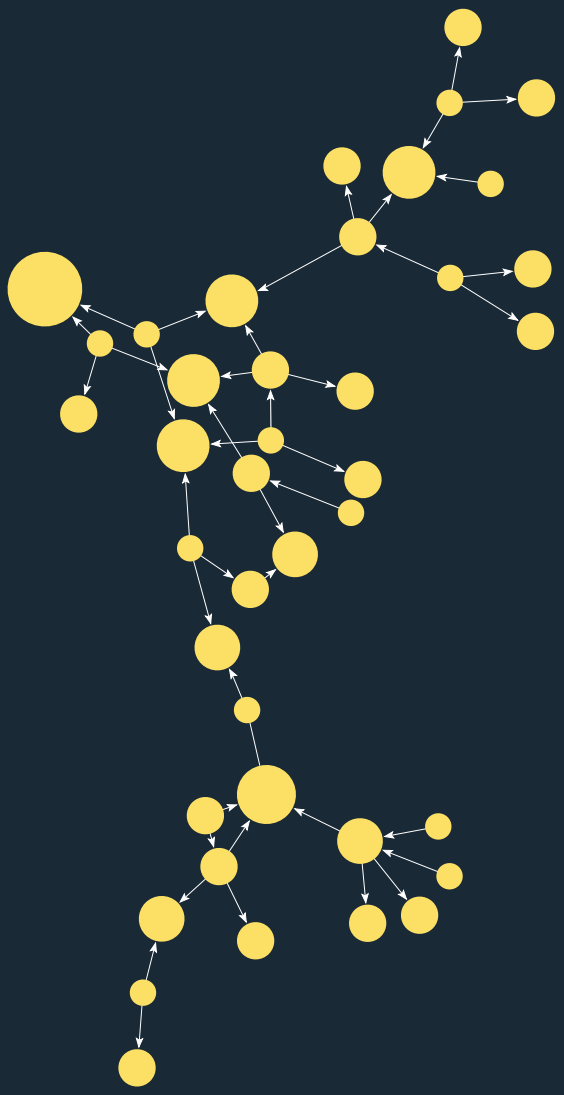


The Impact of COVID-19

On Romanian Tech Start-ups • *July, 2021*

ROTSA
The voice of Romanian Tech Start-ups

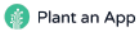
ROTSA
The voice of Romanian Tech Start-ups

A big thank you to

This study was initiated by **ROTSA** but the research that led to this study report is a collaborative and voluntary effort of **over 130 organizations** that have joined our effort to get to know each other and communicate more easily.

A big thank you to the start-up ecosystem that embraced our initiative.

Tech Start-ups







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learning made fun

InTake

MANNA FOODS

LUMEN

loginro

Linnify

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MOMSI.APP



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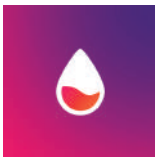


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acbc Camera de Comerț și Industrie Bacău
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INNO rethinking business networks
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12 Key Facts About The Study

#1 The pandemic's effects were very nonlinear depending on the industry and on the start-up size, however over 70% of the start-ups confirm that COVID-19 affected their business to some extent.

#2 The most thriving local tech start-up ecosystem is Bucharest, followed by Cluj, Timiș and Bihor.

#3 The study revealed a Romanian tech start-up profile: locally incorporated, under 4 years on the market, no more than 4 employees and an annual turnover of €150K.

#4 The most noticeable evolution was seen in 2017, when the number of newly founded tech start-ups almost tripled compared to the previous year.

#5 In 2019 there were over 300 people working in more than 117 local tech start-ups, with an average team size of 3-4 employees per start-up.

#6 In Europe, France, Spain, Italy and Poland are the main represented markets in our pool, while 48 respondents mention the US as their main market.

#7 The biggest employers are start-ups in Fintech (35.2%), Automation (35.2%) and Marketing (14.2%).

#8 The highest earners are start-ups in Automation (38.1%), Fintech (31.8%) and Marketing (12.1%).

#9 Self-financing is the main source of funding for tech start-ups, while 36% of them have raised private funds.

#10 When making decisions to mitigate the impact of the pandemic, founders consulted with the entire team (50%) or the advisory board, mentors, and coaches (49%), while 39% took advice from other entrepreneurs.

#11 Romanian start-ups are identifying and pursuing opportunities in markets such as North America and South-East Asia.

#12 The need to access funding to sustain the operations and expand is the main challenge for tech start-ups.

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COMP-CUI: The Fiscal Code

Foreword

Recent black swan events, unpredictable yet with serious consequences, such as the global economic crisis have already called on organizations to manage change and make decisions faster than ever. After the shutdown measures due to the COVID-19 pandemic, the global economy is expected to expand by 5,6% this year (according to the forecast of the World Bank). This evolution is encouraging, since in 2020 we experienced one of the worst recessions since World War II (Felsenthal, 2021). Despite the downfall of the global economy, certain sectors will recover faster than expected, particularly in those areas where virtual experiences are no match for the real thing, while others will need years and maybe a rethinking of their strategy.

The financial crisis of 2008 propelled the Uber and Airbnb start-ups to the top of Western preferences. Citizens' incomes had fallen steeply, and national economies collapsed, forcing buyers to change their behavior by moving to other options to meet their needs. The SARS epidemic of 2002-2004 catalyzed the huge growth of Alibaba's small e-commerce platform and helped put it at the forefront of Asian retail.

In the case of the COVID-19 pandemic, we are already seeing major changes in consumer behavior and especially in the business area. However, what brought the COVID-19 pandemic into the organizational and business environment? It has intensified the need to adapt, putting pressure on the speed of organizational transformation by fast forwarding innovation.

Thus, concepts such as digitalization, globalization and automation have rapidly transformed from medium-term plans into immediate actions for the survival of organizations in this more volatile, uncertain, complex, and ambiguous world. In almost all industries, the current pandemic has caused downtime, with start-ups facing some

of the biggest challenges. From the beginning of the pandemic, I wondered what the ecosystem of technology start-ups will look like after this disruptive episode. Specifically, to what extent existing start-ups will be able to adapt, reinvent, innovate quickly or which start-ups will be born from the opportunities created by these circumstances. For example, Clubhouse - a social networking platform based on audio chat whose number of users has exploded since its launch.

Industries that thrived under COVID-19

Areas such as cybersecurity, health-tech and SaaS have seen significant growth, and the effect of COVID-19, despite its serious business consequences, has become a growth factor. The current pandemic has proven to be a powerful catalyst for the cloud journey. Telemedicine has seen an increase that could be widely accepted as part of a new normal.

With cultural spaces and cinemas closed, with legally regulated social distance rules, we stormed streaming platforms, short videos, and away weekends; free time turned into endless binging sessions. In the first half of 2020, Netflix recorded 25 million new subscriptions. The TikTok platform, with 54 million users in 2018, crossed the threshold of 689 million users in 2020.

As work from home became the new norm, meetings that normally took place in boardrooms have moved into makeshift offices in employees' own homes, while video conferencing platforms became the main means to meet at work or to socialize. According to data from Zoom, in March 2020, 200 million people worldwide used the

platform daily, either for personal or professional purposes, compared to December 2019 when there were only 10 million active accounts on the platform. According to Apple's internal data, in many countries, Zoom is in the top of user preferences, to the detriment of traditional players such as Google or Microsoft. Once again, a start-up manages to position itself as the go-to solution for users without relying on the strength of the parent brand.

Another industry that has benefited from the COVID-19 pandemic is online gaming, which according to a study by Deloitte has grown in 2021 by $10.5 billion from March to April. E-commerce, initially affected by restrictions taken at national level by the authorities, managed to recover in a few months as some of the new regulations were lifted. Amazon India has announced that it has doubled its profit from one year to the next. However, with the opening of physical stores, online retailers will need to implement a combination of artificial intelligence, machine learning and analysis for a deeper understanding of their customers that will inform new acquisition and retention strategies.

Industries affected by COVID-19

At the opposite pole there are the areas that are struggling to survive or that have ceased their activity during the months following the outbreak of the pandemic. Given that people had to stay home, work remotely, and make considerable changes in the way they lead their daily lives, companies in transportation, hospitality and tourism have experienced significant losses.

Following the losses, Uber withdrew the driverless cars from the market in December 2020, closed more than 180 help centers and laid off more than 3700 employees. After laying off 25% of its employees, Airbnb managed to stabilize by December 2020 at a market value of 100 billion dollars.

However, stability comes with sacrifices. Laying off the workforce means limiting further development capacity. For many industries, a strong recovery is expected, especially for those in the tourism area, mostly because people have been restricted from traveling for quite a long time.

The pandemic has changed the landscape of the ride-sharing industry by influencing the ability and willingness of people to move in ways that were difficult to predict. To limit the negative impact on this sector, companies have identified other areas to focus on so that the damage can be minimized. Dacia has announced its entry into the electric vehicle market with Spring, pre-orders being available starting with March this year. A surprising move by the company, given the current situation, was the entry of the car into the market, initially through car-sharing companies, probably to anticipate a change in consumer behavior.

The shock of the global pandemic has left us with an unavoidable conclusion about the future of technology start-ups: to stay put and hope for a future like the past is not a viable strategy. Current start-ups need to evolve beyond this pandemic, where innovation and digital experiences will be even more important for the success of start-ups.

Research has shown us over time that history is important and for it to be conclusive,

we need data to see exactly what the situation looks like both at the start-up level and at the ecosystem level. The current pandemic will influence internal processes, the business model, setting long-term goals, and those who anticipate the future of the market will be the real winners, while we, the communities around these companies, must collaborate and get more involved than ever before.

At the beginning of 2021, the Romanian Tech Startups Association began researching the impact of the COVID-19 pandemic on Romanian tech start-ups with the purpose of studying the activity of local start-ups, in terms of needs and opportunities. This study, whose results are presented here, highlights potential strategies to better support ecosystem development and reveals potential programs and services to accelerate the tech entrepreneurial sector.

Cristiana Bogăţeanu,

Executive Director

ROTSA - Romanian Tech Startups Association

The Romanian tech start-ups included in the study

One core question stood at the basis of our research: who are the Romanian tech start-ups? There are several ways to define a start-up, for analytical purposes or for policy roles. For our study, we decided to create the sample based on those companies that self-declare this intention and plan to achieve fast growth through technology. Thus, we used the reputational method to build our sample.

In the first phase, over 130 communities (angel investors networks, national development agencies, incubation programs, acceleration programs, VCs, NGOs etc.) contributed to our effort by sharing the questionnaire within their network. Based on these actors, twenty seeds were identified through already existing maps of the start-up ecosystem created by actors of the national ecosystem.

We asked our selected start-ups to recommend 3 more start-ups to watch for and we applied our questionaire further to the recommended companies. This snowball method opened our research to the field of start-up entrepreneurship and the network of emulation, collaboration and competition that naturally structure the start-up ecosystem. Only in an innovative milieu can new companies hope to develop and launch new business models or technological advancements with a global potential for scaling up.

