

THE INVESTMENT FIELD OF COMPANIES WITHIN SOFTWARE PROJECTS

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Abstract

Software startups are new corporations with no operating history and are quick in producing newfangled technologies. Startup companies operate in extremely unsure conditions, facing aggressive markets with few resources at their disposal. These conditions in which most startups operate create many challenges for software development activities. This study aims to structure and analyze the literature on software development in startup corporations, deciding thereby the potential for technology transfer and distinguishing software development work practices reported by employees, managers, and recruiters. We analyzed the investment field of companies within software projects by obtaining their classification, ranking the principal activity fields, the main technologies in the most important projects, and the turnover and income summary. A complete study of how software development startups and companies work in a world dictated by investment is mapped and synthesized in the current article. From the reviewed primary studies, multiple engineering corporations were classified and analyzed for the present research paper. This study provides a clear vision of what it means to invest in a startup or company, during a global and epidemic crisis. The results indicate that startups choose and adapt their software engineering work practices with great regard to the constraints of the startup context.

Keywords: software project management, technology companies, software engineering, startups, investing strategies, from theory to reality

JEL Classification: L86, D25, E22, F21

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1. Introduction

In recent years, we have observed a constant and substantial increase in the number of businesses called startups. The procedure by which a company moves from theory to reality is named a “startup”. Being a business in the first stage of its operations, it tries to discover a match between the product and the market, by adapting to the market, establishing and classifying customers by their needs and desires, and discovering the various characteristics of the product. Although most of the time everything is set up properly, and the business seems to have a chance to evolve from the initial phase, 90% of them disappear before turning 3 years old. According to a study conducted by National Business Capital [1], it is estimated that approximately only 80% of startups survive their first year of business. This number only decreases with time to 70% for the second year, 50% for the fifth year, with only 30% managing to make it past their tenth year. The most common cause is not validating the idea alongside actual clients or potential clients, to create a product intended to bring something completely new to the customer or to significantly improve what currently exists. Thus, due to low earnings or high costs, most startups do not have long-term success.

Previous studies show the evolution of these companies over time globally, among the best-known examples of great ideas of some young undergraduates that have led to outstanding companies, including Facebook, Uber, Airbnb, LinkedIn, Spotify, Pinterest, and Instagram [2,3]. Since the beginning of the decade, in Romania, there has been considerable public interest in promoting and funding startups that attempt to bring innovation, original products, and to seek, develop, and validate a scalable business model. To identify the cause of the remarkable progress of this type of organization and to find out the reason why more and more young students are among the financiers of these companies, this paper aims to explore what a startup really is for scholars at the beginning of the road, who do not have plenty entrepreneurial experience but with enthusiasm and overflowing passion for novelty. Furthermore, we have the objective to encourage readers to have the audacity to put their own ideas into practice, through the example of other successful young people across our country.

2. Background and Related Work

2.1. Background

In 2018, the news of the year in the national IT industry came from a start-up, and not from a well-known company. UiPath, now the world’s leading Robotic Process Automation (RPA) software corporation has become the first Romanian unicorn (start-up with a valuation exceeding \$1 billion) in the investment field after attracting \$153 million in funding. Founded in 2005 in Bucharest by Daniel Dines and Marius Tircă, with a team of only 10 people, the RPA platform monitors user activity to automate repetitive processes performed by employees, including customer relationship management and enterprise resource planning (ERP) software. According to the CEO of UiPath, Daniel Dines, the drivers of such growth are not technology or business strategies but building an organization of people who believe in what they do and treat each other equally. He also mentions that other ingredients of success are represented by setting a global vision, bringing the best people, and not pursuing profit. To Dines, looking at some solid principles and following

them has been more important than doing all sorts of tactics to make money. That is the reason why the entrepreneur advises new generations to become better and better, build a bigger culture, and have a well-defined idea when they decide to start their own company [4].

