



Software engineering methodologies in programming companies in Albania

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Abstract

Single software development is a systematic engineering process that requires the selection and application of appropriate software development methodologies to ensure project success. Software Engineering (SE) necessitates a set of principles and tools to facilitate the production of high-quality software products. With the continuous evolution of information technologies and software engineering, the development and application methodologies for the Albanian market have also advanced. Our company places significant emphasis on investing in people, infrastructure, methodologies, and modern tools. In recent years, there has been a notable trend toward the adoption of agile methodologies, resulting in a surge in its utilization compared to traditional approaches. This study aims to examine the existing methodologies employed by software companies in Albania and assess their readiness for transitioning to agile methodologies.

1. Introduction

In the fast-paced and ever-evolving world of software development, selecting and implementing effective methodologies is crucial for project success. The right methodology can contribute to the project management, the improvement of the high efficiency of the software and of the software with the quality within the specified time limits. There are a number of different methodologies, each of which offers a different approach to project management, such as Waterfall, Prototypes, XP, Agile, Lean and DevOps. These team methodologies in their principles, processes and organization as they organize, making them different for all types of projects and organizational contexts.

One of the challenges in his challenges is the potential for the project. Incomplete requests or in the change of a reason why they are not designed. This happens when the project faces the challenge due to insufficient specifications or its changes, leading to delays, becoming such a project, which should be the project's project. According to Yong there are various factors contributing to the failure of software development projects [1]:

- Accuracy and change of requests in later stages increasing time and cost. Formalized requirements gathering and subject matter experts can help minimize this issue.
- Feature creep, where additional functionality keeps getting added, delays product release and can result in insufficient testing. Frequent release development methodologies and test-driven development can mitigate this problem.
- Underestimating the required labor, especially when key components are unknown. Starting small and prototyping can help manage this.
- Lack of funding.
- Programmers with low technical skills who take time and learn from mistakes or experience
- Non effective marketing.

The demand for software in Albania has grown significantly, leading to the increase of software companies in Albania. Professionals in these companies are always in demand. Although the number of students who graduate from high school has decreased in the last 5 years, many students choose to study computer science and information technology. Software development companies in Albania are becoming more international and the market has demands for professionals. All these require good knowledge of software engineering and its methodologies. This study focuses on highlighting the methodologies used by Albanian development companies to better understand the requirements of these companies and the improvements that can be made in the treatment of software engineering subjects at the university. Although we are in the case of Albania, the findings of this study and the recommendations may have a greater impact on the software development communities and future professionals. Additionally, the findings and recommendations are subject to the availability and accuracy of data collected during the research process.

A questionnaire survey was conducted to collect quantitative data regarding the software engineering methodologies implemented in the related programming companies. The questionnaire included questions related to the primary methodology used, adaptations made, communication and collaboration practices, quality assurance measures, user involvement, and key performance metrics. The survey was administered to relevant stakeholders within the respective programming companies to obtain their perspectives and insights. To adapt to the significant economic changes experienced by Albania in the past decade, universities and other educational institutions must proactively realign their study programs with the emerging needs that have arisen. Both public and private universities offer computer science programs, which encompass various subjects, including software engineering. The curriculum for these programs needs to be aligned with the latest literature, considering the accreditation requirements set by the Albanian Agency for the Accreditation of Higher Education (ASCAL) over the past five years.

In the past, software engineering syllabi primarily focused on traditional software development models such as waterfall, prototype, concurrent, and component-based models. However, since the introduction of the Agile Manifesto in 2001, universities have started incorporating newer models into their curriculum. The pace of the latest was slow, quite often limited to a mere mentioning of the concepts without aiming concrete outputs in agile working skills [2]. This study also offers insights in this regard. Based on how the software development methodologies are currently aligned in the Albanian software industry, education institutions may revise the related courses programs to better aid on a quicker integration of the students /t trainees in the labor market. The rest of the paper is organized as follows. Section 2 highlights various insights related to the Albanian software development landscape. Section 3 gives a short overview of software engineering methodologies and their development over the years. Section 4 details our research methodology giving details about the questionnaire that was conducted and the participants profiles. Section 5 points out the results of our study. Section 5 concludes the paper giving also recommendations based on our findings.

2. Albanian software development landscape

The number of Albanian programming companies is increasing consistently. In 2007 there were only 7 software development companies which mostly dealt with the local private market and the public sector (through various e-Government services) [3].