Another methodological option would have been possible, that of a formal definition of a start-up. Based on that formal definition we would then find all matching companies. For example, we could have considered the Eurostat definition. Eurostat defines a start-up as a company with less than ten years of operations, with a 20% annual growth of employees or turnover, within a window of three successive years.

The major drawback would have been to miss both charting the ecosystem, a major endeavor for us as an organization, as well as the start-ups which were not yet incorporated. Such start-ups are in the incubation phase. Any formal definition would have meant to use the official public balance sheets, which presupposes an incorporation. The starting point putatively tilted our sample towards two cities: Bucharest (capital city and largest population) and Cluj-Napoca (ROTSA headquarters location). However, the distribution of the surveyed companies reflects the actual economic geography of technically driven start-ups.

To better understand the Romanian tech start-up ecosystem, we analyzed the economic data provided by the respondents and created the profile of a typical entrepreneurial company in the tech field. Our study was conducted on a sample of 117 tech start-ups. The typical Romanian tech start-up is locally incorporated, has no more than 4 employees and an annual turnover of 150.000 euro, out of which 25% is foreign capital. In addition, most start-ups in our pool are active on the market for no longer than 4 years.

Based on our survey data, the most represented city within the local tech start-up ecosystem is Bucharest, with 45 start-ups having set up headquarters there. Additionally, five start-ups are in Ilfov, the adjacent county to the capital city. Such a strong representation is not unusual, as Bucharest is the most populated and developed city in Romania, with an exceedingly high concentration of multinational companies that attract a highly skilled workforce.

The Western region of the country is also an important entrepreneurial pole, Cluj being the second most represented county among our respondents (30 start-ups), followed by Timiș (10 start-ups) and Bihor (6 start-ups). The enablers for start-up development

in this area are a fast-growing IT sector, well-ranked university centers, and a start-up culture supported by both public and private actors (public administration, angel investor networks, accelerators/incubators, community).

Although Iași is one of the most developed counties in the Eastern part of Romania, with important players in the IT sector and manufacturing activating in the area and a highly skilled workforce, it is underrepresented within our sample of respondents. In our datasets there is weak representation of the local tech start-up ecosystem in the South-Eastern and South-Western part of the country. Given that we used the reputational and snowball method to reach our respondents, under-representation comes from a weaker start-up ecosystem in those counties (fewer start-ups participating in events, accelerators, publications, and an underdeveloped network of support actors).

Figure 1.

The larger reputational networks that structure our sample, comprised of *74* start-ups. The network is based on the recommendation made by the start-ups themselves.

The size of the nodes represents the notoriety of the start-ups in the eye of their peers.

Figure 2. Geographical distribution of the researched tech start-ups

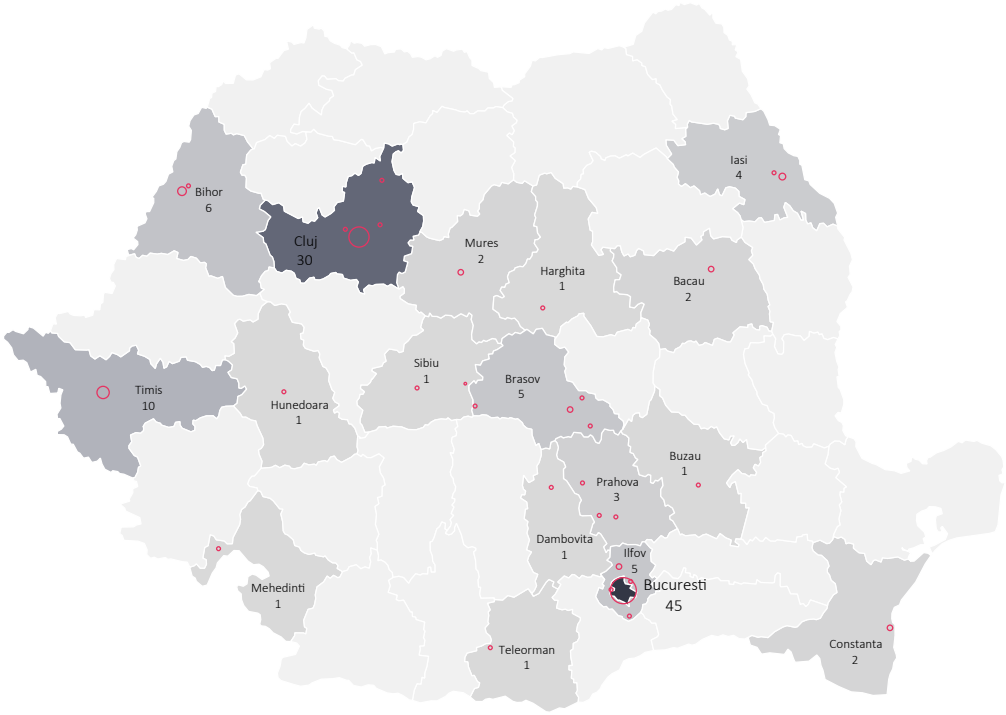
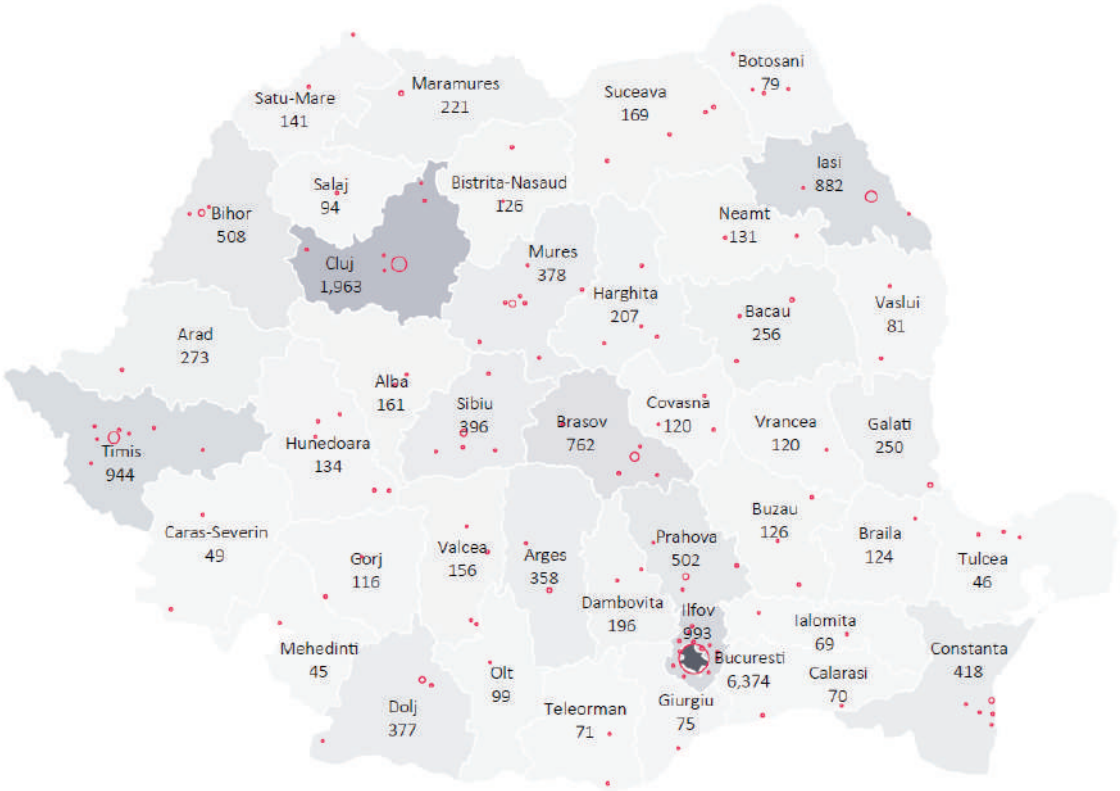


Figure 3. Geographical distribution of the companies active in the information technology field



Economic performance of the start-up ecosystem

Main industry and vertical

Based on the fiscal code of the companies we have identified the official main business domain. In addition, we have collected data regarding self-identified business domain of the company. When comparing the data, we noticed a mismatch between the official nomenclature of economic activities and the self-declared vertical of start-ups. The self-declared vertical cannot be easily identified within the NACE code list or the NACE codes under which our responding start-ups operate.

Out of the 117 respondents, 5 are not yet incorporated, thus NACE code information for those start-ups were not available. The results show that according to NACE codes, most of the incorporated responders are active in the Information and Communications sector, while the three most mentioned verticals based on self-classification were Health-Tech, Automation and Tech-Marketing. The results are consistent with the current concerns due to the pandemic, as people put their health and safety first, while companies strive to rethink how they do business.

Education remains one of the most underrepresented fields in both cases, while the greatest discrepancy can be noticed regarding Health (only 2 start-ups were registered under the respective NACE code, compared to 24 start-ups choosing the Health-Tech vertical as defining for their activity) and Financial services (1 start-up based on the NACE system vs. 11 self-declared start-ups working in FinTech). Although Agriculture is missing from the NACE classification, there were 4 start-ups that chose AgriTech as their main vertical. This could be a signal that local tech start-ups started addressing new challenges (even just as a consequence of the pandemic context).

