Investigating the Professional Profile of Software Architects in Brazil using Job Advertisements

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ABSTRACT

Software systems are vital to industry, emphasizing the need for quality assurance. Software architecture underpins quality systems by reinforcing key requirements. However, defining the Software Architect role is still challenging, particularly in a dynamic market demanding complex systems. This emerging results paper investigates the profile sought for Software Architects in Brazil through an analysis of job ads collected from an online platform in October 2024. Of 411 ads, 286 were valid for analysis. The data revealed 191 different terms for the role, indicating a lack of standardization. The market favors candidates with formal education in IT and a broad skill set - ads listed an average of 11.4 skills, including APIs, Java, Azure, and DevOps. While planning and implementation tasks appeared in 69.5% of ads, activities like architecture management were less emphasized. Results also show a preference for in-person roles, and higher salaries were linked to degrees and on-site work. These findings help map employer expectations and reflect the diversity of the role in Brazil.

KEYWORDS
software architect, advertisement, quality, profile

1 Introduction

Software systems are essential in the daily life of the industry. Recent data produced by the Brazilian Association of Software Companies (ABES) and the International Data Corporation (IDC) [1] indicate that Brazil is the leader in Latin America in investments in Information Technology (IT), which encompasses software, hardware, and services. According to the same study, focusing only on the software market, Brazil ranks 11th in the world. Such data reflect the importance of software production both nationally and globally.

According to Gharbi et al. [10], the value and commercial success of companies and products are often determined by the software technologies adopted and used, but mainly by their quality. Poorly designed software systems can lead to a range of problems, including data leaks, operational instability, high maintenance costs, and even negative impacts on the company's reputation. The primary concern, in this regard, is ensuring the quality of such systems. To achieve this objective, it is essential that the company has one or more qualified professionals responsible for the software architecture of the systems, designated as software architects. They are a fundamental part of the process of designing and developing quality software, since the software architecture encapsulates the architectural decisions regarding the prioritized quality attributes, becoming the backbone of any quality software system [15, 19, 21].

Defining the activities of such a position concisely is not simple. With an increasingly dynamic market, more complex software systems have been required, which also demands qualified professionals to manage them. New methods and practices in the software industry, such as the recent intensive use of Artificial Intelligence, can make it even more difficult to delimit the scope of the position. In the work of Wan et al. [27], where an interview was conducted with 32 experts on three different continents, challenges were also raised, such as the absence or conflict in the use of tools for architectural support (monitoring, error traceability, refactoring, etc.), difficulties in documenting and traceability of decisions, in addition to the lack of defined processes for making and sharing architectural decisions. Gregor Hohpe [11] discusses the changing roles of the software architect. At the same time, agile practices and modern tools reduce the need for support in critical decision-making, but dealing with the scope and complexity of systems is increasingly challenging. It is interesting to note that the definitions of the software architect's activities can differ depending on the purpose or method used in building the system, as can be seen in [8], [18], and [24]. Although the Software Engineering Body of Knowledge (SWEBOK) [12] defines roles in relation to Implementation, Maintenance, Management, and Architecture knowledge management, there is still no consensus regarding the skills expected of this role.

In this context, the main contribution of this emerging results paper is to investigate the profile of the software architect professional

sought by companies in Brazil. A total of 411 job advertisements for the software architect position in Brazil was collected from an online platform and subsequently analyzed. The results showed a great diversity in the nomenclature of the positions related to software architects, totaling 191. We noted that planning and implementing architectural activities were the most requested, and specific technical skills were also commonly required. Furthermore, it was evident that the market values formal training (higher education in the IT field) and work in an on-site modality.

The remainder of this paper is organized as follows. Section 2 presents the theoretical basis and related work. Section 3 discusses the method used to conduct the research. Section 4 shows the results obtained, categorized by research questions. Section 5 discusses the obtained results. Section 6 addresses threats to validity. Finally, Section 7 concludes the paper with final remarks.