Their number has currently increased to more than 50 and this has been immediately reflected to an increased interest of Albanian students to pursue the profession of software developer.

According to INSTAT and the Ministry of Education and Science, the interest of students for engineering, computer science and economic degrees is rigorously increasing even though the general number of students is decreasing (Figure 1).

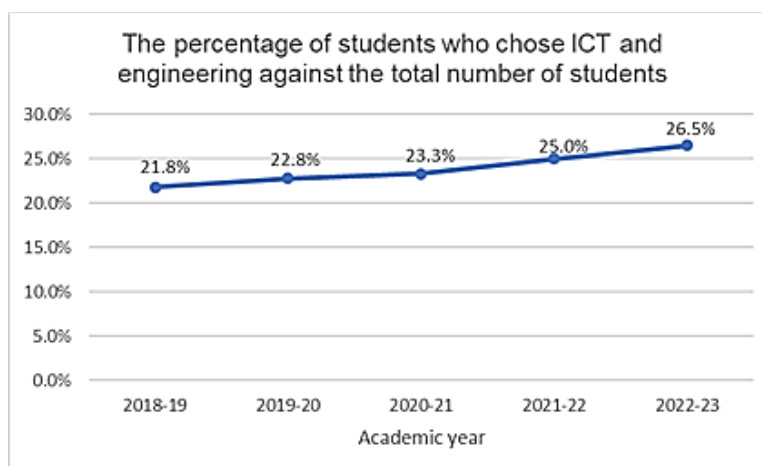


Figure 1. Students of ICT and engineering against the total number of students [4].

According to a 2016 study, the weight of ICT is at 3.3 percent of GDP, this weight depends on the weak domestic demand for such services [5].

Due to the limited cooperation with industry, Albanian universities have also not been able to keep up to date with the needs of the industry in terms of knowledge and skills. Curricula are often outdated, and textbook based. A company director stated that finding skilled IT graduates is very difficult despite the universities producing an overall of roughly 10,000 graduates a year. Equipment and software are also lacking. There are industry training programs held by Cisco and Microsoft aimed at skilling graduates in their software programs, but there is certainly scope for more co-op programs. Albania has the potential to become an ICT start-up hub due to its young, multilingual population and low capital requirements for setting up ICT businesses, however universities in Albania have limited incubation and entrepreneurship activities [6].

In 2023, there has been a significant increase in the percentage of GDP contributed by the industry sector (21.56%) and the services sector (43.82%) compared to the previous year's [7]. This shift is accompanied by a growing interest among young individuals to pursue studies and careers in the field of information technology.

The various university degrees of computer science education in Albania encompass the field of software engineering, which is an integral subject within these programs. Albanian universities, as the main source of software engineering experts, should stay aligned with technological advancements and market demands to produce well-prepared graduates [8].

To enhance the effectiveness of software engineering education at universities or higher education institutions (HEIs), it is crucial to incorporate modern methodologies like Scrum [9]. Even though the level of adoption of it needs to be investigated (see below), being acquainted with various modern software methodologies better prepares the prospective software engineers to be integrated in diverse teams. This, in turn, contributes to an elevated student employability, improved industry competitiveness, and enhanced reputation for the HEI.

2.1. Software engineering methodologies

SE is based on several models of software development. For a very long time, the most used model was the waterfall model. Traditional software development would be divided into linear and evolutionary, but starting from the year 2001, in the conference attended by 17 important representatives of software development, agile methods will be presented. Below is a longstanding illustration depicting the progression of software development over the years [10].



Figure 2. Software development over the years.

According to Jiujiu Yu, software development models are divided into three main phases [11]:

1. Structured programming models (Waterfall Model): Sequential structured programming model with a linear sequence of development stages. Lack of flexibility can impact efficiency when facing obstacles.
2. Progressive Development Models (Prototype, Spiral, Incremental, RUP, XP models, etc.): Object-oriented models for evolving software with unclear or limited initial requirements. Iterative process, but incomplete requirements pose design and integrity challenges.
3. Component Development Models: Focus on overall software structure using component-based assembly.

Enables efficient design, development, and maintenance. New models may emerge to improve software quality.