Bitdefender was founded in Bucharest by two mathematicians and researchers, Măriuca and Florin Talpeș. The revolution of December 1989 made the two doubt the safety of their jobs, so they decided to resign and start their own business. Thus, in 1990, Softwin was born, an IT company started with the idea of providing services to companies in Western Europe, and the first customers came from France and Germany. Subsequently, they developed their own products, including Antivirus Expert (AVX), which was rebranded as Bitdefender in 2001 [5]. At present, the company is one of the most innovative IT security software providers in the world. With more than 1600 employees and a team of more than 800 engineers and researchers, the business is valued at almost \$2 billion. Florin Talpeș claims that what makes a startup successful is a revolutionary idea, exposed courageously and meant to generate a high degree of innovation [5].

The most famous online store in Romania, eMAG, was founded in 2001 as a distributor of computer systems and office products, being founded by Radu Apostolescu, Dan Teodosescu, and Bogdan Vlad. In 2009, 51% of the company's shares were bought by Asesoft Distribution, and the general manager of eMAG became Iulian Stanciu [6]. Today, the company under new CEO, Tudor Manea, deals with the online sale of IT equipment and components, electronics, home appliances, personal care items, automotive products, sporting goods, books, home and garden products, pet shops, children's items, and more [7]. Currently, initial founder Radu Apostolescu and his wife, Monica, invest in their ophthalmology clinic that has already gained its reputation, Clario. They say that confidence in what you do, desire to learn and act, curiosity, and courage to change are the essential elements to developing a profitable business [8].

Given those cases of prosperous and rewarding corporations, the paragraphs that are going to be talked through the section 4 below have the goal to encourage people to start their own companies, through the power of the example of young students who have embarked almost on their own on the difficult and surprising road of the investment world.

2.2. Related Work

Ross et. al. [9] addresses the subject of investment within software projects related to the IT field, putting emphasis on explaining, characterizing, and dividing the IT-Investment Framework. An essential step to reach these goals was to undergo a study based on interviewing business and IT executives at over 30 US and European companies. In their study. The study led to the conclusion that investments tend to be based on two main factors, namely strategic objectives, and technology scope. The first aims to make compromises between short-term profitability and long-term growth, whilst the latter aims to highlight the main differences between the shared infrastructure and potential business solutions. Based on these observations, they conclude that companies should focus on investing in four types of investment, specifically transformation (for changing an inadequate infrastructure related to the desired business model), renewal (aimed at reducing overall costs or improving the quality of IT services), process improvement (aimed at improving

the operational performance), and experiments (finding new technologies or ideas that could benefit products or business models).

Paternoster et al. [10] describe the methodologies implemented to control the development activities of startups, whilst also performing a systematic mapping study (SMS) aimed at dealing with wide and poorly defined areas. This option was chosen despite a systematic literature review (SLR) to answer the overall research question: “*What is the state-of-art in the literature pertaining to software engineering in startups?*”. The SMS process follows a series of simple steps, starting with the definition of research questions, continuing with searching between all papers and screening the relevant ones, keywording, data extraction, mapping, and concluding with synthesis and the classification of work practices.

Berghout et al. [11] discuss the impact certain business cases can have on IT investment decisions and analyze this impact by looking at municipal e-government projects. They start with a theoretical foundation that is used to describe certain methodologies used in different business cases which are later used to propose several hypotheses that are used to predict how certain elements of a business case might affect the initial cost estimation of an investment. Based on these hypotheses, they then construct a theoretical model aimed at identifying the influence of these elements. An empirical test is performed on the model by looking at similar business cases of municipal e-government projects and how the initial cost estimates were affected. Based on the results they obtain, a framework is derived, which can be used to develop IT business cases based on certain components. Lastly, a regression analysis is performed to validate the hypotheses, as well as content analysis to determine whether a certain case contains certain elements from the proposed developmental framework.

3. Market Overview

Before diving more in-depth and starting to discuss our analysis and the methods that we used to examine the investment field within software projects and the newly founded startups we came across during our study, an overview of the current market of project management software is needed.

A tool that is used a lot, regardless of the industry, when developing a certain project is a Project Management Software (PMS). Whilst this tool is mostly aimed at project managers, it can also be used by other interested parties, such as stakeholders or clients. It provides different functionalities that aid with developing and maintaining a project, such as planning and scheduling, the management of different resources and how they change over time, up-to-date documentation, and quality management, whilst also being able to be used as an organizational framework.