2 Background and related work

In 2024, Software Architecture became a Knowledge Area (KA) in the Software Engineering Body of Knowledge (SWEBOK) [12]. According to Venters et al. [26], software architecture is the basis of any software system and provides a mechanism for analyzing the main software quality requirements. Within this same understanding, Bass et al. [3] state that the activity of designing an architecture directly impacts the quality of the final software.

Software architecture design can be understood as the planning stage of a system. It is through it that complexity is abstracted, creating mechanisms for coordination and communication between the elements. Software Architecture comprises the elements that will define the structure and behavior of the system. However, it is worth noting that the architectural project, as explained by van Vliet and Tang [25], has different methods depending on the approach used for development, the complexity of the system, and even the organization's business outline.

The professional responsible for abstracting the complexity associated with software development must be able to make decisions and manage the team. However, Fowler [7] warns that decision-making should not be a centralized activity but a social construction where team members can share their understanding of the software. To this end, the software architect should serve as a guide, seeking to reduce complexity and allowing the team to participate in decision-making, while consolidating these decisions into architectural decisions that reinforce the prioritized quality attributes. It is important to remember that such practices change over time and that this phenomenon is expected. The subject has been debated in the literature, as per Spinellis [22], Frey et al. [8], and Venters et al. [26].

There are few studies that outline and analyze the profile of software architects in Brazil. In dos Santos and Ito [6], a questionnaire was applied to IT professionals from several companies to obtain a sample of companies with these professionals. Additionally, this study aimed to validate whether software architecture concepts were effectively applied. The results showed that the companies surveyed followed processes in the development of the architecture, although the role played by the software architect, the techniques for evaluating architectures, and the use of emerging methodologies were still not very mature at that time. Despite its evident

pioneering nature, this research was limited to the state of São Paulo, thus leaving a gap in relation to the other states.

In the research by Neto et al. [20], we aimed to explore the current state of practices among software architects in Brazil. A questionnaire was disseminated to collect the data. Data were collected from 105 professionals from 24 Brazilian states. The results showed that not all companies have a dedicated software architect position; in some cases, other professionals perform this role, while in other cases, the company has a software architect, but other professionals handle the associated activities. Given this scenario, it would be interesting to understand what motivates these role changes in relation to the software architect's activities. One possibility is to outline the profile that the market seeks in this professional, and then compare it with the data on the state of the practice.

Job advertisement analysis enables the mapping of the required professional scope, allowing for the visualization of market trends and providing an overview of the terminology used in the field. This type of method can be applied to various purposes and research areas. In Kassab et al. [14], job advertisements were collected to explore the profile of software testing positions in the United States. In Gellweiler [9], a categorization of the tasks and skills required for the software architect position in Germany and the United Kingdom was conducted by analyzing job advertisements. Examples of studies in other areas that employ this method can be found in Ana Costa Laranjeiro [2], Mantas Lukauskas [16], and de O. Carvalho and Conte [5].

Within this context, where no studies have been dedicated to exploring the profile of software architect advertisements in Brazil, this work proposes an exploratory study on this topic.

3 Research method

This section outlines the method employed in this study.

3.1 Aim and research questions

This work **aims to** investigate the profile of the software architect professionals, **with the purpose of** characterizing, **with respect to** the required competencies, **from the point of view of** researchers, **in the context of** advertisements from Brazilian companies. Thus, a systematic collection of such advertisements was made. Such analysis allows us to identify the technical skills required and the real market demand, since the advertisements disclose the skills that companies consider essential for hiring [23]. To outline the profile sought in the Brazilian job market for the software architect position, and based on the stated objective, we defined the following Research Questions (RQ) along with their rationales:

- **RQ1** - *What terms are used to define the positions that perform the role of Software Architect in the Brazilian job market?* Identifying such terms can contribute to mapping the profiles required by companies and understanding how the market structures and names such positions.
- **RQ2** - *What are the tasks expected of a Software Architect?* Listing the tasks expected of this position can provide a preliminary view of how the practical performance of Software Architects is viewed.