Figure 4. The number of the tech start-ups based on NACE code

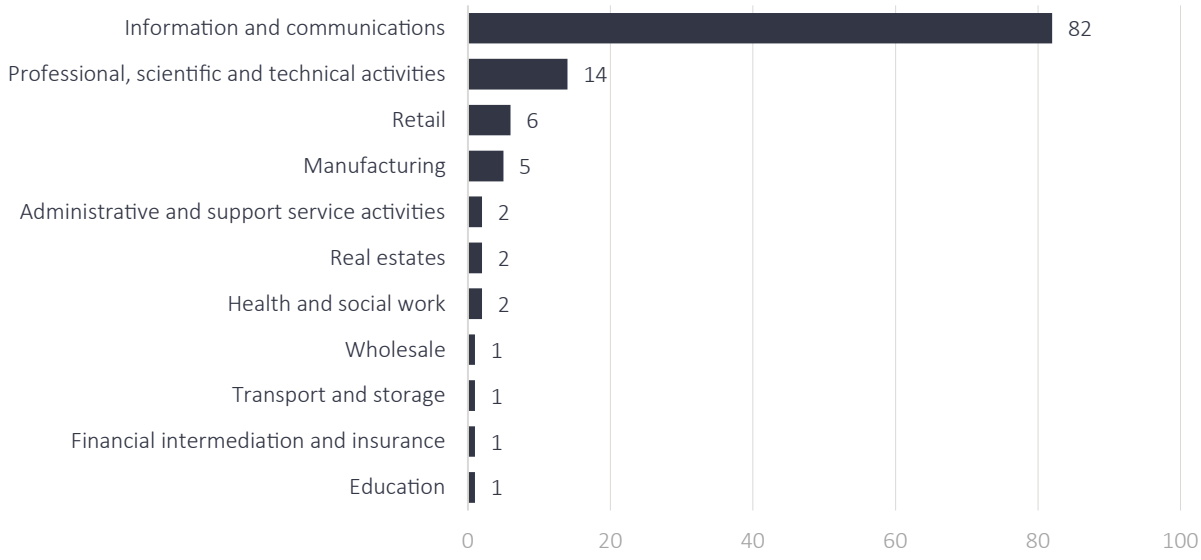
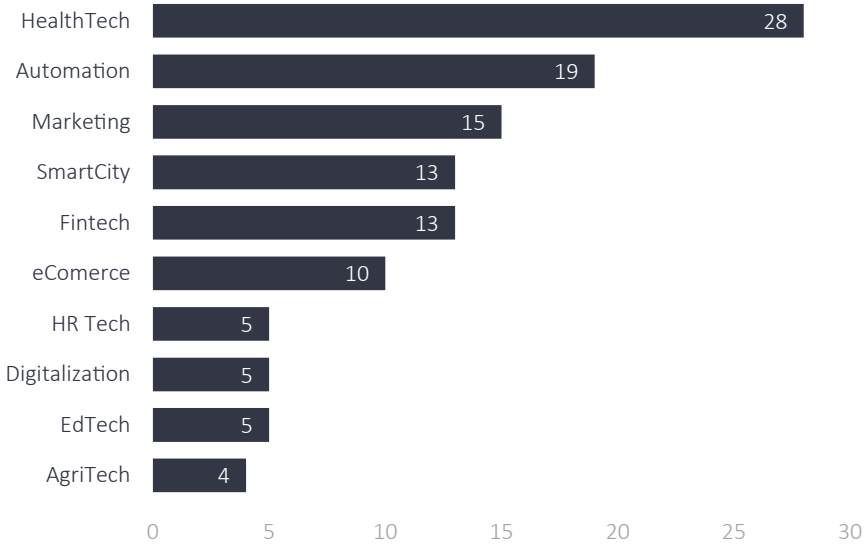


Figure 5. The number of start-ups based on their business vertical



Technical data: The ten-fold classification is based on a K-Means algorithm (Hartigan & Wong, 1979) based on the start-up self-classifications. The companies could have chosen multiple answers between 22 categories of activity (AdTech, Marketing Tech, EdTech, HR Tech, Fintech, eCommerce, MedTech, Health-Tech, Smart City, Mobility, CleanTech, Cybersecurity, Cloudtech and DevOps, Data, Crypto and Blockchain, Legal Tech, Agritech, Robotics, IoT, Wearables, VR/AR, Other value). Evaluation metrics: maximum diameter is 10.918; minimum separation is 3.282; Pearson's γ is 0.637; the Dunn index is 0.301; the entropy is 1.610; the Calinski-Harabasz index is 11.914.

Temporal dynamics

The publicly available data regarding the year of establishment of the start-ups from our sample shows a rising trend in the last five years. The most noticeable evolution can be seen in 2017, when the number of newly founded tech start-ups was more than triple compared to the previous year.

Considering the context, this upward trend starting in 2017 can be related to a series of national and European funding initiatives that may have incentivized founders to incorporate their business. Such programs are the Start-up Nation program implemented by the national government and Horizon 2020, Regional Operational Program 2014-2020. We notice that tech start-ups followed the same trend as regular businesses, as with the launch of the government program, Start-up Nation, there was an uptick in the number of registered businesses (Petrovici, Mare, & Moldovan, 2021) .

Human capital is an important asset for business development, irrespective of the vertical or the size of the company. The number of people working in the tech start-ups under analysis increased, mainly after 2017 when more companies were founded.

However, despite this rising trend in employment, the size of the team did not change over the years, being comprised on average of 3-4 employees. Although there is no universal optimal team size, previous research does confirm that start-up teams of three or less members experience faster growth by the addition of an entrepreneur to the team (Shrivastava & Tamvada, 2011), as opposed to larger entrepreneurial groups. Similarly, tech talent is one of the most expensive workforce worldwide, therefore hiring decisions account for this aspect.

Depending on the vertical, the most important employers from our sample are start-ups from FinTech and Automation. These sectors hired more than 70% of the overall

workforce. Health-Tech, the most common vertical within our sample of tech start-ups, concentrates only 5% of the employees working in the analyzed companies. This discrepancy may be explained by the fact more founders seek to capitalize on the opportunities brought by the pandemic (need for digitalization and hardware in the health sector, need for technological solutions to sanitize spaces, the rise of telemedicine, etc.) and urgency to go-to-market might have forced them to count on a small-sized core team.

However, consistent with international trends and forecasts this sector has the potential to become a "force multiplier" for traditional health care providers (Moses, Hurley, & George, 2021). Many companies that have been successful during the pandemic have been those that developed diagnostic tools and communications platforms that are easy for consumers to use.

Figure 6. Years of establishment of tech start-ups

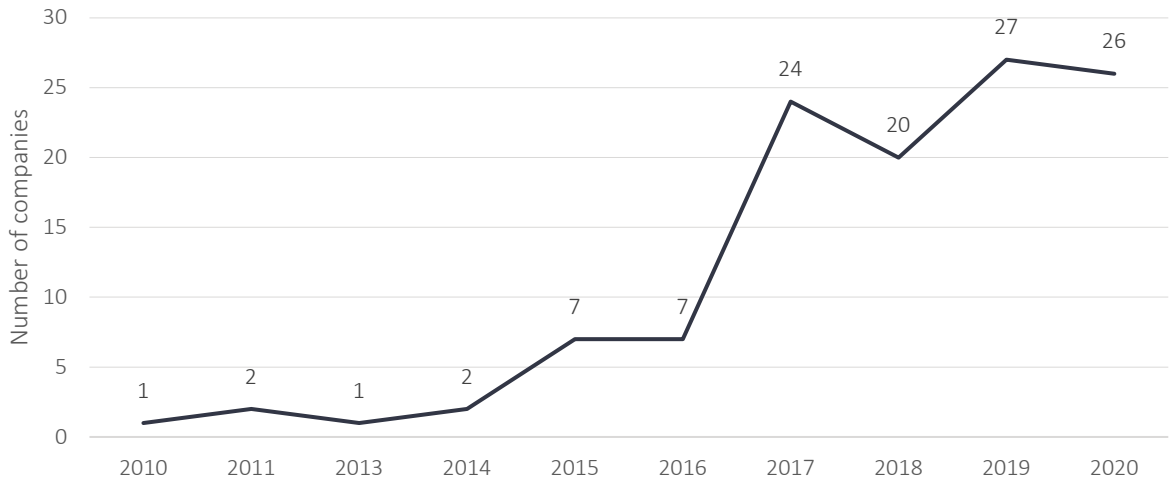


Figure 7. Number of aggregate and average employees

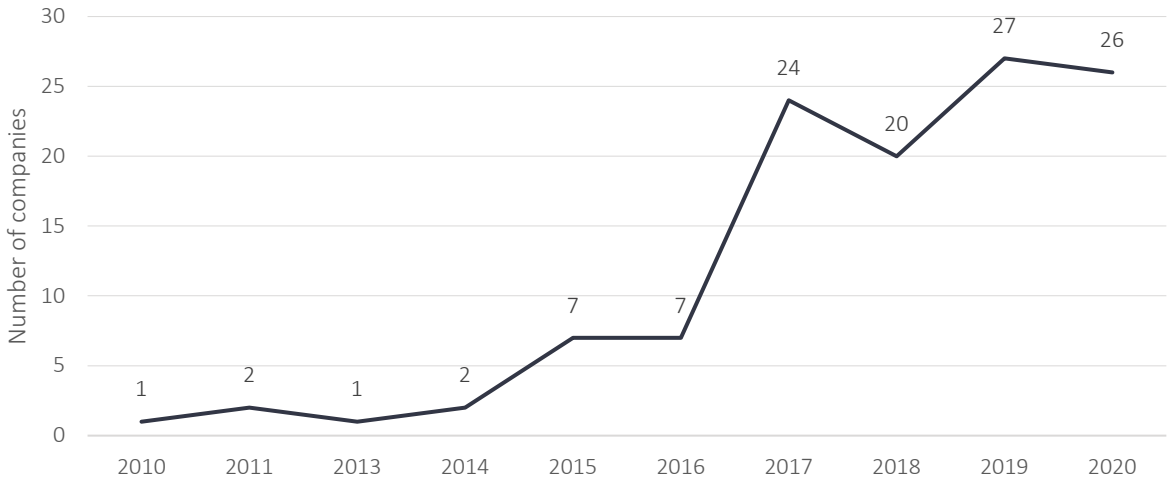
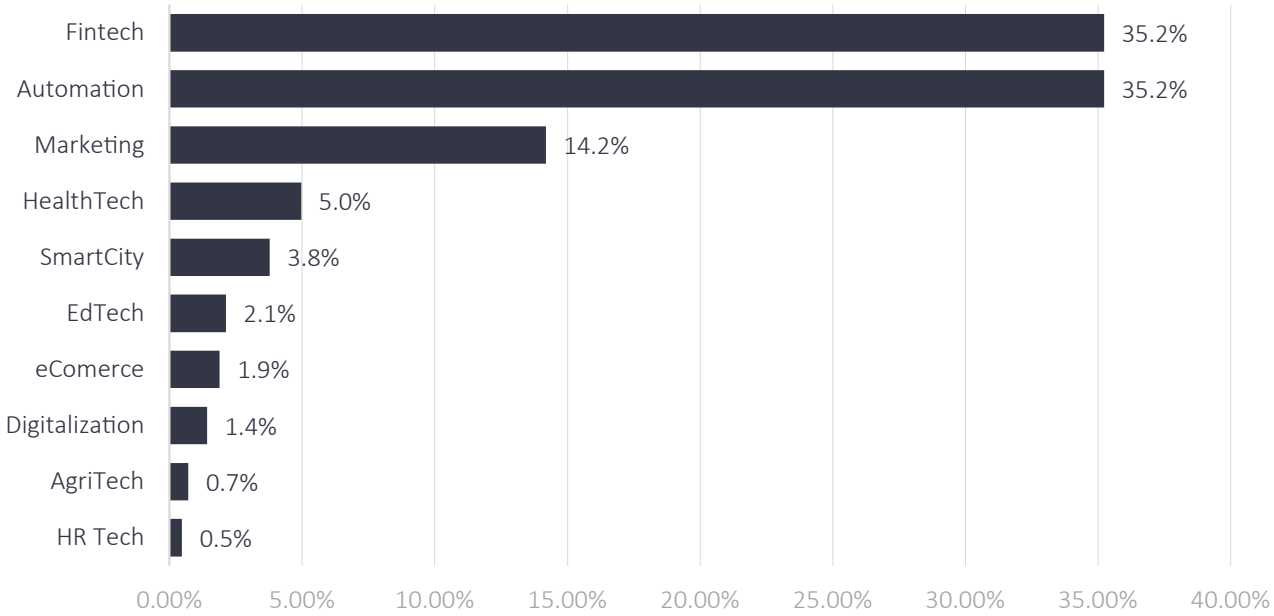


Figure 8. Distribution of aggregate employees based on business vertical, 2019



Turnover

The rising number of tech start-ups established especially between 2017 and 2020 contributed to a similar increase (>3x) in the aggregate turnover reported by the studied start-ups. Local investments remain the main source of funding for the tech start-ups. The volume of local investments has grown significantly between 2017 and 2019, as the number of incorporated start-ups evolved.