In terms of net worth, the PMS market was estimated at a value of ~\$5.4 billion in 2020 [12], a value which is expected to further grow and reach a value of ~\$9.8 billion by 2026. This is mainly because most companies nowadays continue to grow, thus a complex and comprehensive solution, that can manage the portfolio of projects they might have, is required.

This gave PMS the opportunity to develop into an essential component of businesses due to the fast changes that occurred across every industry. Since most software offers

functionalities for managing resources as well as real-time updates regardless of time and place, it can be seen as a good tool to be used for reducing overall risks as well as costs associated with most projects. All these factors combined are predicted to increase the speed at which the PMS market continues to develop.

However, the main issue associated with PMS is that most software frameworks present a certain complexity and require a learning curve. This coupled with the fact that different frameworks can diverge in different directions, and the costs of setting up such a framework in a large organization, are the main factors considered to be preventing most companies, as well as clients from investing a lot of resources into PMS.

PMS has additionally advanced into a method for new product development, attributable to the rise of the Internet of Things (IoT) and the reception of Agile New Product Development (NPD), which has now converged with Project Management Software and resulted in new firms being born, such as GenSight, UMT360 and Decision Lens in the field of enterprise product manufacturing.

Another factor to be considered in the current market for PMS is held by the ongoing COVID-19 pandemic, which led to a huge impact on many businesses. Due to different requirements, and the fact that most of the world was forced to now work in an online environment, the dependency on a computerized solution that can keep track of projects increased even more and is likely to keep so even after post-pandemic.

4. Proposed approach

4.1. Survey Form

Surveys are one of the most essential ways to gather the data that organizations need. Done right, surveys can lessen risks, give insights about employees, clients, and management, and even adjust PR, advertising, and different communications programs. Done inadequately, they can derail strategies and generate misguided marketing, communications plans, and customer service.

Our target group consists of employers, entrepreneurs, or acquaintances that have/had a startup. Having mentioned that, the survey that we proposed has the main target to visualize what are the current tendencies when it comes to investing in a new business, what area attracts new investors, how entrepreneurs manage their business, the impact of project software on a line of work and to eventually forecast a possible area/idea of investment in the future by analyzing the extracted data and trying to find relevant patterns.

When requesting data, we also took into consideration the main technologies used in the most important projects ongoing inside the firm, to make a correlation between the current clients' demands and the overall propensity towards technology or another in that line of work. It's important to know how different technology is used and what purpose it serves to choose the right fit when planning a new project idea. Following this, we aimed to analyze the tools that are brought together and how they assist to solve various tasks and specific problems, reduce excess time, and help to interact and exchange information.

Besides this data, we figured that knowing the available budget for a project might allow us to have a better view of how the business owner can concentrate on cash flow, reducing

costs, improving profits, and increasing returns on investment. After all, budgeting is the basis for all business success. Besides, we concluded that by having the ability to oversee a firm's budget for various projects, together with the access to both planning and control of the finances, we would be able to have a better understanding of the type of clients a firm has or even what needs a particular client has.

Studies [13] have shown that understanding a client's budget and budget-related issues provide benefits by being able to tailor and present solutions in a way that meets a client's wants and needs, as well as reducing a lot of time and resources. It is also crucial that the budget planning is done appropriately, in order to ensure that throughout the duration of the project, the budget isn't exceeded.

We concluded the survey by asking about the overall impact that the pandemic had on the investment plan of the company, whether it was good or bad. We considered this question relevant, keeping in mind that the number of working business owners plummeted from 15.0 million in February 2020 to 11.7 million in April 2020 [14] because of COVID-19 health and economic driven demand shifts, leading to a loss of 29% from the total hours worked by all business owners, but at the same time big companies like Microsoft, Amazon.com Inc, and Alphabet Inc registered increases in share prices and were expected to exceed their sales estimates for the quarter [15].

