineering.	2022

The results of the study [7] designed to identify the knowledge and skills needed by the software programmer. Data was collected over three months through web surveys, on-site interviews, focus groups, and a field survey. The article's focus was to analyze technical, non-technical, and business skills. Among the soft skills found, the following stand out: listening skills, problem-solving process, teamwork

skills, and time management skills. The study's motivation highlights that identifying the most essential skills is the first step in ensuring that the academic and industrial training curriculum focuses on the most appropriate combination of skill development.

In the study [23], 500 advertisements for IT positions were extracted and analyzed on several websites (workopolis.ca, eurojobs.com, monsterindia.com, and seek.com.au), focusing on the non-technical skills mentioned. The analysis helped determine which soft skills were in high demand for software development jobs and which were overlooked despite their importance. The study analyzed soft skills from software development positions, such as system analyst, software designer, computer programmer, and software tester. Nine soft skills were identified in the advertisements: communication, interpersonal, analytical/problem-solving, team player, organizational, fast learner, ability to work independently, innovative, open, and adaptable to change.

A field study was reported in [1], in which 35 software engineering professionals from companies in Uruguay were interviewed to find out their points of view on which soft skills they consider most valued by the leader and other software development team members. According to the study, leadership, communication, customer orientation, interpersonal skills, and teamwork are the most valued skills for team leaders. For team members, problem-solving, commitment, responsibility, willingness to learn, motivation, and teamwork are the most valued. These results showed differences in soft skills demands depending on the experience level of the software professional.

The study in [16] performed a systematic mapping to identify existing research on non-technical skills in software engineering and determine which soft skills are considered relevant to the practice of software engineering. At least half of the selected studies mention five skills: communication, teamwork, analytical, organizational, and interpersonal skills.

The article in [15] investigated which hard and soft skills are most required in IT companies, analyzing the description of 20,000 job opportunities in Stack Overflow Jobs (SOJ). Communication, collaboration, and problem-solving were the soft skills in demand. An interesting point that this article highlights is the lack of standards for these abilities. They can be advertised in more subjective and general ways, such as "good communication skills" or through more specific words.

The objective of this article in [5] was to outline the current panorama of non-technical skills in the area of software development by carrying out a study in two phases: (1) analyzing job vacancy advertisements to assess how frequently these skills are requested and (2) interviewing junior developers to find out what non-technical skills they think are needed in their organization, and understanding how they exercise those non-technical skills. In the article, it is noted that practically all job advertisements mention at least one soft skill. The developers interviewed believe that non-technical skills help them understand organizational culture, team dynamics, and their careers. Teamwork, communication, willingness to learn, problem-solving, and business orientation were the top five skills among the 30 mapped skills.

Ultimately, the focus of the article in [3] is to understand (1) what the relevant soft skills in software engineering are, (2) how soft skills relate to the types of job positions in the

field, and (3) how soft skills relate to the characteristics of hiring organizations through the analysis of 530 job vacancies in New Zealand. The study highlights 17 soft skills in this context, including communication, collaboration, problem-solving, teamwork, leadership, and others more linked to behavior, such as creativity, empathy, and independence.

It is essential to highlight the primary research methods used in the studies evaluated: data extraction from job advertisements, interviews with software professionals, and systematic literature review. We opted for the first method, considering the research question aimed at understanding the scenario of demands for software skills by companies that are “attractive” to software development professionals within an increasingly distributed and globalized context.

This current study differs from the works discussed in this section in two specific aspects. The first is related to the focus of job postings in two categories of companies, the best to work for and the largest in profitability, seeking to understand differences in soft skills demands between them. The second aspect is the analysis of more recent job postings, making evident, on the one hand, the change in the careers of software professionals in the last decade, as shown in the study [23], and on the other hand, the permanence of soft skills demands over time. This characteristic reinforces the importance of soft skills in preparing professionals for future careers. With this vision of companies' demands at market-leading levels, we intend to motivate initiatives aimed at developing soft skills in the education of remote software development professionals, both in academia and in industry training.