Waterfall Model and the Spiral Model are both software development life cycle models, which indicates that there is a specific flow and set of rules to follow when it comes to development. While the Agile-based methods incorporate the idea of embracing change, empowering teams to accept that their development plan will have to change often [12]. SCRUM is a widely adopted example of agile methodologies. Its principles involve [13]:

- All the team members are involved in project development.
- The retrospective phase increases the visibility of the process, hence guarantying the traceability of the whole development process.
- Knowledge islands are avoided due to all of the development team members being part of the various

development phases.

The implementation of Scrum can bring great benefits, but its success will depend on the conduction of cultural change strategy within the organization and the commitment of the entire team [14].

3. Research methodology

To investigate the Software Engineering Methodologies used in various programming companies in Albania, an online survey was conducted. The electronic questionnaire was distributed through electronic communication platforms in the period of June 17-28, 2023, in various IT companies based in Albania. The included questions surveyed about the concrete methodology used in the respective companies, and factors that might have influenced its adoption.

3.1. Participants profiles

The questionnaire was completed by a total of 31 participants actively engaged in various aspects of software development processes within software houses, telecommunication companies, or banks. Predominantly, the participants held roles as software developers, while others occupied a diverse range of positions across the software industry, encompassing managerial roles and various other job functions (Table 1 and Table 2). It is noteworthy to mention that the survey specifically targeted businesses operating in the Albanian area, with a focus on those boasting a workforce exceeding 50 employees and demonstrating a track record of success.

Table 1. Participant profiles.

Variables		Frequency	Percentage
Work Experience	< 1 year	2	6%
	1 - 5 years	22	71%
	6 - 10 years	3	10%
	> 10 years	4	13%
Position	Software Developer	15	48%
	QA Engineer	1	3%
	DevOps Engineer	2	6%
	System Administrator	3	10%
	Business Analyst	3	10%
	Project Manager / Product Owner	2	6%
	Manager	5	16%

Most of the participants have been working for the respective companies for enough time that allows a clear view of the processes followed by them, the various adopting factors, and the resulting outcomes.

Table 2. Related companies' profiles.

Variables		Frequency	Percentage
Company size	1 - 20 employees	7	30%
	21 - 50 employees	3	13%
	51 - 100 employees	4	17%
	> 100 employees	9	39%
Industries	Education	2	9%
	Software Development	15	65%
	Finance	3	13%
	Telecommunications	3	13%

3.2. Questionnaire questions

Other than the segmenting (profiling) questions, our questionnaire asked the participants about:

- The specific methodology used by their company.
- Various factors that influenced the adoption of the methodology.
- Insights of the outcomes of the chosen methodology.
- The communication process used in their companies.
- Quality assurance practices in their companies.
- Clients/users inclusion in the software processes.

4. Results

Table 3 details the insights of the used methodology by the participants' companies including the years of adoption for each methodology. Most participants possess considerable industry experience, which enables them to make informed assessments of the benefits and challenges associated with software engineering methodologies. Approximately 70% of the respondents are software engineers, while the remaining participants are IT experts.

The average duration of employment for the interviewed individuals within their respective companies exceeded four years. Due to the growing abundance of offerings in the market by developing companies and technological advancements in Albania, the forefront of contemporary technologies prevails. When considering the methodology employed, most companies have chosen the agile methodology (Figure 3).

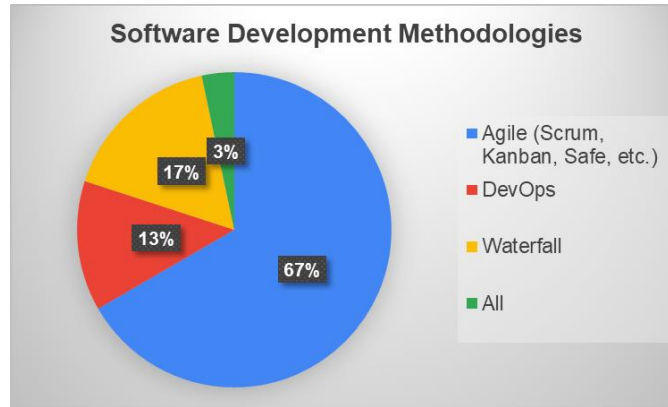


Figure 3. Methodology selection factors.

Table 3. Mythology of software engineering used in Albania.