The 4x growth is also noticeable in the case of foreign capital, although the volume remains lower compared to the local capital. However, this upward trend may indicate that owning a tech start-up or being a shareholder in one is becoming more popular in Romania, despite all the associated risks.

Aggregate turnover refers to the total value of all taxable deliveries, duty-free deliveries, exports of goods or services and inter-state deliveries of start-ups that have affiliate shareholding. The fact that there is an exponential increase in aggregate turnover vs. average turnover could be due to the following factors:

1) There is a trend to concentrate start-ups around stakeholders with capital, probably VCs or investor syndicates designed around local angel clubs. This fact could determine some start-ups to be considered as "aggregate" start-ups.

2) There is a high probability that these aggregate start-ups will be more scalable towards internationalization under the influence of VCs through which the aggregation was done and this has determined an exponential growth starting with 2018/2019 of the aggregate figure in the above chart, figure that also includes exports of goods and inter-state deliveries.

The same tendency does not apply to the average turnover, as its value decreased starting with 2016. This metric had a breakpoint in 2017, followed by an upward trajectory in the next few years. However, in 2019, the average turnover still did not reach a comparable value to that reported between 2014 and 2015. The distribution of the aggregated turnover based on the type of incorporation suggest that the vast majority of the Romanian tech start-ups conduct their businesses on local grounds with local incorporation. Although foreign incorporation started to become an option in the last few years, especially in 2018 - 2019, it is still at a low level.

Figure 9. Aggregate turnover of tech start-ups

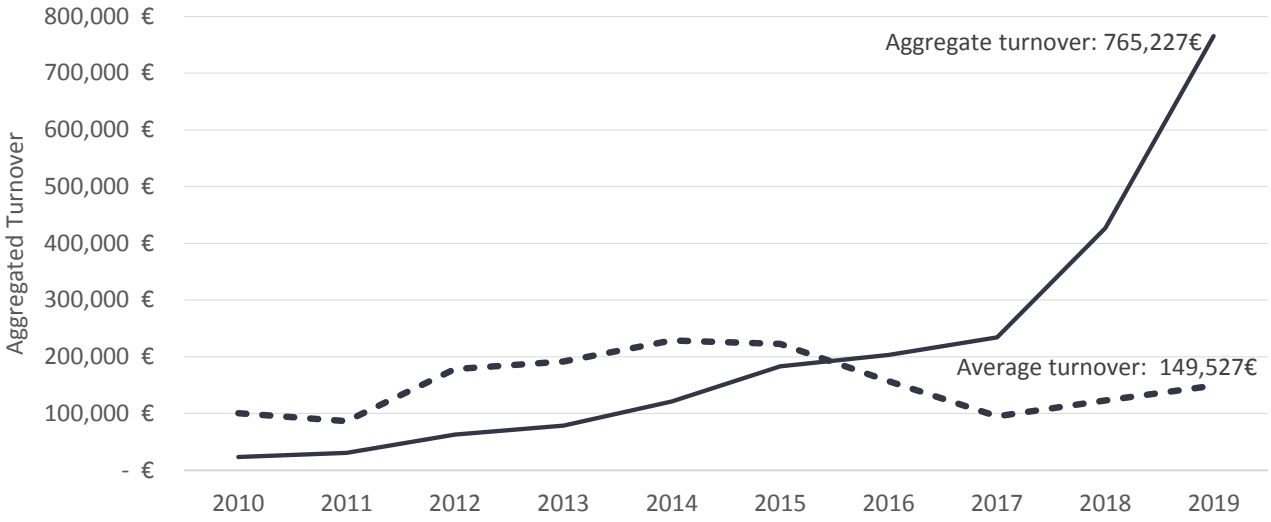


Figure 10. Aggregate turnover, split by the type of capital based on shareholders

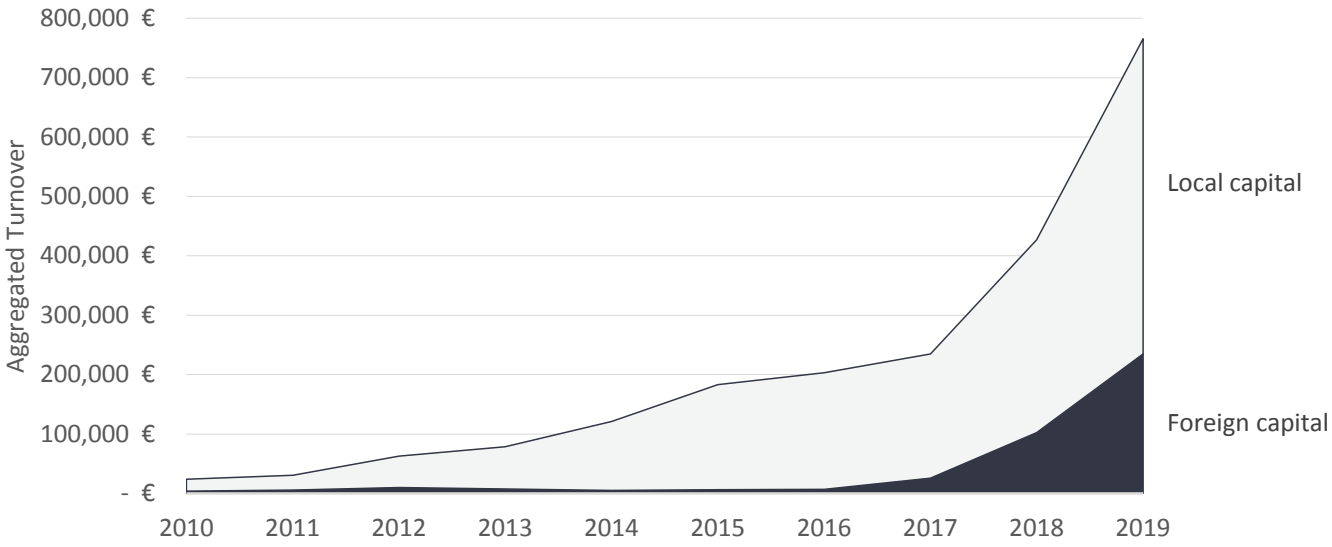
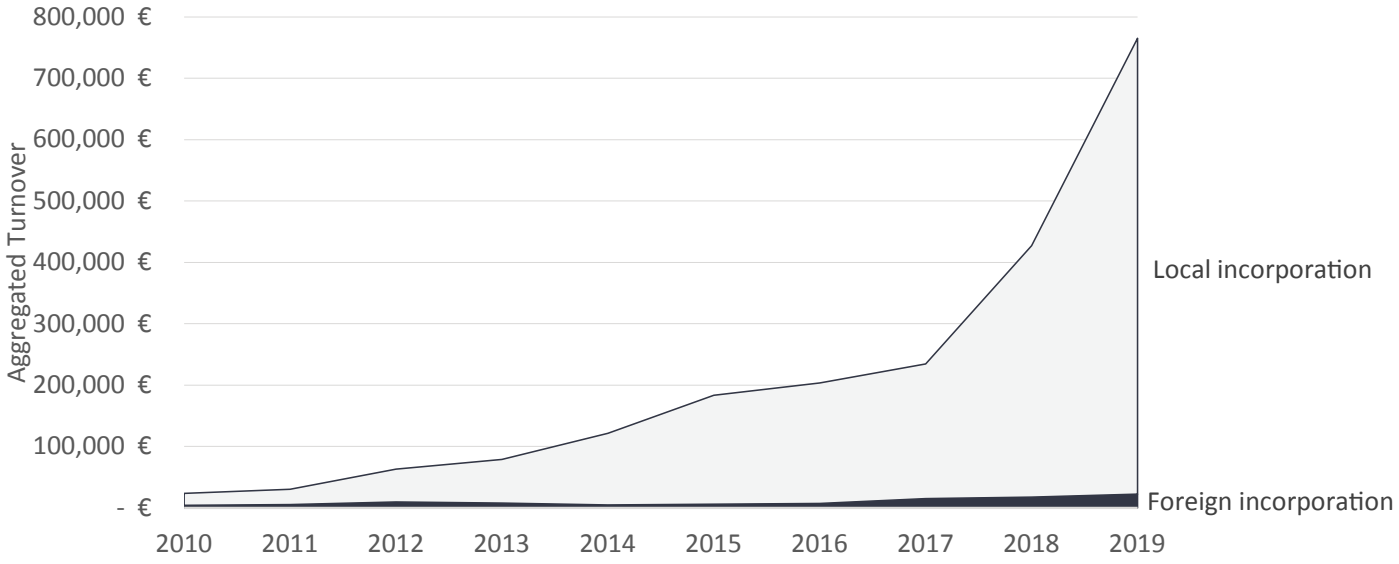


Figure 11. Aggregate turnover, split by the type of incorporation



Revenue and financing sources

The highest earners are start-ups in Automation (38.1%), Fintech (31.8%) and Marketing (12.1%). In terms of financing, we notice that most respondents are self-financing their start-up, while 38% have raised private funds.

-The 4% of companies that raised private funds via equity crowdfunding have done so from the main such actor in the Romanian start-up scene, SeedBlink. The equity crowdfunding platform was launched in 2020 and facilitated 42 campaigns in their first year, helping start-ups raise over 15 million euro (Erdő, Vădan, & Pascaru, 2020).

-Similarly, as shown in the Romanian Venture Report 2020 (Iordache, 2020), there was a significant increase in private investment between 2017 and 2020. The investment volume doubled two years in a row, from €8.2m invested in 2017 to €28.6m invested in 2019. The growth, although minimal (6%), was sustained in 2020, despite the pandemic.

-Business angels represent an important source when it comes to raising funds. Unsurprisingly, angel investing in Romania has grown significantly in the last few years. Starting with just a few investors, nowadays we can talk about a growing and vibrant network, with more than 10 active angel networks and over 250 investors, most of them are located in the major Romanian cities.