- **RQ3** - *What skills should Software Architects have to perform their work?* Investigating technical and interpersonal skills can provide insight into the competencies considered essential according to the Brazilian market, thus providing professionals with clues on the most valued technologies and practices today.
- **RQ4** - *What education and experience do employers seek for Software Architect positions?* Understanding the required levels of formal qualification has the potential to identify which levels the market is most inclined towards.
- **RQ5** - *What is the average salary offered in the advertisements?* The average salary is a good parameter to measure the appreciation of Software Architect professionals within the Brazilian market.
- **RQ6** - *How are the positions for Software Architects distributed geographically in Brazil?* Analyzing the geographic distribution of job advertisements can indicate which regions most value Software Architect professionals, thus identifying regional inequalities and potential innovation hubs.

3.2 Data collection

As performed in Kassab et al. [14] and Gellweiler [9], the present study collected data from job advertisements in Brazil. For this purpose, GlassDoor[1] was utilized, a job and recruitment advertisement website. Bringing together advertisements for a wide range of positions, this website has already been used as a database in other studies dedicated, in some way, to analyzing job advertisements, such as [13] and [17].

We estimated a sample size of 271 advertisements for the proportion statistical parameter with a confidence level set at 90% and a margin of error of 5%.

Data collection was performed by the following steps:

(1) **Definition of search *strings*** - To perform a search on Glassdoor, two *strings* are required. The first represents the position and the second the location. These were defined, respectively, as: "software architect" and "Brazil". The search engine interpreted the strings and retrieved several relevant job advertisements related to the search term. Thus, a wide range of job titles was obtained using the defined search string, including Systems Architect, DevOps Architect, and Programmer, among others.

(2) **Data acquisition** - The collection was carried out on October 24, 2024, and yielded a total of 411 advertisements. The data was obtained by *download* using the *Jobs Miner* and *Exporter for Glassdoor* extensions[2], which delivered the ads in a structured table format in a .csv file.

(3) **Scope definition** - Software Architect positions were defined as the object of study, not limited to the nomenclature, but to the set of functions and duties of such a position.

(4) **Exclusion of out-of-scope ads** - During a simple check, it was noticed that some positions returned were outside the intended scope, belonging to the areas of civil engineering and architecture. To filter these positions, a manual search

procedure was performed in the results returned using the following strings: `Urbanism`, `Landscaping`, `Designer`, `Interiors`, `AutoCAD`, `Measurements`, `Civil`, `Revit`, and `Sales`. After identification, the ads were checked and only then excluded. A total of 115 ads were excluded at this stage.

(5) **Exclusion of correlated ads** - Then, manually and through observation and analysis of the collected data, ten advertisements in the IT area that were not related to the position of software architect were identified. Among them, we can highlight the positions of Product and Sales Manager. After analyzing each one, they were excluded. In total, 125 advertisements were removed because they did not include software architect positions, leaving **286 valid advertisements for analysis**.

3.3 Data extraction

To answer the research questions, we extracted 11 items from each of the 286 valid advertisements. Some items were extracted directly from the table generated by the Glassdoor extension, while for others a form was created in Google Forms[3], available at https://forms.gle/3X4ibSwZ9KC6jN7G8.

The following steps were taken to extract the items:

(1) The items 'Job Name' (RQ1), 'Company Name' (RQ1), 'Job Location' (RQ6), 'Salary' (RQ5), and 'Salary Currency' (RQ5) were extracted manually from the original table (.csv file).