Methodology / Adoption Time	Number of companies	Percentage (%)
Agile (Scrum, Kanban, etc.)	20	66.7
< 1 year	1	5.0
1-3 years	6	30.0
4-5 years	7	35.0
> 5 years	6	30.0
Waterfall	5	16.7
1-3 years	1	20.0
> 5 years	4	80.0
DevOps	4	13.3
< 1 year	1	25.0
3-5 years	3	75.0
Hybrid / Various	1	3.3
> 5 years	1	100.0
Grand Total	30	

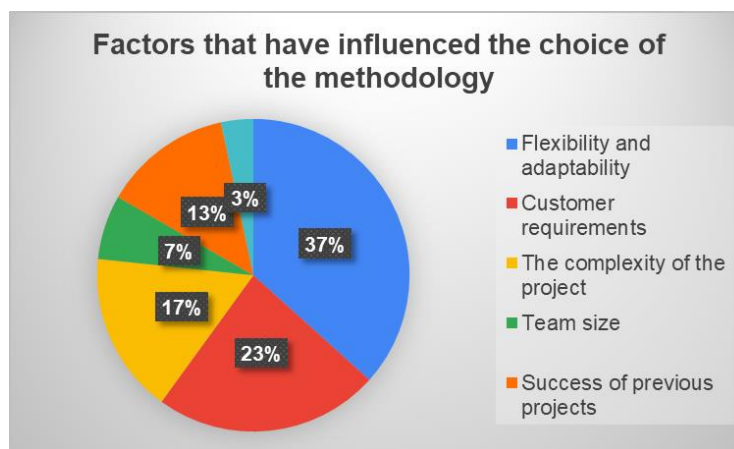


Figure 4. Software Engineering methodologies used in Albania.

The selection of software engineering methodologies has been influenced by various factors, as illustrated in Figure 4. Notably, the advantages associated with flexibility and adaptability have emerged as prominent influences in favor of adopting agile methodologies.

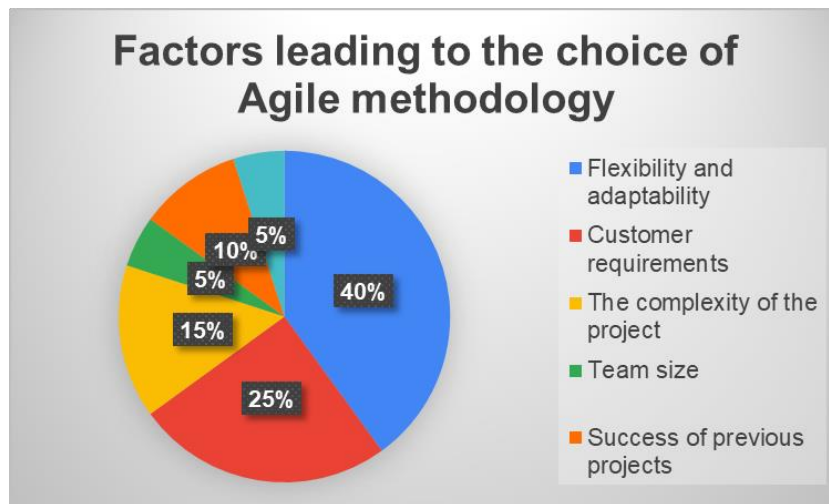


Figure 5. Methodology selection factors.

Figure 5 shows the distribution of factors for the adoption of agile methodologies. Flexibility and adaptability still play a key role on their adoption (40%) while the Customer requirements have been reported to play a role in the adoption by 25% of the respondents. Flexibility and adaptability are inherent prerequisites, as companies universally seek competitiveness in the market. Notably, an observed trend pertains to the alignment with customer demands, predominantly driven by Albanian programming firms continually expanding their service offerings in the international market.

Upon examining the duration of implementation for each methodology, it becomes evident that companies employing the waterfall model have been utilizing it for more than five years, with banking and telecommunication systems emerging as prominent adopters. Additionally, the latest sectors have begun incorporating agile methods, or have imminent plans to do so. The presence of a retrospective or analysis phase after project completion is a prevalent practice in companies. It is noteworthy that a significant majority, approximately 75.86%, consistently conduct retrospectives to assess the completed project. Additionally, around 23.34% of companies engage in retrospective activities on a periodic basis, indicating that they conduct such analyses intermittently.