4.2. Interviews with students

The road to success may be different and difficult from one entrepreneur to another, but all of them certainly recognize the opportunities that arise from one day to the next. According to data provided by the European Commission [16], the founder of a startup is male (82.8%), has a university degree (84.8%), is currently 38 years old, and has been 35 years since he founded the business. This highlights the fact that most founders have skills acquired through education in university (84.8%), practical knowledge, and experience. This section tells the stories of several students at the Politehnica University of Bucharest, Faculty of Automatic Control and Computer Science, having the purpose to show that "exceptions" exist: our interviewed colleagues are between 20 and 23 years old and, although they are at the beginning of the road to entrepreneurship, they are overflowing with enthusiasm, passion, and ambition.

Right in the middle of the pandemics, two freshmen come up with the educational idea of creating a platform that helps people understand the basic principles of cybersecurity by playing games: which links are safe to be clicked on, what kind of passwords we should use, why we should not download any file from the Internet. Having the goal to save corporations from data breaches and security issues in their minds, they participate in Innovation Labs 2020 [17], where they present the concepts of their idea, obtaining support from mentors and experienced businessmen. The path was clear: from idea to notion, to prototype, and finally to implementation. But unfortunately, due to other priorities in their lives, the students stopped following their dream temporarily. Cheerfully, though, they want to continue working on this solution next year, when they think they will have more free time to focus on their entrepreneurial careers.

In September 2020, an enthusiastic colleague dared to build up together a group of people who found his startup idea innovative: a marketplace concentrated on organic products,

between local producers and consumers. This thing came to his mind at the moment when he realized that healthy food is becoming rarer and rarer these days. With a team of supportive and intelligent people, the student presents the concept within an entrepreneurship program, called BrightHub, which took three months. Their first intention was to finance the project from their personal funds, attracting ulteriorly more investors. But understanding that the money needed could be more than they had, they decided to postpone the implementation for a few years to gain more experience, vision, and, not lastly, the capital. Asked if he would change a thing in the past process, the student sustains that he would improve the way the team was organized (from weekly meetings to effective discipline of members), the set of goals, and his attitude towards having his idea rejected by important investors. He also believes that a design expert would have brought a huge benefit to their plan.

In the same year, another intelligent man came up with the idea of consultancy and development tools application during a college programming course. Unlike the above examples, this man financed his corporation from his own funds. Recently, however, he has gained funding from top investors. Even if the whole startup is still at the beginning, he diligently believes that his idea will work, but he still cannot be sure in what phase the company will be in 5 years. The only thing that the young entrepreneur would change in this whole story is that they would turn to specialists from an early stage, even if they are expensive, and at the start, the budget is a problem. This model has the role of showing the fierce importance brought by the interesting way of teaching a college course by an inspirational teacher.

In June 2021, after two failed startups created in high school, a second-year student comes up with a new and braver view, due to his need to achieve new and interesting things that will also bring clear benefits for the future. At first, he presented his idea in a contest, and later at Innovation Labs. Afterward, he and his teammates started financing, but they soon received funding from some businessmen (even had important meetings with top investors like Andrei Pitiş, CEO & Founder of Simple Capital). Even if he believes that the pandemics can be negative to some companies, to his startup it wasn't the case, as his idea was a web portal. He also thinks that the future is bright for them if they find enough good investors.

Innovation Labs 2020 signifies the beginning of the road to success for many of our students. Wanting to have their own organization and to work for themselves, but not for other managers, a group of four programming enthusiasts thought of an idea to help agriculturists, who asked for something new-fashioned and more innovative to ease their labor. From here, based on their preferences and needs, they developed the concept step by step. After this long product, they came up with a functional product that could be tested and approved by users. Their project did not need initial funding, they incurred costs until the actual launch of the product. The idea turned into a tangible product, it brought them an award in the InnovationLabs 2020 Demo Day Final, namely Best Potential Award Team. The boys believe that their project was helped by the pandemic, claiming that they brought digitization to a time when all areas were in dire need of it. He considers that the pandemic was an unusually positive factor for them and that it helped them to expose the usefulness of the product much better. Their idea is for the future and the team believes that in 3-5 years they will get more customers, i.e., agricultural cooperatives that will use their application daily to digitize the production planning process. At the same time, the media appearances gave them a significant boost: on the *Telejurnal Matinal* on national television,

then they gave an interview for "Agriculture of tomorrow", for the entrepreneurship website start-up.ro. The most important television appearance, however, was on the show "I like IT" on PRO TV.