(2) The other items, namely 'Company Domain Type' (RQ1), 'Activities Performed' (RQ2), 'Skills' (RQ3), 'Required Certification' (RQ3), 'Educational Level' (RQ4), and 'Minimum Experience' (RQ4), were extracted manually using a form. This information was not categorized in the original table, since the vast majority of advertisements, in the 'Job Description' column, did not describe only the activities of the advertised position; often, a brief history of the company, benefits, work method, desired and required certifications, and other information were also present, adding noise to the analysis. This extraction stage was divided into the following steps:

(a) Construction of a Google Form with discursive questions for the items: 'Company Domain Type', which was intended to describe the market sector in which the company operated, and 'Salary', to store the salary value offered in the advertisement. The fields 'Minimum Education', 'Minimum Experience', 'Mandatory Certification', and 'Desirable Certification' were configured as multiple-choice, and all had the option 'Others', allowing for the insertion of discursive values. The extraction of the item from line 5, 'Activities developed', was performed through a checkbox, allowing the selection of more than one option. The activities that composed this question were extracted from SWEBOK [12] and were categorized into five main ones, namely: *(i)* Planning and Implementing Architecture *(ii)* Maintaining the Architecture *(iii)* Managing Architectures *(iv)* Managing Architectural Knowledge *(v)* Managing the Team

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[1]https://www.glassdoor.com.br/Vaga/index.htm
[2]https://chromewebstore.google.com/detail/jobs-miner-exporter-for-g/ndnomcanokhgenflbdnkfjnhaioogmdk

[3]https://www.google.com/intl/pt-BR/forms/about/

In addition to these options, the 'other' option was inserted, in case there was any activity not listed above.

(3) One of the authors was responsible for conducting the data extraction independently. Thus, each job advertisement was read in full, and each item on the form was answered.

(4) In an attempt to validate the data extraction, another author performed a random audit on 10% of the dataset. In this audit, no abnormalities were found.

4 Results

This section presents the obtained results.

4.1 RQ1 - Terms defining software architect

To gather such data, several additional steps were required. The data consists of job advertisements submitted by individuals or companies. They contain specific fields, such as the job title, contain information that goes beyond the expected position title, which can lead to some confusion in the standardization of job nomenclature. A preliminary review revealed spelling errors and the inclusion of unnecessary characteristics in the job title, such as city, salary, and type of work schedule, among others. Therefore, the data presented here underwent Portuguese language correction, standardization of job titles, and normalization of the job title using the male form (e.g., "arquiteto"). Additionally, some terms originally in English were translated into Portuguese.

A total of 191 nomenclatures were found to designate the software architect position. This number is mainly because, in many positions, the technology or specialty was inserted together with the nomenclature, such as, for example, "Software Architect - Cloud Computing". The vast majority of positions, 160 of the total (83.7%), appeared only once. Within this list, the most used nomenclature was "Software Architect", appearing 26 times, followed by "Solutions Architect", "Information systems Architect", and "Tech Lead", with respectively, 20, 9, 8, and 5 occurrences. Figure 1 shows the graph of the main nomenclatures found. It is essential to highlight that there were 182 occurrences of positions that appeared once or twice, and for better visualization, they are not shown in this figure.
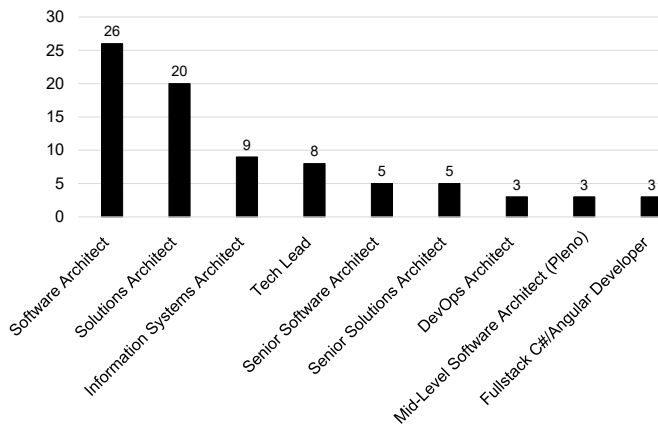

Figure 1: Main nomenclatures found.