IV. RESEARCH METHODOLOGY

This study aims to explore the demand for soft skills in the software development industry, focusing on the comparative analysis of non-technical skills in job vacancies at the biggest and best IT companies. For this, we started the research process by defining the research scope that would enable this study using the Forbes and Great Place to Work (GPTW) rankings, respectively. Considering the understanding of soft skills in the job postings extracted from these companies (see Tables III and IV), it was necessary to define a taxonomy. Thus, we carried out a quasi-systematic literature review of studies [24] that defined taxonomies in the context of soft skills. Fig.1 summarizes the research steps.

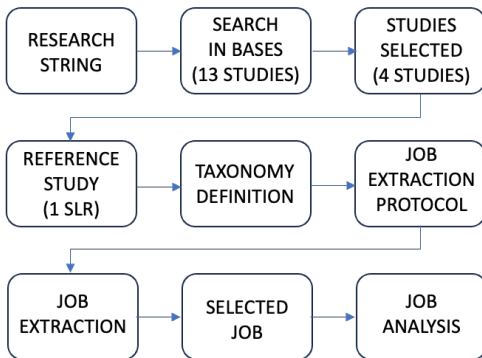


Fig. 1. Research steps flow

The first step involved defining the search string: “*soft skills taxonomy*” OR “*non-technical skills taxonomy*.” Inclusion criteria were set as follows: (1) studies related to taxonomies of soft skills; (2) publication period: 2015 to 2022. The databases ACM DL, Scopus, and Google Scholar were selected for the article search. Although this search resulted in

thirteen studies only four articles ([3], [9], [10], and [17]) were chosen based on abstract review and adherence to the inclusion criteria.

Considering the completeness and level of detail, the study [10] was selected as the foundation for defining a taxonomy in this work. This study presents a systematic review of articles and organizational reports concerning soft skills taxonomies, resulting in a taxonomy of 92 soft skills. With the reference article defined and soft skills mapped, these abilities were grouped based on ten meta-categories as shown in Table II.

To define these meta-categories, the authors of this study carried out a thematic analysis, grouping related soft skills manually from discussions, votes, and consensus, in a synchronous meeting. Table II shows the software skills associated with each meta-category.

TABLE II. JOB POSTINGS OF GPTW RANKING

<i>Soft Skills Taxonomy based on [10]</i>	
<i>Meta-categories</i>	<i>Soft Skills</i>
Communication (11)	Sharing information, Non-verbal, Oral, Written, Give feedback, Presentation, Request for help, Question, To Listen, Synthesize, and Situational awareness.
Collaboration (15)	Teamwork, Appreciation of others, Guidance/Mentorship, Empathy, Support, Team coordination, Conflict Management, Delegation, People management, Influence, Inspiration and Mobilization, Contact/Relationship Network, Respect, Tolerance to diversity, and Etiquette.
Problem-Oriented (9 skills)	Problem analysis, Problem-solving, Tolerance to complexity, Autonomy, Adaptability, Forecasting and Anticipation, Prioritization, Proactivity, and Tolerance to ambiguity.
Innovation (11 skills)	Abstract thought, Critical thinking, Logical thinking, Mental flexibility, Disruptive thinking, Divergent thinking, Intuitive thinking, Strategic thinking, Opening, Monitoring, and Creativity.
Learning (4 skills)	Application of knowledge, Life-long learning, Multidisciplinarity, and Fast learning.
Business-Oriented (10 skills)	Customer guidance, Customer Relations, Setting goals, Organizational awareness, Professionalism, Achievement orientation, Business knowledge, Conformity, Negotiation, and Global consciousness.
Emotional Intelligence (9 skills)	Perseverance, Resilience, Emotional awareness, Emotional expression, Emotional regulation, Stress management, Humor, Positivity, and Tolerance to negative feedback.
Management (9 skills)	Planning and Organization, Project management, Leadership, Deadline accomplishments, Resource management, Self-management, Workload management, Balance between work personal life, and Attentional focus management.
Decision Making (8 skills)	Evaluative/selective judgment, Objectivity, Assertiveness, Awareness of details, Revision, Risk Analysis/Identification, Accepting risks, and Decision making.
Metacognition (6 skills)	Cultural adaptability, Ethic, Health awareness, High Standards, Responsibility, and Reflectivity/Metacognition.

We can briefly describe each meta-category as follows:

- *Communication*: efficient communication skills, especially how to obtain and share information.