In March 2020, another team's project begins with the participation in the Innovation Labs pre-accelerator. The interviewed young woman says that she has always wanted, through the knowledge and skills acquired over time in school and college, to succeed in creating with her colleagues a solution that will really help and bring a change for the better in society. Together they created various projects, sketches, and prototypes with which they participated in a multitude of national and international competitions, but, after the completion of the competitions, our projects remained only at the idea stage. That is the reason they decided to start our own business, to identify the real needs of our customers and to take the project to a final stage, widely used.

The idea started from the identification of some problems reported by their current partners: the lack of a digitized and autonomous system for detecting the profile of truck tires. They went through several brainstorming sessions and decided what technical solutions to design and test, especially considering the optimal functionality conditions for end-users. It helped them a lot in this process of moving from idea to practice and using a Lean Business Canvas [18], with the help of which they determined what their first goals are. For a start, they held a pitch about their concept at the Innovation Labs 2020 event, during which they had the opportunity to present the entire evolution, including in the grand final. Subsequent presentations were also at the Atos IT Challenge 2021 international competition, but also at the press conference that took place after winning the grand prize at this competition.

Since the founding of this project, they have had a large transport service company with us, as partners and future customers. They support the team with industry information and constant feedback in everything we do. At the same time, they brought funding to the project, after it became a research project within the Politehnica University of Bucharest. All the presentations went very well, and the constructive feedback they received each time helped them to evolve. Even their presentations have evolved over time, moving from concept to project evolution to the first live demos of the prototype. The results obtained from these presentations were the Best Smart Mobility award offered by OMV Petrom within Innovation Labs, respectively the 1st Prize at the Atos IT Challenge [19] competition. She believes that success was guaranteed by passion, dedication, and desire to make their solution constantly improve.

Chronologically, the company started almost simultaneously with the pandemic. This made the first part of the project's evolution a little difficult, due to the passage of our meetings in an exclusively online environment. But after a while, they adapted and turned this impediment into a solution to hear even more often with their mentors and partners. They were also affected by the pandemic when they tested the prototype in the field because they had to wait for certain periods of high infection in their area to pass. But they cannot say that the pandemic caused any failure, because, even during these delays, they worked remotely on other necessary functionalities.

They dream that the robot and the company's services can be available on most truck routes, both in Romania and in the rest of Europe. In the future, they want to enter partnerships with at least 3 transport companies, and each station to be used daily by over 100 trucks. At

the same time, it intends to impose a rigorous standard regarding road safety, offering its services to the local authorities that have the duty to periodically carry out legal checks.

Consequently, the young woman states that the TV appearances below helped a lot in the development of the company: the first of them was in the ZF IT Generation show, then they went live in the grand final Innovation Labs 2020, followed by the promotion of the project in an article from startup.ro. The great prize obtained at Atos IT Challenge also brought them a multitude of appearances in the national and international press (atos.net, digital-business.ro), but also in the press conference within PUB. On this occasion, they also appeared live on the show "In front of the nation", from the Antena 3 television station, and later they were congratulated in the grand finale of the Innovation Labs 2021. Finally, in the near future, a news article about their organization will be published by the Romanian Tech Startups Association.

5. Results

To realize an adequate and comparative analysis, we decided to interpret ten answers of the respondents of our Google Form, which had the goal to identify the important aspects of the investment field of companies in software projects from Romania. Moreover, to better understand the interests, needs, and desires of young entrepreneurs from Romania, we conducted eight interviews with students from the Politehnica University of Bucharest, Faculty of Automatic Control and Computer Science, who are currently running a startup business.

The first couple of questions were intended to establish a basis regarding the place where the company was founded, and the year it was founded. Given that all these companies could be considered startups, the place where they were founded is also where they would be conducting their business. Figures 1 and 2 show the answers received when asked these questions.