Among the advertisements analyzed, three positions explicitly specified gender, and they were for female software architects. The diversity of advertisements allows companies to adapt their positions according to their needs.

4.2 RQ2: Software architect expected tasks

After analyzing the job descriptions, the job activities were mapped as shown in Figure 2, which shows the graph of the activities found in the ads. It is possible to see that the planning activity, which is closely linked to defining the architecture and supervising the implementation of the system, was the most sought after by recruiters, comprising a total of 69.5% in the ads analyzed. The other mapped activities did not reach 10%.
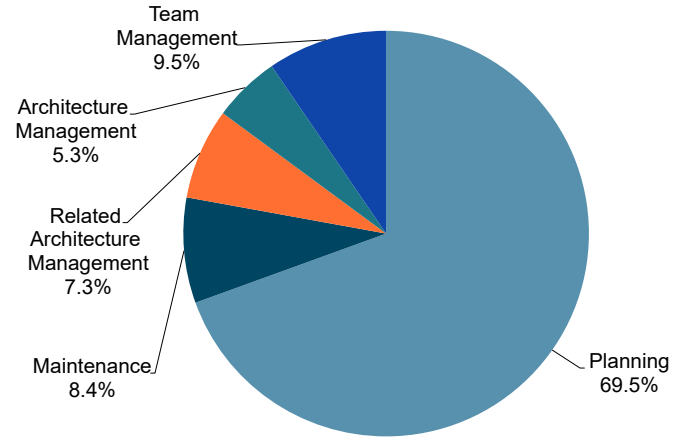

Figure 2: Distribution of activities for the position of Software Architect

This can be explained by the belief that, after implementing the system, the architect would no longer be useful, which is invalid, since according to Spinellis [22], Neto et al. [20] and IEEE Computer Society [12], the management and maintenance of existing architectures are also activities of a software architect, in addition to continuous research in the search for improvements, support and innovation in processes.

4.3 RQ3: Software architect competences

The expected skills are the technological, commercial, and personal aptitudes critical for professional performance. These skills can be classified as technical - related to the mastery of specific technologies, social - such as the ability to communicate and work collaboratively, and business - understanding of organizational processes. The present study analyzed only technical skills, as done in the research by Gellweiler [9], which highlighted the relevance of these skills for the exercise of the position of Software Architect.

The majority of advertisements requested more than one skill. Each advertisement requested, on average, 11.4 different skills. However, there were advertisements in which more than 20 skills were requested. This data may reflect the level of demand placed on a software architect in the Brazilian market.

Figure 3 demonstrates the employers' interest in skills for Software Architect positions. Skills that appeared in fewer than 20

advertisements were suppressed to generate the data range. It can be seen that the "APIs" skill, which is basically normative for software components to communicate, was the most demanded, appearing in 120 different advertisements. In decreasing order come the technologies "Java", "Azure", and the "DevOps" approach, with respectively 101, 98, and 97 advertisements.
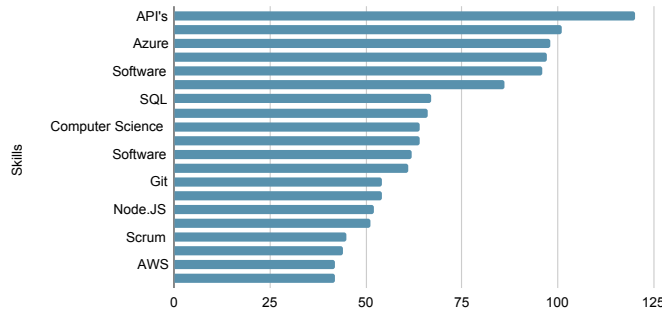

Figure 3: Skills required by ads.

4.4 RQ4: Software architect education level

The analysis found that a little more than half of the advertisements, 146, required a minimum level of education. Of these, the majority, 129 advertisements (88.3%), required a degree in Information Technology (IT) for hiring. In addition, 13 positions (8.9%) were observed for high school graduates, one position (0.6%) for undergraduate students, and two positions (1.3%) for technical level graduates.