- *Collaboration*: abilities to work effectively with other people, whether co-workers or a project team.
- *Problem/Task orientation*: abilities that allow a person to identify, analyze and solve problems efficiently and effectively, using appropriate strategies.
- *Innovation*: abilities to innovate and think to reach this goal.
- *Learning*: abilities that allow the individual to acquire, understand and apply new knowledge, allowing continuous professional evolution and development.
- *Business orientation*: abilities that allow the individual to understand and act in accordance with the objectives, values, and culture of the company in question, aiming for joint success and the achievement of common goals.
- *Emotional intelligence*: skills that involve understanding and regulating your own emotions, as well as the ability to identify and understand the emotions of others.
- *Management*: ability to manage performance, behaviors, working time, among other points.
- *Decision-making*: abilities that allow a person to make informed, well-evaluated and effective decisions, considering factors such as objectives, values, available resources, and possible consequences.
- *Metacognitive*: abilities that involve awareness and control of our thought processes, responsibility, and ethic.

The stage of extracting job postings from companies was based on the systematic literature review process by Kitchenham & Charters [25], adapting the method for the research's purpose. Thus, the extraction planning, the definitions of the search protocol, the inclusion and exclusion criteria, and the data extraction process were defined according to [25]. In the job posting extraction protocol, defining which job platform to use for extracting the postings was necessary. Therefore, the LinkedIn platform was utilized for this purpose, given its extensive use as a professional networking platform, and it is the world's largest professional network, with over 850 million users across 200 countries and territories [26]. With the platform chosen, the next step involved defining the search criteria through LinkedIn, using the job search tool and available filters on the platform, resulting in an appropriate "search link." For this, the following criteria were applied to the LinkedIn platform search: selecting of the search type as "job postings;" selecting the target company; setting the location field to "worldwide;" using the "remote" filter in the search; selecting the "information technology" function in the search filter.

After that, we needed to establishing criteria for including and excluding job postings. Consequently, job postings from the biggest and best technology companies were included. Additionally, only remote job postings and those that were open at the time of the research were considered. The current study's authors reviewed job postings' titles and details to determine exclusions. Job postings in the German or French

language were excluded, as well as those unrelated to the software development industry, such as management, design, and support positions that were not within the context of software development. Additionally, duplicate job postings from the same company, with identical titles and descriptions, were omitted.

The next step involved searching for job postings on LinkedIn, considering the study's criteria and objectives. This search was limited to job postings open during the first two weeks of March 2023. Given the high volume of job postings (731 in total) and the complexity of data extraction, an automated approach was explored. The study explored different options for extracting data from LinkedIn, including creating a web scraper and using an automated data scraping tool. However, creating a scraper was not favored due to LinkedIn's strict policies against scraping and potential legal issues. Instead, we choose a user-friendly and free tool called Octoparse [27] to automate the data extraction, addressing challenges like IP rotation. This decision was made to ensure compliance with LinkedIn's policies and to expedite the research process. Considering the challenges faced and using the Octoparse tool in the search protocol, the job listings were initially extracted, as shown in Table III and Table IV.

TABLE III. JOB POSTINGS OF GPTW RANKING

GPTW Ranking		
Company	Extracted	Unique
CISCO	32	24
Salesforce	238	13
SAP SE	0	0
Accenture	17	16
Mercado Libre	1	1
Sopra Steria	42	30
Adobe	86	7
Total:	416	91

TABLE IV. JOB POSTINGS OF FORBES RANKING

Forbes Ranking		
Company	Extracted	Unique
Apple	0	0
Alphabet	0	0
Microsoft	138	25
Samsung	0	0
Tencent	4	4
Meta	67	38
Intel	0	0
Taiwan Semiconductor	0	0
IBM	106	32
Total:	315	99

With the filtering of job listings in the previous stage, we analyzed the job postings, focusing on the mentioned soft skills. To accomplish this, we employed the concepts of

thematic analysis, as described in [3]. The thematic analysis aims to narrate the story of your data flexibly and efficiently, enabling a detailed and comprehensive examination of the obtained data. Specifically, within the framework of this technique, we adopted the concepts of themes and codes, which, in our context, correspond to meta-categories (clusters of soft skills) and individual soft skills, respectively.