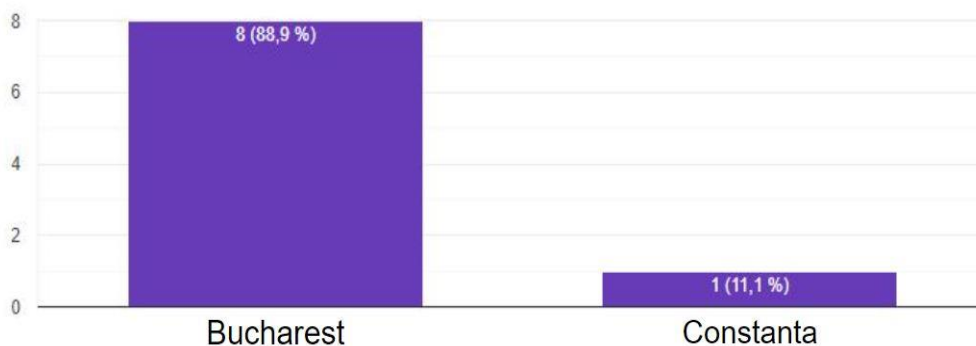


Figure 1 - The place where a corporation conducts its business

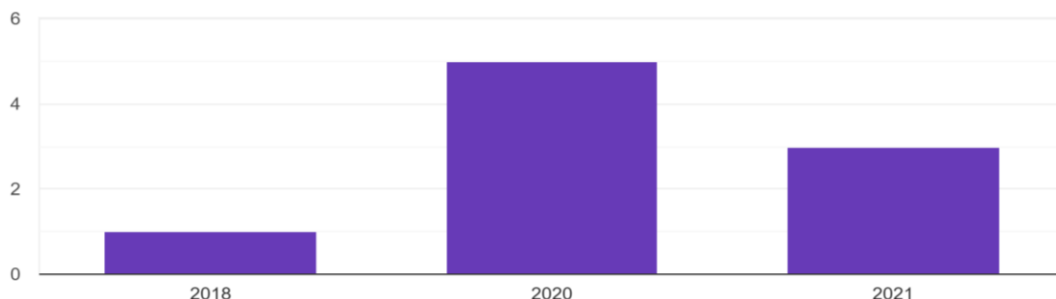


Figure 2 - The year when the company was founded

Based on the answers received to the first question we can conclude that most startups would pick a major city as a place for business. This could be because, while it is riskier to grow due to a lot of competition, the growth can also be faster due to the potential numerous clients and investors that could approach the business.

We also asked our respondents to provide a source for the information that is needed when trying to run a business. We tried to analyze how they keep up to date with the most current and accurate information, where they are taking their information from, and trying to see if there is a common ground between different companies. We let the respondents answer freely to this question and their answers are as follows:

- 44.45% revealed that their main source of information consists of dedicated websites for financial news
- 22.22% consider that their main source of information is represented by websites dedicated to startups ideas or projects involving new startups
- 11.11% use social media in order to keep up with the news
- 11.11% take their information and news from books or documentation
- 11.11% answered that their main source of information comes from following important entrepreneurs or a major media personality

Figure 3 shows some of the main fields of business of the interviewed companies.

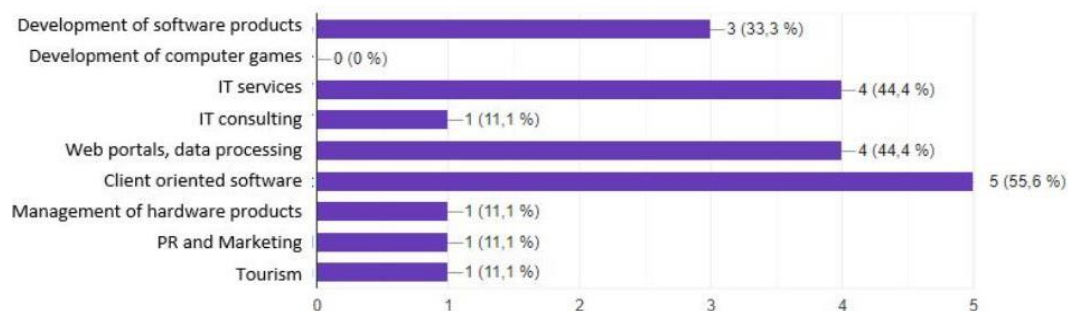


Figure 3 - The scope of the businesses

The investment field of the software projects created by the people who answered the questions is quite numerous, but most of them imply customer-oriented software:

- 55.6% - Client-oriented software
- 44.4% - IT Services and web portals, data processing, and web page administration
- 33.3% - Development of software products
- 11.1% - IT Consultancy, hardware product management, tourism, and PR & Digital marketing
- 0% - Development of computer games

Business intelligence technologies are software programs that help decision-makers - executives, managers, and analysts - make informed decisions. Here are some of the most important technologies, used by our respondents to increase the success of their companies:

When asked about the most used technologies when developing a project, the main choices were Python, C++, Blockchain, and Javascript, with others such as Golang, IPLD, and IPFS, following closely behind.