5. Conclusion and recommendations

Our investigation into the software development landscape in Albania illuminates the critical dimensions that contribute to the success of computer applications. The multifaceted evaluation of factors such as functionality, user experience, reliability, security, integration, scalability, performance, and cost-effectiveness underscore the complexity inherent in this field. The strategic alignment of specific applications with industry requirements emerges as a key consideration in fostering success. The prominence of software engineering across diverse industries attests to its indispensable role, with an escalating demand for swift and effective solutions to software application challenges. The thriving labor market, characterized by a multitude of programming companies and high demand for skilled professionals, reflects the industry's robustness.

Our findings underscore a prevalent preference for the agile methodology among Albanian companies, while the extended use of the waterfall model in banking and telecommunication sectors aligns with global trends. Notably, retrospective analyses, a hallmark of agile processes, are consistently adopted by approximately 75.86% of companies, with an additional 23.34% conducting them periodically. This commitment to continuous improvement is a noteworthy feature of the software development landscape in Albania. A growing enthusiasm among students in computer science studies, specifically those leading to software engineering/software developer careers, signals a potential talent pool for the industry. Recognizing universities as primary suppliers of software engineers, it becomes imperative for these institutions to align their programs with the evolving technological landscape in software engineering.

The pervasive incorporation of agile methodologies, holding the largest market share in Albania, points to a compelling need for educational institutions to address alignment gaps in software engineering programs. This strategic alignment not only serves the industry's demand for skilled professionals but also aims to significantly reduce the onboarding time for junior developers, allowing them to navigate the non-code related aspects of the software industry more effectively. In summary, our study provides a comprehensive overview of the software development landscape in Albania, emphasizing the nuanced interplay between industry practices, educational programs, and emerging trends. As we acknowledge the study's limitations, including the modest sample size, we envision these insights as catalysts for future research endeavors aimed at further refining our understanding of the dynamic and evolving nature of software engineering in the Albanian context.

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Author contributions

Blerta Leka: Conceptualization, Methodology, Writing-Original draft preparation, Data processing, questionnaire.
Klesti Hoxha: Data curation, Visualization, Writing-Reviewing and Editing.

Conflicts of interest

The authors declare no conflicts of interest.

References

1. Young, D. (2013). *Software Development Methodologies*.
2. Sommerville, I. (2020). *Engineering software products*, 355. London: Pearson.
3. Dalaci, A., & Kapcari, E. (2007). Software development techniques in Albanian private software companies. 7th Workshop Software Engineering Education and Reverse Engineering.
4. Ktona, A., Karapici, A., Shehu, E., Batalli, I. Dragoshi, F. (2016) The contribution of ICT sector in the national economy, *Policy and Economics for Sustainable Agricultural and Rural Development*, 109-119.
5. INSTAT (2023) Education enrolment statistics. <https://www.instat.gov.al/media/11613/press-release-statistika-te-regjistrimeve-2022-23.pdf>
6. Hach, K. & Trenkmann, E. (2019). Albania economy briefing: Science, technology, R&D and innovation in Albania (or the lack thereof) *Weekly Briefing*, 32(2).
7. Statista, (2023). Albania: Distribution of employment by economic sector from 2011 to 2021, <https://www.statista.com/statistics/454897/employment-by-economic-sector-in-albania/>
8. Leka, B., Baraku, B. & Mulliri, J. (2023). An overview of Software Engineering in Albania. *Scientific Journal of Professional Studies*, 5(1), 125-132.
9. Saeedi, K., & Visvizi, A. (2021). Software development methodologies, HEIs, and the digital economy. *Education sciences*, 11(2), 73. <https://doi.org/10.3390/educsci11020073>
10. Henseler, T. (2018). Timeline of Software Development Methodologies, <https://www.hexacta.com/timeline-of-software-development-methodologies/>
11. Yu, J. (2018). Research process on software development model. In *IOP Conference Series: Materials Science and Engineering*, 394(3), 032045. <https://doi.org/10.1088/1757-899X/394/3/032045>
12. Risener, K. E. (2022). A study of software development methodologies. [Computer Science and Computer Engineering Undergraduate Honors Theses, University of Arkansas].
13. Liu, Z., Li, F., Wu, C., Liu, H., & Zhang, J. (2018). A Study of Agile Methodology–Scrum for Cockpit Simulation. In *2018 3rd International Conference on Modelling, Simulation and Applied Mathematics (MSAM 2018)*, 62-65. Atlantis Press.
14. Nishijima, R. T., & Dos Santos, J. G. (2013). The challenge of implementing scrum agile methodology in a traditional development environment. *International Journal of Computers & Technology*, 5(2), 98-108.



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