Figure 12. Aggregate turnover based on business vertical, 2019

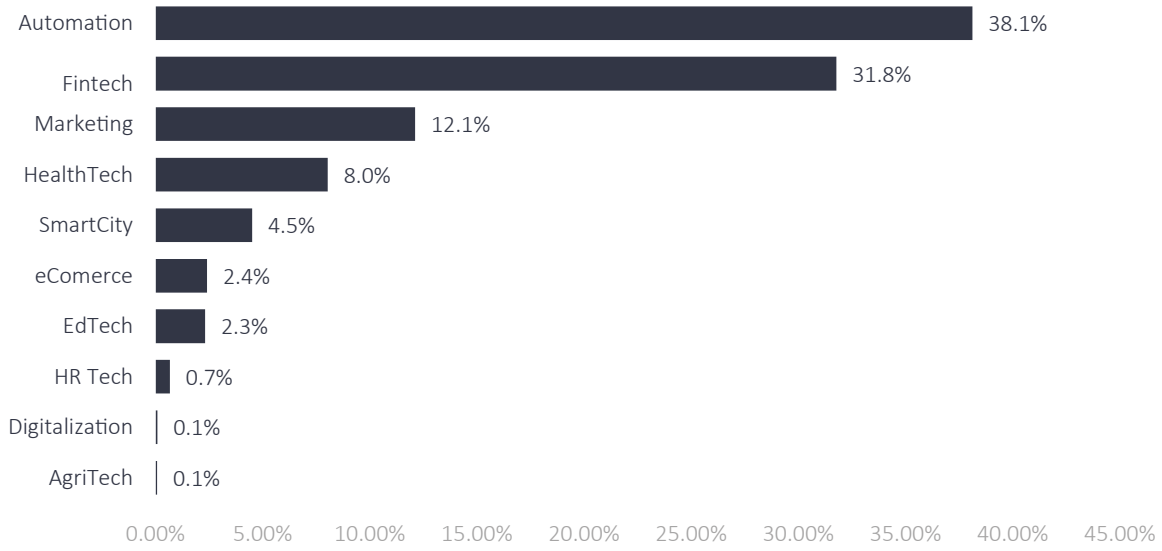
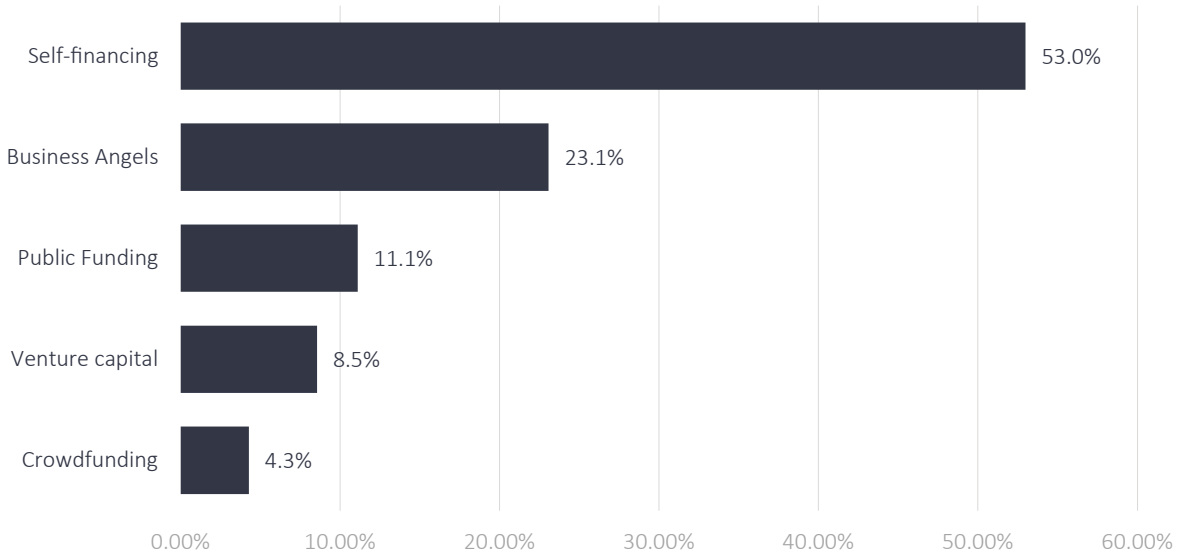


Figure 13. Financing source of tech start-ups



Sales and business model

When it comes to sales markets, the tech start-ups that participated in the study provide their products/services to clients all over the world. In Europe, France, Spain, Italy, and Poland are the most represented markets in our pool. However, there is a noticeable shift towards North America, with 48 respondents mentioning the US as their main market. English speaking countries (US, Australia) are in focus for our respondents, as language barriers can be easily overcome.

This signals a positive trend towards the internationalization of the local start-up ecosystem and an upward move on the value chain. As the global tech landscape shifts with the rise of China and increased regulations from the EU, Romanian start-ups are identifying and pursuing opportunities in markets such as North America (69 start-ups) and South-East Asia (14 start-ups).

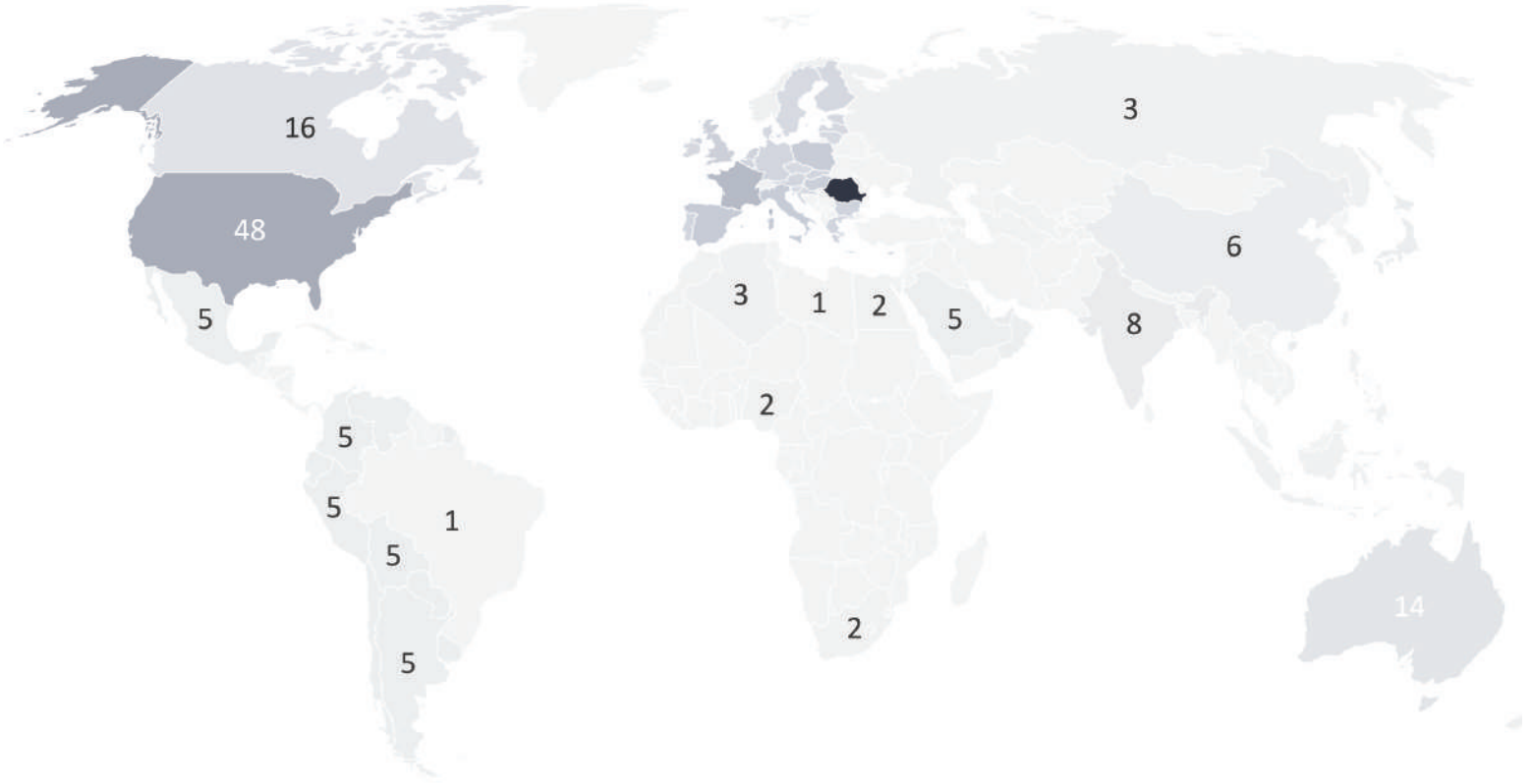
A significant part of the studied tech start-ups provide their services / products to other businesses (B2B, 43%) as shown in the figure below. About 1 in 4 start-ups uses a mixt business model, addressing its services / products to both individual and organizational consumers, while also using subscriptions. We have tested whether there is a relationship between the business model of choice and the main field of activity of start-ups.

-Results show that start-ups in Automation and Marketing tend to use a B2B business model, while start-ups active in eCommerce tend to operate using a B2C model, as well as a mixt model in which they address both individual consumers and companies (B2B & B2C, 23%).

-Health-Tech start-ups tend to opt for subscription models that fit the direct-to-consumer telemedicine trend. There is also a relatively significant association (95%) with B2B & B2C business models, as these start-ups can sell their services to corporates as part of the employment benefits packages.

-In Fintech we see a relatively significant association (95%) with subscription based business models, as the Romanian Fintech start-up ecosystem is dominated by personal finance solutions, wallets and payment apps, or investment and wealth management solutions (Enache & Iliescu, 2019).