When asked about the average budget for their projects, most of the respondents wanted to keep this information private, while few of them declared that the average budget for a project is estimated at ~20.000€.

As was mentioned from the beginning, a study shows that 33% of startups fail in their first 3 years. The interviewed people, however, prove the opposite: 55.6% of the companies reported neither a gain nor a loss, while the remaining 44.4% registered considerable profit.

A 2021 economedia.ro article says that seven out of ten Romanian technology startups have been affected by the COVID-19 pandemics, according to a study initiated by the Romanian Tech Startups Association (RO TSA), in partnership with actors from the national start-up ecosystem [20].

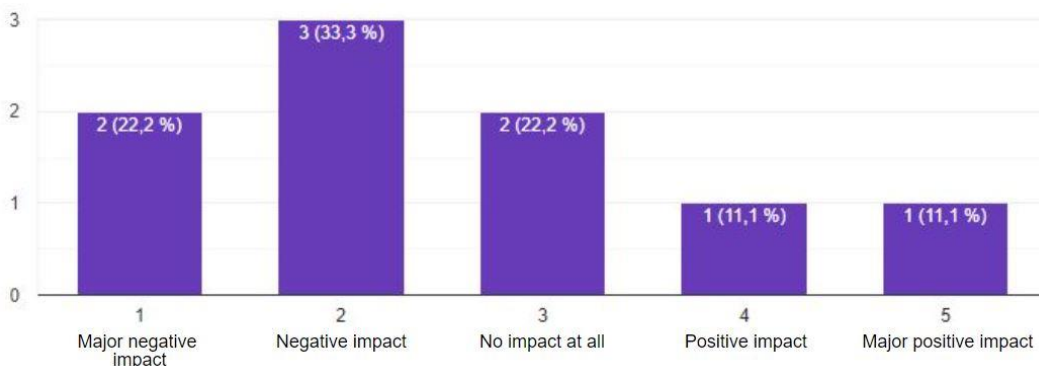


Figure 4 - COVID-19 impact on software projects

The form respondents have various opinions about how the disease influenced their projects:

- 33.3% - 2nd column - negative impact
- 22.2% - 1st column - major negative impact; 3rd column - no impact at all
- 11.1% - 4th column - positive impact; 5th column - major positive impact

6. Conclusion

This article shows that starting a business is a lot harder than most people think, but the steps of the process are similar: first, our young entrepreneurs identify an opportunity in an innovative concept; then, they suggest their ideas in front of top investors, mentors, and businessmen in competitions like Innovation Labs, Start-Up Nation or Business Plan Challenge. If their solutions present interest among entrepreneurs, they get motivation, financial support, and virtual promotion from the investors, thus obtaining a boost of energy and confidence in their project. Furthermore, the young people continue to invest time and resources in their startups, focusing on implementation and continuous development.

The reasons why they chose this path may vary: most students want to change something, making the world a better place, by improving their ideas, while some of them desire to become their own CEOs, work for themselves, and to guide other people, creating jobs for them. Another significant part of our colleagues aspires to turn their passion into profit, increase their earning potential, and become experts.

In conclusion, the current article has the objective to stimulate people to start their own business, as shown above, it offers several benefits. Each day at the office is motivating when you work for yourself and follow your passions and dreams. Moreover, you can achieve financial independence, control your lifestyle and your schedule and you'll soon become a professional in your own industry, as well as you will learn multiple skills: from HR decisions to inventory management to customer service. Starting your own business is compelling enough since each day provides new difficulties, fascinating chances, and the opportunity to pursue your passion. It certainly feels good to know that you've opted to take charge of your own destiny.

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