After this understanding, we carried out another crucial stage of the work, involving the detailed analysis of the final job listings. For each job, a thorough examination of the job details section, which contains key information such as requirements and the job's purpose, was conducted to extract the specific soft skills mentioned. As a result, three essential columns were created in the final job listings spreadsheet:

- *Excerpts with Soft Skills*: a column detailing each section in the job details that mention soft skills.
- *Soft Skills Taxonomy*: a column specifying the specific soft skill addressed in the job listing considering the previously defined taxonomy.
- *Meta-Category*: a column indicating the category to which that soft skill belongs.

From this detailed information, and primarily because the taxonomy used as a basis only listed capabilities without associating them, it was necessary to link them together to gain an understanding between categories. Therefore, from the fundamental job listing data to the specific soft skills, it became possible to associate them with meta-categories and their soft skills, enabling a holistic view of the demands of the largest and best technology companies. The data used in this analysis are available at <http://zenodo.org/records/13236948>.

V. PRIMARY RESULTS

In this section, we will present the results obtained from the analysis of job postings in both rankings, along with the relevant discussions regarding the data presented. When analyzing the final job postings of the best technology companies to work for, a more specific view reveals the soft skills most in demand by companies in the GPTW ranking as shown in Fig. 2, considering the meta-categories.

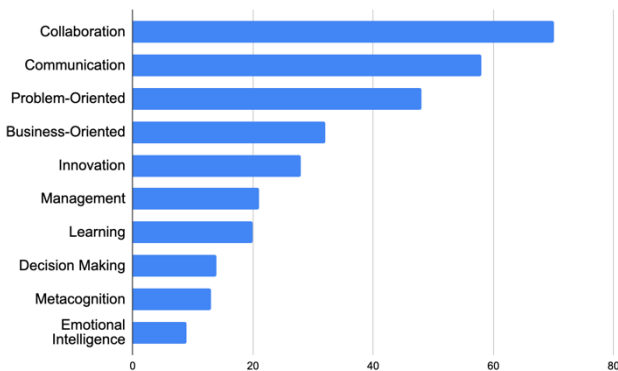


Fig. 2. Soft skills in meta-categories per number of job postings in GPTW companies.

Within this more specific view, one can discern the significant importance of GPTW ranking companies on “collaboration” with focus on teamwork, accounting for 76.9% of job postings that mention this skill. It is also interesting to note the demand for skills related to

“communication” in general, along with specific soft skills like “oral communication” and “written communication,” totaling 63.7% of the job postings related to this group. Another noteworthy point is the focus on the soft skill of “problem-solving,” accounting for 52.7% of job postings, confirming the significance of the ability to understand and address issues in the software development industry to design effective solutions. A passage from job posting 057 at Cisco reaffirms this observation: “*Excellent analytical and problem-solving skills.*” Three postings did not explicitly present/demand soft skills concerning jobs to a lead software engineer in a specific platform, a security specialist, and a data administrator, comprising 3.2% of the total.

On the other hand, when examining the final job postings of the biggest technology companies, a more detailed perspective reveals the soft skills most in demand by companies in the Forbes ranking as shown in Fig. 3, also considering meta-categories.

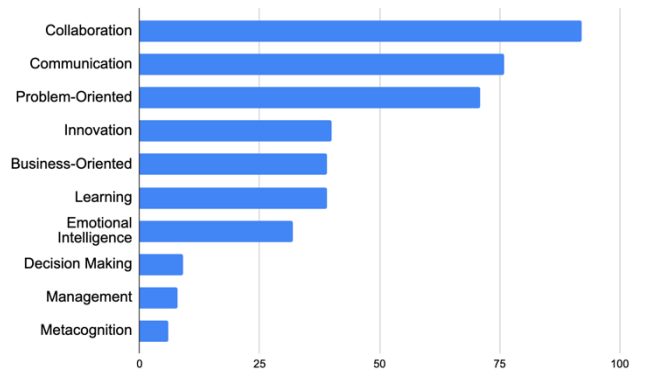


Fig. 3. Soft skills in meta-categories per number of job postings in Forbes companies.