Figure 14. Sales markets of tech start-ups



On Bing Platform

Figure 15. The business model of tech start-ups

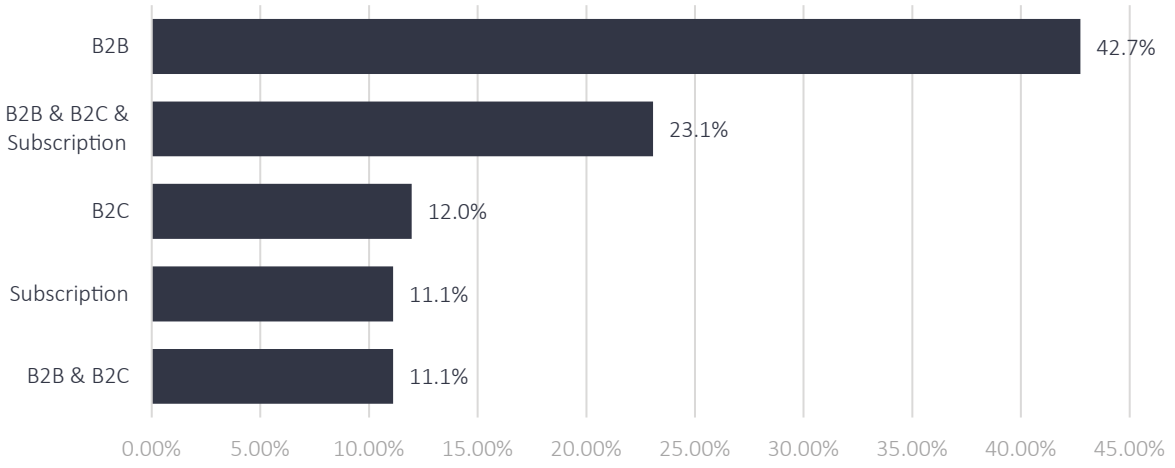


Table 1. Business model based on business vertical

	B2B	B2B & B2C	B2C	Subscription	B2B & B2C & Subscription
AgriTech	4%	8%	0%	8%	0%
Automation	26%	8%	7%	8%	11%
Digitalization	8%	0%	0%	0%	4%
eCommerce	6%	23%	29%	0%	0%
EdTech	2%	0%	7%	8%	7%
Fintech	8%	15%	7%	23%	11%
Health-Tech	10%	31%	36%	54%	26%
HR Tech	4%	0%	7%	0%	7%
Marketing	22%	0%	0%	0%	15%
SmartCity	10%	15%	7%	0%	19%
Total	100% (50)	100% (13)	100%	100%	100% (27)

Overal association Cramer's V = 0.339; X^2 is significant at $p < 0.05$; at celuar level for adjusted standardized residuals $p \leqslant 0.01$; $p \leqslant 0.05$

The impact of COVID-19 on Romanian tech start-ups

According to the latest Start-up Genome report (2020), the COVID-19 virus could be "a mass extinction event" for start-ups. In the first three months of 2020, venture capital financing fell by 20% globally, while in China it fell by 50%. Moreover, the report shows that 72% of start-ups worldwide have experienced a significant decline in revenue, averaging 32%. On a more positive side, technology start-ups have been able to adapt quickly to the new remote work trend, and companies offering online services, cloud infrastructure, automation have accelerated their development and expansion process.

At the national level, things are not different from what is happening globally. Our results are aligned to the global trend, as over 70% of the start-ups that participated in the study confirm that the COVID-19 pandemic has affected their business to some extent. To mitigate the side effects, most founders reacted with a series of stabilizing measures, such as: remote work, cost reduction, human resources optimization, strategic adjustments by developing new products or addressing new markets. For this reason, business owners remain optimistic for 2021, significant increases being expected especially in terms of demand.

The situation created by the pandemic has divided the world of technology and start-ups between winners and losers. While some market segments experienced large increases, both in the user base and in terms of investment, others suffered significant losses, especially in terms of demand and sales.

Although technology has been more and more present in our lives for years and the need for digitalization in the business area is more evident, we are now able to

accelerate the process of innovation, digitization, and digital transformation. This acceleration occurred not because it was planned, but because the entire economic chain is currently subject to constant changes generated by the consumer's need to be safe. The national quarantine imposed by the authorities has led to the collapse of most businesses in the cultural sector, by far one of the most affected sectors. After a year of agony, the beginning of the test events in several countries came as a sign of hope for those who managed to survive.

We asked 117 Romanian tech start-ups a set of questions to determine what measures they took (adaptation), how they came to that decision (decision-making process), the risks they foresee (risk) and what their needs would be to move forward (needs). For each section, we identified several types of responses, which allowed us to group the start-ups based in several cohorts.

-First, when it came to adapting to COVID-19, the surveyed start-ups showed 4 main patterns in their answers, depending on their level of development. We called these strategies: Internal repositioning, External repositioning, Scaling up, and Balancing act.

-Second, regarding the decision-making process, once again 4 main cohorts were formed, based on their development level. We called these start-ups: Listeners, Involvers, Choosers, On my own.

-Third, in the matter of perceived risks, our respondents coalesced into two cohorts: The pioneers and The beginners.

-Fourth, in terms of needs, the start-ups can be roughly divided in three main categories: Independent, Vulnerable, and Rebound.

Adaptation strategies

Internal repositioning
External repositioning
Scaling up
Balancing act

The state of emergency forced many small businesses and start-ups to suspend their activities. However, this was also an opportunity to identify creative strategies, tools and opportunities to continue to serve the customers and even strengthen the position on the market. By the time the survey was launched, the third wave of coronavirus infections was in full swing, while we were approaching the one-year mark of the pandemic. That gave start-ups enough time to test adaptation strategies.

The adaptation strategies covered different types of adjustments at company level and its market repositioning. These responses can be roughly classified fourfold: personnel changes, financial decisions regarding the cash flow, market strategy and organizational adaptation. The response was far from even across the ecosystem. In fact, there were four types of responses based on the business profile of the companies: internal repositioning, external repositioning, scaling up, balancing act.

Differences in adapting to the new reality were due to the size of the start-up (number of employees & level of revenue) and its maturity (level of development of start-up, or maturity of start-up team in cases of spinoffs).

Internal repositioning (5 companies). The largest five start-ups (7 employees, €729K in revenue), active in Fintech, Automation, Marketing and Health-Tech. The

main measures taken was to freeze the hiring processes, cut salaries, and reduce administrative costs (such as office space). At the same time these companies strategically experimented with new pricing models and repositioning strategies on the market.

External repositioning (12 companies). **The medium size start-ups (7 employees, €193K in revenue) operating in the field of Marketing, Smart city and Automation.** The main measures taken were to freeze bonuses and salary increases and make layoffs, while reshuffling employees and augmenting their marketing and tech teams. These companies on the one hand increased their marketing budgets, on the other hand, cut their expenses, office spaces and postponed investments.

Scaling up (30 companies). **Some of the smaller companies (5 employees, €129K in revenue in 2019) operating in Health-Tech, Digitalization, SmartCity, but also, in smaller proportion, in all the other fields.** These companies were in position to treat the new context as an opportunity and changed their organizational strategy and marketing position. The main measures taken were to expand their team, with new tech, marketing, and sales colleagues, and even the management team. These companies also increased their investments, made new acquisitions and expanded their marketing budgets.

Balancing act (70 companies). **Most of the small start-ups (2 employees, €110K in revenue in 2019) mainly active in Fintech, Health-Tech, Automation, SmartCity, as well as to a smaller extent in all the other fields.** These companies pushed the deployment of their products by expanding the tech team with one or two members and by increasing the marketing budgets. Since most of the start-ups were caught in their development phase one could argue that this was the typical adaptation reaction.

Table 2. The characteristics of tech start-ups based on their adaptation strategy to COVID-19 pandemic

Group	*#*	*Start-upsWith Income*	*Income (avg.)*	*Start-upsWith Employees*	*Employees (avg.)*	*Operating Years (avg.)*	*Dominating fields*
Internal repositioning	*5*	*100%*	*729,254 €*	*60%*	*20*	*3.4*	*Autom., Fintech*
External repositioning	*12*	*92%*	*210,835 €*	*75%*	*6*	*3.8*	*Marketing*
Scaling up	*30*	*57%*	*227,839 €*	*43%*	*11*	*3.6*	*Health-Tech*
Balancing act	*70*	*59%*	*189,065 €*	*43%*	*5*	*3.2*	*Health-Tech, SmartCity*
Total	***117***	***63%***	***237708***	***49%***	***7***	***3.4***	

Technical data: K-means clustering using Hartigan and Wong (1979) algorithm based on the answers given to the set regarding the adaptation strategies to the COVID-19 pandemic. All variables were coded as dummy and were used without further standardization. Evaluation metrics: maximum diameter is 3.162; minimum separation is 1; Pearson's γ is 0.459; the Dunn index is 0.316; the entropy is 1.331; the Calinski-Harabasz index is 17.298. All the values in the tables were computed as a second step after the clusters were created.