Interestingly, the positions requiring a high school diploma did not require experience. In contrast, for the two positions that required a technical qualification, there was also a requirement to prove at least six years of experience in the area. Only 20% of the advertisements required expertise ranging from six months to 15 years of proven practice. A single ad required 15 years or more of experience for the position of software architect, in a remote mode, in a company that produces solutions for tax automation.

Certifications for the scope of this study are statements issued proving that the candidate is proficient in some technology, platform, or method. They are usually validated through rigorous tests. Of the 286 advertisements analyzed, only 21 required some certification; that is, 92.7% of the advertisements do not consider certification necessary for hiring. This does not mean that it is irrelevant, as some advertisements showed the employers' intention to sponsor/encourage such certifications after hiring. Among the 21 required certifications, the most common were certifications generated by AWS, in addition to cloud certifications in general, such as Azure, Microsoft, or Google.

4.5 RQ5: Software architect average salary

Unfortunately, out of a total of 286 advertisements, the sample had only 13 with explicit data regarding the salary offered. The average salary was R$ 11,436.03, with a 95% confidence interval (t-test) ranging from R$ 8,259.46 to R$ 14,612.61. Analyzing the three advertisements that offered the best salaries, namely R$ 19,697.00, R$ 18,000.00, and R$ 16,000.00, it was noticed that they were for on-site positions, two of them in Brasília-DF, and that all of them required

at least a degree in the technology area. The nomenclatures found in decreasing order in relation to salary are: "software architect specialist", "solutions architect", and ".NET architect". None of the positions required mandatory certification, and only the highest-paying position required a minimum of 5 years' experience.

Although it is impossible to generalize these values due to the sample size, there is an indication that the market values graduate professionals willing to work in the conventional on-site format.

4.6 RQ6: Geographical distribution of software architect positions

A geographic analysis was performed to understand how positions for the position of Software Architect are distributed in Brazil. A high concentration of positions was observed in the Southeast and South regions, especially in São Paulo, which had 113 advertisements, appearing as the most prominent demand hub for this type of professional. In addition, it is possible to notice a highlight for the region of the Federal District, more specifically, Brasília, with 19 positions. This distribution suggests a centralization of opportunities in large urban centers and more economically developed regions, reinforcing the idea that the market for Software Architects follows the concentration of large technology companies and corporate centers.

5 Discussion of results

This section discusses results from Section 4.

5.1 Discussion of RQ1

191 different terms were found to define the role of Software Architect, which suggests a lack of standardization in the Brazilian market. The most common term found, as expected, was "Software Architect", followed by "Solutions Architect".

The diversity of advertisements allows companies to adapt their positions according to their needs. However, this lack of standardization in terms of nomenclature can hinder the recruitment process and possible studies on such data.

It would be interesting to see whether the positions were defined according to the SWEBOK standardization [12] and personalized in the fields reserved for their description.

5.2 Discussion of RQ2

The most sought-after activity in job advertisements was "Architecture Planning and Definition". This data may reveal a limited view of the role of a Software Architect, focused only on the project's initial phase. However, according to SWEBOK 2024 IEEE Computer Society [12], the Software Architect professional must be present throughout the software life cycle.

This simplistic perspective on the role of such a professional may be generating architectures that are unfeasible to maintain in the future due to the lack of continuity and architectural adaptation.

5.3 Discussion of RQ3

By analyzing the data, it was clear that the Brazilian market is demanding regarding the skills required to fill the position of Software Architect. On average, each job posting requested 11.4 skills,

and postings with more than 20 required skills. Among the most requested skills, the following stand out: APIs, Java, Azure, and DevOps, reflecting the appreciation of skills in specific technologies.

In disagreement with this requirement, the requirement for certifications was well below expectations, only 7.3% of the postings. This raises questions about how such skills are verified by hiring managers.