Within this view, it becomes evident that these companies also place significant importance on “collaboration” and “communication,” accounting for 92.9% and 76.7% of job postings, respectively. Almost all postings mentioned the needs of collaboration with team members and business stakeholders, continuous feedback, and mentoring activities. The emphasis on the soft skill of “communication,” underscoring the significance of the ability to obtain and share relevant information in the software development industry in a broader sense. Additionally, it is interesting to note the demand for skills such as “life-long learning” (Learning meta-category) and “tolerance for negative feedback” (Emotional intelligence meta-category), representing 39.3% and 32.3% of job postings, respectively. Only one job posting did not explicitly demanded a soft skill, concerning to an API programmer.

Considering the specific demands of these organizations, the positions were classified into six distinct roles: Software Engineering, IT Consultant, Data Administrator, Business/Data Analyst, Solutions Architect, and Security Specialist. Considering that each company adopts different career terms, identifying these positions was carried out through a thematic analysis involving the authors of this study, considering the analysis of the titles and descriptions of the job postings. Table V presents some of the synonyms found for each position.

TABLE V. CAREER POSITIONS FOUND IN THE POSTINGS

Career Positions	Job Titles
Software Engineer	Senior frontend engineer, DevOps engineer, Java full stack engineer, Test & Development engineer (SDET), QA engineer, Game developer
IT Consultant	Consulting manager, Senior technology consultant, Consulting engineer, AppDynamics consultant
Data Administrator	SQL Server DBA, Data engineer, Cloud database administrator, Remote access delivery manager, Data center systems engineer
Business/Data Analyst	Senior data scientist, Senior Data Engineer, Business system analyst, BI analyst, Master data analyst, Data and applied scientist
Solutions Architect	Lead Technical Architect, Cloud Architect, Lead Technical Architect, Enterprise Architect, Application Architect
Security Specialist	Security Architect, Security engineer, Site reliability engineer, Firewall technical support engineer, Product Security

Fig. 4 shows the concentration of job postings by career position.

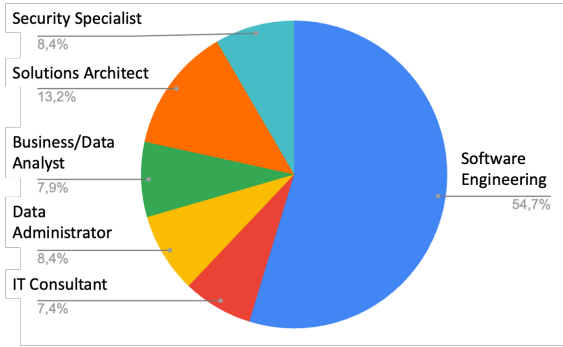


Fig. 4. Concentration of job postings by career positions

Table VI shows the demand for soft skills in each position found in the two rankings, considering the color dark gray (high demand) when the presence of soft skills is greater than 50% in the respective job postings, medium gray (moderate) when it is between 30% and 50%, and light gray (low demand) when it is less than 30%. For skills not identified, we use the mark “-.” The consistent presence of soft skills in basically all these roles highlight the paradigm shift in the modern workplace. Leading companies value technical skills and recognize the importance of interpersonal skills for individual and organizational success.

Among these functions, “Software Engineering” stands out with 54.7% of positions, highlighting the emphasis of these companies on strengthening their software development teams and the importance of soft skills such as collaboration, communication, and problem orientation for this Professional Profile. While technical knowledge remains the backbone of software engineering, soft skills are essential to translate that knowledge into practical results. Professionals combining robust technical and interpersonal skills are more likely to excel in such a dynamic and interconnected field. Furthermore, “Solution Architects”, present in 13.2% of positions, highlights that interpersonal skills are as crucial as technical ones, including the soft skills previously mentioned, business orientation and management skills. Clear communication is essential for translating complex concepts, while negotiation and collaboration skills are necessary to align solutions with business objectives. Interpersonal

relationships play a fundamental role in more technical roles, such as “Security Specialist” and “Data Administrator” present in 8.4% of positions. Clear communication is vital to explain security issues to non-experts, while collaborating with diverse teams requires teamwork skills.