Figure 16. Adaptation strategies: Internal repositioning

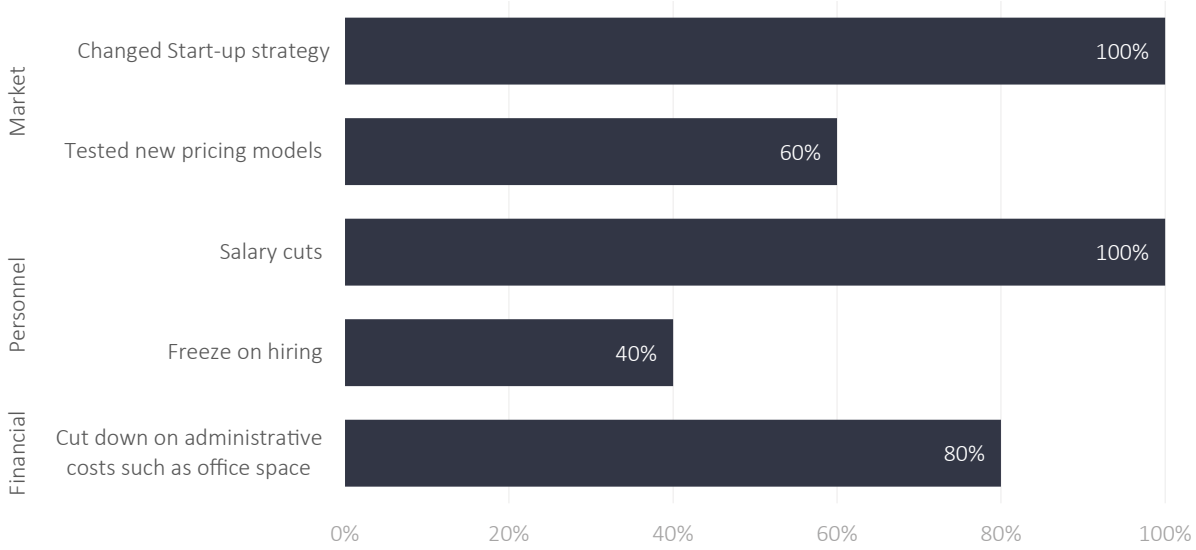


Figure 17. Adaptation strategies: External repositioning

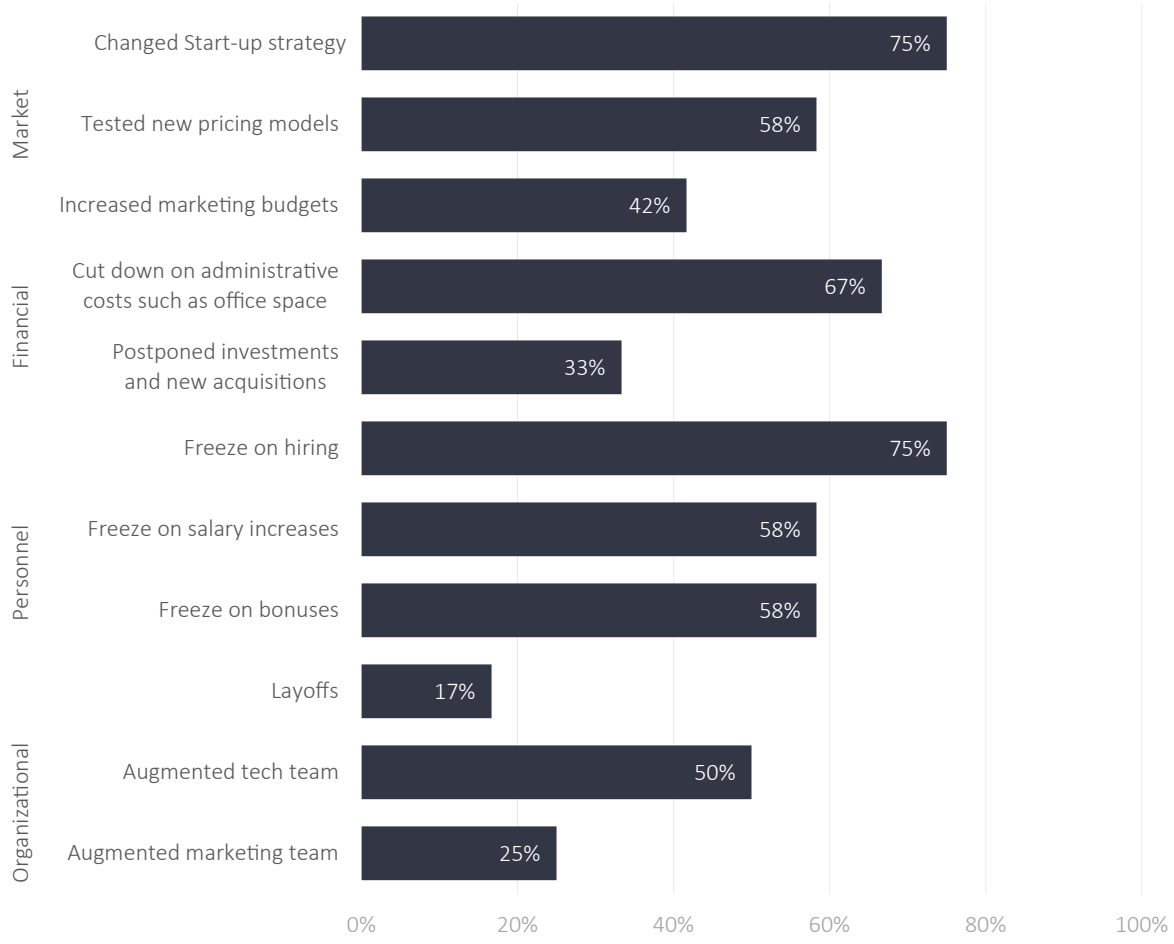


Figure 18. Adaptation strategies: Scaling up

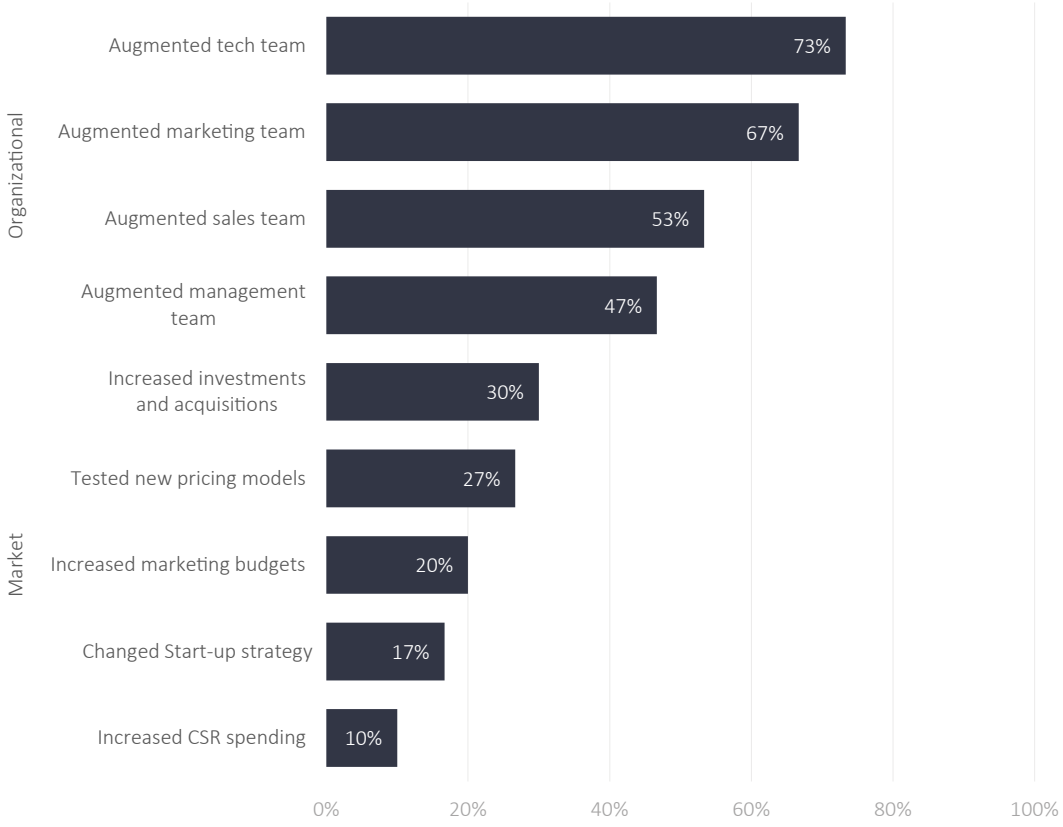
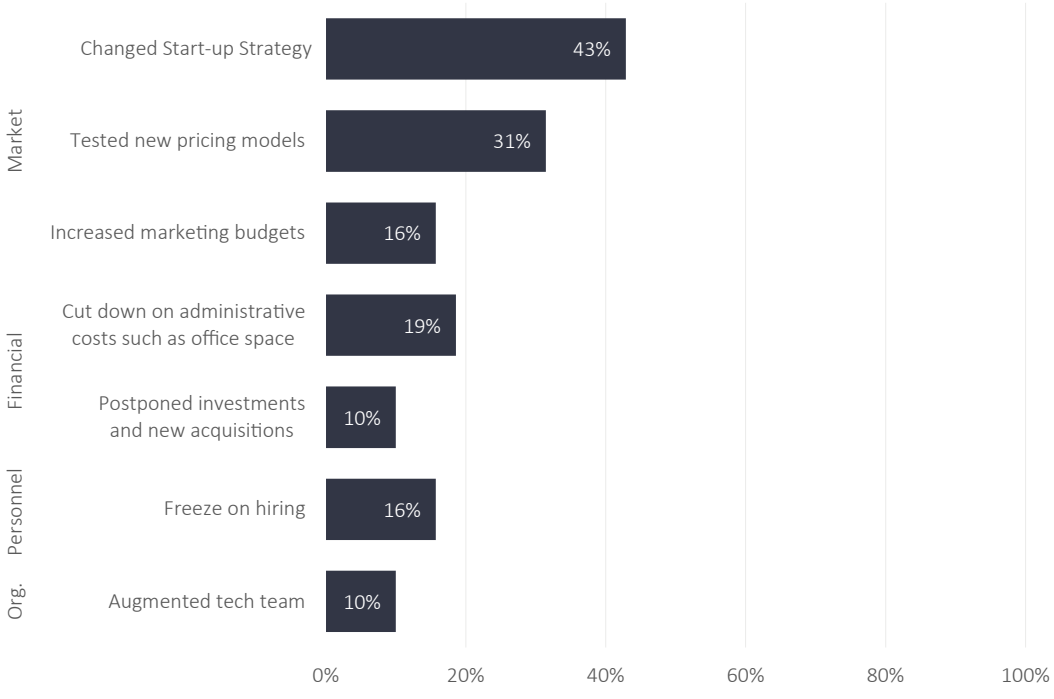


Figure 19. Adaptation strategies: Balancing act



Decision making

Listeners
Involvers
Choosers
On my own

Deciding in business is not an easy task, especially when it is imposed by an external factor, as in the case of the COVID-19 pandemic. For most of the start-ups, the decision-making process related to the response given to the pandemic involved consultation with the entire team (50%) or a consultation with the advisory board, mentors, and coaches (49%). Also popular among start-ups was taking advice from other entrepreneurs (39%) or from the management team (39%).

Four main decision-making processes can be observed:

Listeners: start-ups that base their decisions on the knowledge of their small team, of mentors and of peers from other start-ups. On average, these start-ups have more employees (five), tend to be horizontally organized and tend to be standalone projects.

Involvers: start-ups inspired in their decision making by their management, mentors and other entrepreneurial peers. On average, these start-ups have a smaller team (three employees) while being more structured hierarchically and are more likely to be spinoff projects.

Choosers: start-ups that looked for advice internally, from the management team. These start-ups are the largest in terms of employees (fourteen on average) and secured the largest revenue in 2019 (on average €797K).