5.4 Discussion of RQ4

Just over half of the advertisements required a minimum level of education. Of these, 88.3% indicated a degree in IT as a minimum requirement; however, only 20% required experience. This suggests that the market values formal academic education and is flexible regarding proof of experience.

It is important to note that, according to Bass et al. [3], theory and practice must go hand in hand, especially in strategic leadership positions, such as that of Software Architect.

5.5 Discussion of RQ5

Although a few advertisements disclosed salaries, it was possible to associate these data with the fact that the market prefers professionals with higher education and the ability to work in person.

This data differs from the post-pandemic trend in which work arrangements are more flexible, especially in technology areas. It may also suggest that the Brazilian market is still traditional in valuing higher education, which may indicate a high level of trust in professionals trained in academia.

5.6 Discussion of RQ6

Regarding geographic distribution, the Southeast and South regions concentrate the largest number of positions; this data can be confirmed by the history of Brazilian socioeconomic development, where these regions were privileged. It is also clear that other regions stood out, such as Goiás and the Northeast. Still, the positions were concentrated in large urban centers and more economically developed areas in all regions.

Given the growing number of remote positions, the advertisements were expected to be better distributed throughout the country in the post-pandemic scenario, which did not happen.

6 Threats to validity

This section discusses the threats to the validity of this study. A potential internal validity threat would be bias in data collection, since the data came from a single source. To mitigate the risk, we adopted the job platform "Glassdoor", one of Brazil's most popular job search platforms, minimizing the possibility of working with irrelevant or out-of-context data. In addition, such a platform has been used in similar studies as in Ioana Marinescu [13], Marios Karabarbounis [17], and Bergstrom [4].

Another potential internal threat is the manual analysis of the data, which can lead to some subjectivity. It is important to remember that Glassdoor's search engine not only returned ads within the desired scope but also offered results that were considered relevant to the Strings offered. The method adopted to include/exclude ads was carefully considered, as seen in Section 3. Although the data was collected at a single moment, day, and time, it is reasonable

to note that it included advertisements posted on different dates, which could constitute an external threat. One possible approach would consist of systematic collections, for example, every three months, which could help to identify seasonal variations. Another possibility would be to change the method and include other platforms as a data source, which could increase diversity and therefore the generalizability of the results.

Inaccuracy in data extraction and misclassification refer to construction threats. According to Wohlin et al. [28], this corresponds to the possibility that different reviewers extract and interpret information differently. To address this threat, at least two researchers thoroughly reviewed the full text of each extracted job posting. To review the agreements and disagreements raised in the reviews, consensus meetings of the researchers were conducted during the data evaluation and analysis process.

The fact that the present study was not compared with other studies may lead to the development of a very specific method. However, as explained in Section 2, this is an exploratory study; therefore, there is no delimited research within the intended scope of this work.

7 Conclusion

This paper presented data from an exploratory study that collected job postings for software architects in Brazil. After applying various filters, 286 ads were analyzed. The study revealed that (i) there is no standard terminology for the role, (ii) the market demands a wide range of skills, an average of 11.4 per posting, and (iii) formal education and on-site work are highly valued.

The variety of job titles suggests diverse expectations for the software architect role and varying hiring requirements, including specific technologies and skills. While a few postings explicitly required certifications, most highlighted them as desirable. The study also found that higher salaries were often linked to formal degrees and on-site availability, reinforcing the professional value of this role in the Brazilian market.

It is important to note that these findings reflect a specific moment in the Brazilian job market. Broader conclusions should be cautiously drawn, as market dynamics, technological trends, and hiring practices can evolve over time.

This research aimed to provide initial insights. Future studies should expand the dataset, explore additional variables like company domain and job location, and analyze the presence of soft skills. Cross-referencing this data with studies on the state of practice for software architects in Brazil would also be valuable.

ARTIFACT AVAILABILITY

Data is available at https://doi.org/10.5281/zenodo.15863833.

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