TABLE VI. SOFT SKILLS CONCENTRATION LEVEL BY CAREER

According to GPTW Ranking						
Meta Soft Skills	SE	CO	DA	BA	SA	SS
Communication						
Collaboration						
Problem-Oriented						
Innovation						-
Learning		-				-
Business-Oriented			-			
Emotional Intelligence			-	-	-	
Management						
Decision Making						
Metacognition			-	-		-
According to Forbes Ranking						
Meta Soft Skills	SE	CO	DA	BA	SA	SS
Communication						
Collaboration						
Problem-Oriented						
Innovation						
Learning						
Business-Oriented						
Emotional Intelligence						
Management		-		-		-
Decision Making		-			-	
Metacognition		-	-	-		-

Label: Software Engineer (SE), IT Consultant (CO), Data Administrator (DA), Business Analyst (BA), Solutions Architect (SA), Security Specialist (SS).

Another point to highlight is how the seniority level of the positions posted can influence the requirements for soft skills. For example, jobs for IT consultants, generally related to senior positions, responsible for support activities for cross-functional teams and mentoring, highlight soft skills related to continuous learning and strengthening positive relationships with stakeholders. It is also essential to highlight the low presence of soft skills related to decision-making (12.1%) and metacognition (10%), which only concern software engineers, IT consultants, and solutions architects. We believe this aspect relates to the characteristics of the vacancies offered, which focus on the software development team, not coordinators or decision-making positions common in top management.

VI. DISCUSSIONS: COMPARING THE RANKINGS

Based on the analyses conducted in the previous sections, it is possible to draw some comparisons and generate relevant discussions regarding the demand for soft skills in the analyzed job postings, considering both the best technology companies to work for according to the GPTW ranking and the largest technology companies according to the Forbes.

Firstly, it is interesting to observe the intersections between the rankings as shown in Fig. 5.

The meta categories “communication” and “collaboration” are highly sought after by companies in the GPTW and Forbes rankings. Soft skills related to “teamwork” and “communication” also emerge as some of the most demanded skills in both rankings. This synergy underscores the significance of working effectively as a team and acquiring and sharing relevant information for companies in both categories.

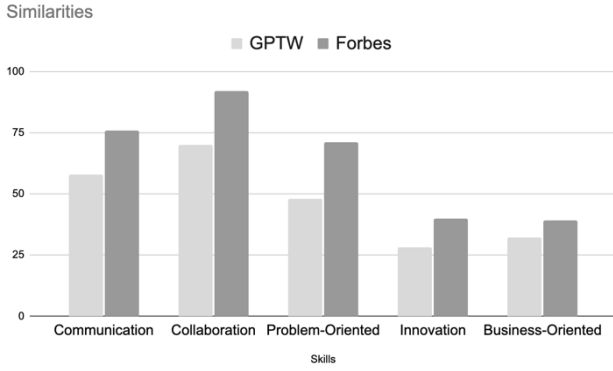


Fig. 5. Comparison between number of meta categories in rankings with focus on similarities.

Fig. 6 emphasize the primary differences between the two rankings.

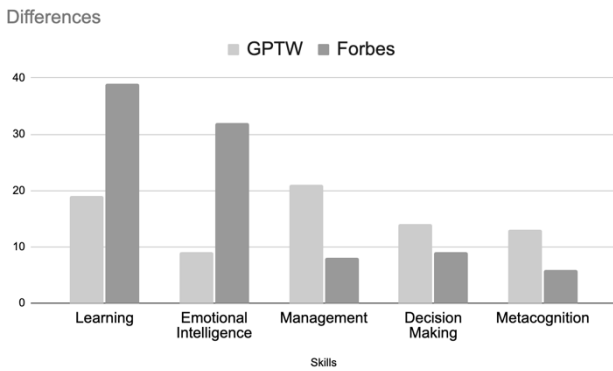


Fig. 6. Comparison between number of meta categories in rankings with focus on differences.

A difference in the demands for the meta-category “emotional intelligence” between the two rankings can be initially observed. While in the ranking of the best technology companies to work for, only 1.3% of job postings require skills related to understanding and regulating one's own emotions, as well as the ability to identify and understand the feelings of others, in the ranking of the largest technology companies, such skills are demanded in 14.3% of the job postings. From a macro perspective, this seems contradictory since one would expect the best companies to work to require these highly relevant skills. On the other hand, it is also important to note that all job postings that require this meta-category in the Forbes ranking precisely correspond to the soft skill “tolerance of negative feedback,” as shown in Table II, which is something to be avoided in companies in favor of constructive feedback.

Finally, it is important to observe the alignment between some skills highlighted in this study and those found in related works. Emphasis on collaboration, communication, problem orientation, innovation, and business orientation demonstrate a certain consensus regarding the relevance of these skills for the remote software development professional.

VII. LIMITATIONS

Considering the exploratory nature of this study, it is essential to emphasize the threats to the validity of the research.

First, as we decided to extract data from the LinkedIn platform, we had some limitations inherent to the platform. Thus, search filters were restricted to the available search parameters, leaving little flexibility for defining the search protocol.

Secondly, we used an initial sample of 700 job advertisements in a specific observation period (first two weeks of March 2023), which still needed to be treated using defined exclusion filters. We consider that the results could differ if we analyzed more advertisements; however, after analyzing around 100 advertisements, we observed that no new skills were added. This aspect indicated that analyzing more ads could lead to different frequency distributions, but it was unlikely that the list of interpersonal skills would change.

Third, we could not create a balanced sample of postings, considering publication time, types of positions, and maturity levels. This challenge occurred because ads are published irregularly and with subjective descriptions without following a standard or format. Furthermore, certain positions may appear more than others, and not all indicate the level of maturity, except when the vacancy is for senior professionals.

Fourth, another limitation is linked to the study's replicability and access to the data used since the vacancies analyzed become unavailable after a certain period. To mitigate this aspect, we collected and recorded the extracted data in spreadsheets to facilitate data recording and analysis.

Finally, to ensure the reliability of the identified interpersonal skills, we involved four researchers in analyzing the advertisements (authors of this article). The description of soft skills was discussed among everyone and refined based on total consensus.

VIII. CONCLUSIONS

In the face of the evolution of the software development industry, especially in remote work, soft skills stand out as indispensable abilities. Both the largest and the best technology companies seek professionals with soft skills related to communication, collaboration, task/problem orientation, and emotional intelligence. It is crucial for a professional to have efficient communication skills and to work effectively with others. Additionally, identifying, analyzing, and solving problems is essential. Skills related to understanding and regulating one's emotions, as well as identifying and understanding the feelings of others, are increasingly valued in a remote and ever-changing environment.

The analysis of job postings in the GPTW and Forbes rankings revealed that 3.2% and 1% did not explicitly mention the search for soft skills, respectively. These data corroborate the importance of these skills in the job market, indicating that companies value them more and more. However, there are still gaps in some job postings and companies regarding some soft skills such as decision-making and metacognition, demonstrating a lack of focus on their importance.

It is concluded that soft skills have become essential in the software development industry. Those who wish to stand out should invest in their development, which contributes to professional success and personal growth.

REFERENCES

- [1] G. Maturro, F. Raschetti, & C. Fontán. “Soft skills in software development teams: A survey of the points of view of team leaders and

- team members.” In 2015 IEEE/ACM 8th International Workshop on Cooperative and Human Aspects of Software Engineering (pp. 101-104), 2015.
- [2] K. Marek, E. Wińska, & W. Dąbrowski. “The state of agile software development teams during the Covid-19 pandemic.” In International Conference on Lean and Agile Software Development (pp. 24-39). Cham: Springer International Publishing, 2021.
 - [3] M. Galster, A. Mitrovic, S. Malinen, & J. Holland. “What soft skills does the software industry* really* want? An exploratory study of software positions in New Zealand.” In Proceedings of the 16th ACM/IEEE International Symposium on Empirical Software Engineering and Measurement (pp. 272-282), 2022.
 - [4] M. F. Flores. “Understanding the challenges of remote working and it’s impact to workers.” International Journal of Business Marketing and Management (IJBMM), 4(11), 40-44, 2019.
 - [5] D. Rabelo, A. Lopes, W. Mendes, C. de Souza, K. Gama, D. Monteiro, & G. Pinto. “The role of non-technical skills in the software development market.” In Proceedings of the XXXVI Brazilian Symposium on Software Engineering (pp. 31-40), 2022.
 - [6] J. A. Botke, P. G. Jansen, S. N. Khapova, & M. Tims. “Work factors influencing the transfer stages of soft skills training: A literature review.” Educational Research Review, 24, 130-147, 2018.
 - [7] J. L. Bailey., & G. Stefaniak. “Industry perceptions of the knowledge, skills, and abilities needed by computer programmers.” In Proceedings of the 2001 ACM SIGCPR conference on Computer personnel research (pp. 93-99), 2001.
 - [8] F. Ahmed, L. F. Capretz, S. Bouktif, S., & P. Campbell. “Soft skills and software development: A reflection from the software industry.” arXiv preprint arXiv:1507.06873, 2015.
 - [9] J. K. Mahasneh, & W. Thabet. “Rethinking construction curriculum: Towards a standard soft skills taxonomy.” In 52nd ASC Annual International Conference, Associated Schools of Construction, 2016.
 - [10] C. Joie-La Marle, F. Parmentier, M. Coltel, T. Lubart, & X. Borteyrou. “A systematic review of soft skills taxonomies: descriptive and conceptual work.” 2022.
 - [11] I. Chiavenato. “People Management: The New Role of Human Resources in Organizations.” Rio de Janeiro: Elsevier, 2008.
 - [12] Anonymous, 2022.
 - [13] ACM/IEEE-SC. Computing curricula 2020 - cc2020 - paradigms for global computing education. Access on 04/16/2021. [On- line]. Available: <https://www.acm.org/binaries/content/assets/education/curricula-recommendations/cc2020.pdf>
 - [14] R. Nagarajan, & R. Prabhu. “Competence and capability: A new look.” International Journal of Management, 6(6), 7-11, 2015.
 - [15] J. E. Montandon, C. Politowski, L. L. Silva, M. T. Valente, F. Petrillo, Y. Guéhéneuc. “What skills do IT companies look for in new developers? A study with Stack Overflow jobs.” Information and Software Technology, v.129, jan. 2021.
 - [16] G. Matturro, F. Raschetti, C. Fontan. “A Systematic Mapping Study on Soft Skills in Software Engineering.” Journal of Universal Computer Science, vol. 25, p.16-41, jan. 2019.
 - [17] I. Khaouja, G. Mezzour, K. M. Carley, I. Kassou. “Building a soft skill taxonomy from job openings.” Social Network Analysis and Mining, v.9, dez. 2019.
 - [18] J. A. Botke, P. G. W. Jansen, S. N. Khapova, M. Tims. “Work factors influencing the transfer stages of soft skills training: A literature review.” Educational Research Review, v.24, p. 130-147, jun. 2018.
 - [19] M. Jiménez, M. Piattinil, A. Vizcaíno. “Challenges and improvements in distributed software development: A systematic review.” Advances in Software Engineering, v. 2009, 2009.
 - [20] C. Castrillon. “Por que as soft skills são as habilidades mais procuradas no momento (Why are soft skills the most sought after skills right now?).” Forbes Brasil, 2022. Disponível em: <https://forbes.com.br/carreira/2022/09/por-que-as-soft-skills-sao-as-habilidades-mais-requisita-das-no-momento/>. Acesso em: 15 abr. 2023.
 - [21] K. Jones, L.N. Leonard, & G. Lang. “Desired skills for entry level IS positions: Identification and assessment.” Journal of Computer Information Systems, 58(3), 214-220, 2018.
 - [22] M. Stevens, Matt & R. Norman.” Industry Expectations of Soft Skills in IT Graduates.” In: ACSW '16: Australasian Computer Science Week. 2016. Disponível em: <https://dl.acm.org/doi/10.1145/2843043.2843068>. Acesso em: 15 abr. 2023.
 - [23] F. Ahmed, L. F. Capretz, & P. Campbell. Evaluating the demand for soft skills in software development. It Professional, 14(1), 44-49, 2012.
 - [24] J. F. Abrantes, and G. H. Travassos. “Quasi-Systematic Literature Review: Characterization of Agile Software Development Methods.” PESC-COPPE, 2007.
 - [25] B. Kitchenham, & S. Charters, Stuart. “Guidelines for performing systematic literature reviews in software engineering.” 2007. Disponível em: https://www.elsevier.com/_data/promis_misc/525444systematicreviewsguide.pdf. Acesso em: 15 abr. 2023.
 - [26] LINKEDIN CORPORATION. Sobre o LinkedIn. Disponível em: <https://about.linkedin.com/pt-br>. Acesso em: 15 abr. 2023.
 - [27] OCTOPARSE. Easy Web Scraping for Anyone. Disponível em: <https://www.octoparse.com/>. Acesso em: 15 abr. 2023.