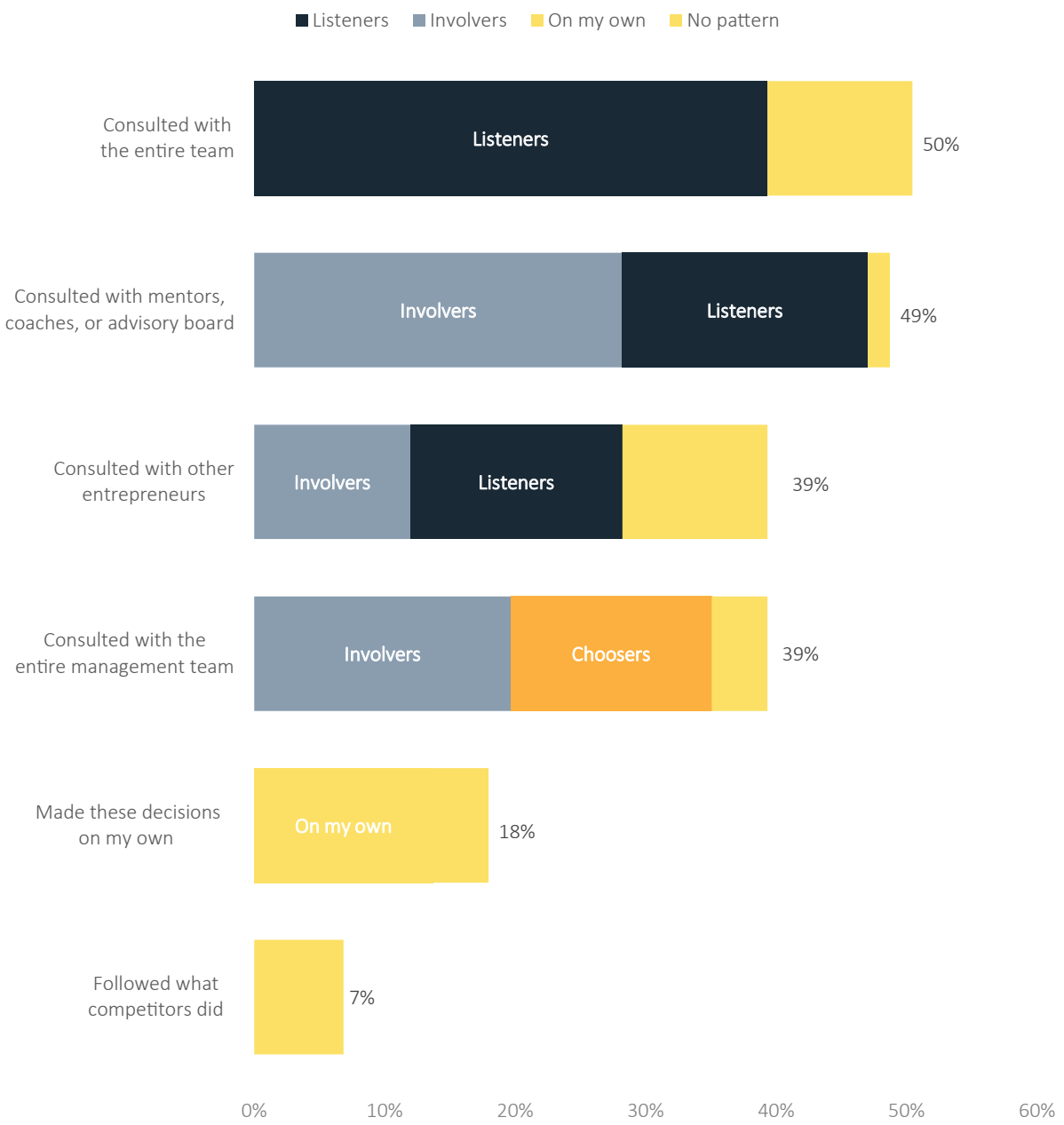
On my own: start-ups where the founder or co-founder based his decisions on his own knowledge. With a medium revenue and team size, these start-ups are the youngest on the market (3 years of activity).

Table 3. The characteristics of the tech start-ups based on their decision making process

Group	#	Start-upsWith Income	Income (avg.)	Start-upsWith Employees	Employees (avg.)	Operating Years (avg.)	Dominating field
Listeners	51	65%	89,767	47%	5	3.2	Health-Tech
Involvers	18	83%	93,395	56%	3	3.6	Automation
Choosers	26	50%	797,543	50%	14	3.9	Marketing
On my own	22	59%	219,930	45%	8	3.0	Digitalization
Total	**117**	**63%**	**237708**	**49%**	**7**	**3.4**	

Technical data: K-means clustering using Hartigan and Wong (1979) algorithm based on the answers given to the set regarding the decision-making processes related to the response given to the pandemic. All variables were coded as dummy and were used without further standardization. Evaluation metrics: maximum diameter is 2; minimum separation is 1; Pearson's γ is 0.6; the Dunn index is 0.5; the entropy is 1.2; the Calinski-Harabasz index is 35.62. All the values in the tables were computed as a second step after the clusters were created.

Figure 20. Decision making process



Risks

The Pioneers
The Beginners

When assessing risk, market and financial factors are the two main sources of perceived risk. The main risks foreseen by the respondents are: Inability to finance their operations (either from lack of access to funding or from decreased sales and/or delayed payments from clients); Loss of market cap due to increased competition; Inability to grow operations by onboarding the needed talent.

As both EU and national level financial support measures were rolled out, the legislative and bureaucratic environment was perceived as one of the lesser risk factors to organizational health and survival. At a closer look, when it comes to perceiving risks, two main cohorts can be identified. We have named them the pioneers and the beginners.

The Pioneers are start-ups with more employees and a higher average revenue. They have managed to grow from a founding team, to reach an average team size of 10 employees, and the pandemic poses a higher risk for stagnation or even degrowth. What market cap they managed to acquire, is threatened by the rapid changes in the market and in human behavior triggered by the pandemic. Amongst the dominating verticals in this cohort are Health-Tech, FinTech and Automation, sectors that have seen growth in the number of start-ups entering the market. Thus, there is more competition, fighting over similar financial, human and market resources (clients).

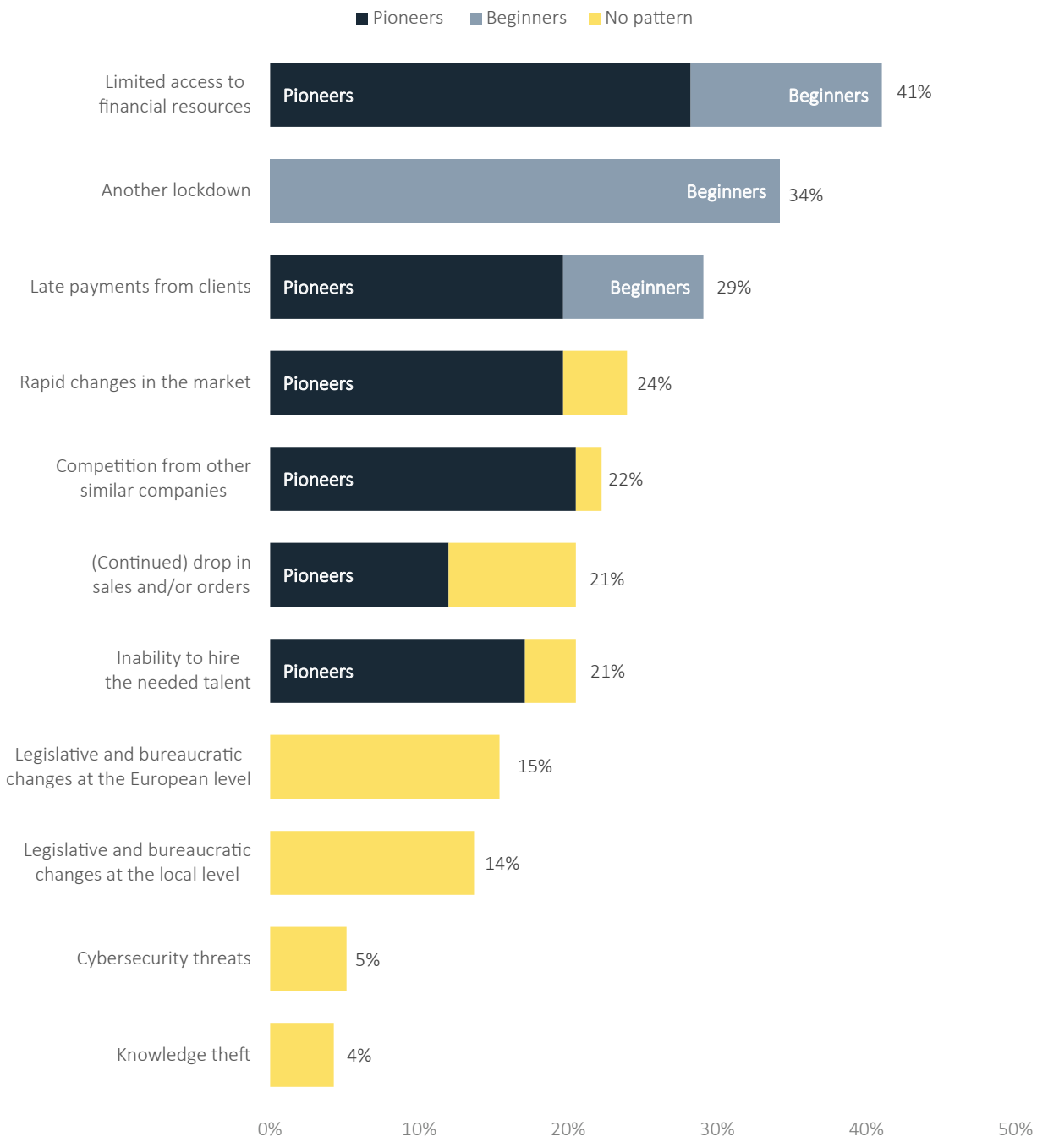
The Beginners were most threatened by a new lockdown and dwindling cash flow, with an average income of just over 100.000 euro and a team averaging only 3 employees. The beginners are in the earlier stages of development and have yet to achieve full market-fit. For this cohort, there is no risk of accessing human capital or loss of market cap. They are small teams, which make them nimble and in a better position to pivot quickly to keep the clients they have or reach new ones.

Table 4. The characteristics of tech start-ups based on perceived risks during the pandemic

Group	#	Start-upswith Income	Income (avg.)	Start-upswith Employees	Employees (avg.)	Operating Years (avg.)	Dominating fields
The pioneers	77	62%	311,143	48%	10	3.3	HelthTech, Fintech, Automation
The beginners	40	65%	102,135	50%	3	3.6	SmartCity, eComerce
Total	**117**	**63%**	**237708**	**49%**	**7**	**3.4**	

Technical data: K-means clustering using Hartigan and Wong (1979) algorithm based on the answers given to the set regarding the risk foreseen by the start-ups in 2021. All variables were coded as dummy and were used without further standardization. Evaluation metrics: maximum diameter is 3; minimum separation is 1; Pearson's γ is 0.279; the Dunn index is 0.333; the entropy is 0.642; the Calinski-Harabasz index is 20.464. All the values in the tables were computed as a second step after the clusters were created.

Figure 21. Perceived risks during the pandemic



Needs

Self-reliant, Vulnerable and Rebound

We asked the surveyed start-ups to mention what support measures they deem are needed. The main need expressed is the one for accessing funding. Be it public or private, the surveyed start-ups are looking for investments to fund their operations and expansion. Most start-ups in our pool of respondents have self-funded their operations or have received investment from Business Angels. In addition, the average life on the market is around 3 to 4 years. This puts them in the particular moment of a start-up's life when they would start raising funds to accelerate their growth.

Three distinct groups can be identified: start-ups that do not need support, start-ups that need some support and start-ups that need the most support. We have named them: Independent, Vulnerable and Rebound. To uncover more insights regarding the proposed groups, we further examined main economic indicators.

The Self-reliant group are in the best position to make it on their own. They are the most mature start-ups in our pool, generating the highest income and having the largest teams employed. Although they foresee the highest numbers of threats to their business, they perceive themselves as having enough experience to mitigate future risks.

The Vulnerable group are comprised mostly of start-ups that could not generate revenue after an average of 3 years on the market. These start-ups are not yet ready

to raise private funds, therefore are looking to available public funding to boost their growth. And just like the third group (Rebound), they need coaching and guidance from both peers and programs. Health-Tech and eCommerce are the main verticals from this group. The two verticals have seen a boom due to the pandemic, and a calculated expansion strategy is what is needed so that start-ups can capture this opportunity.

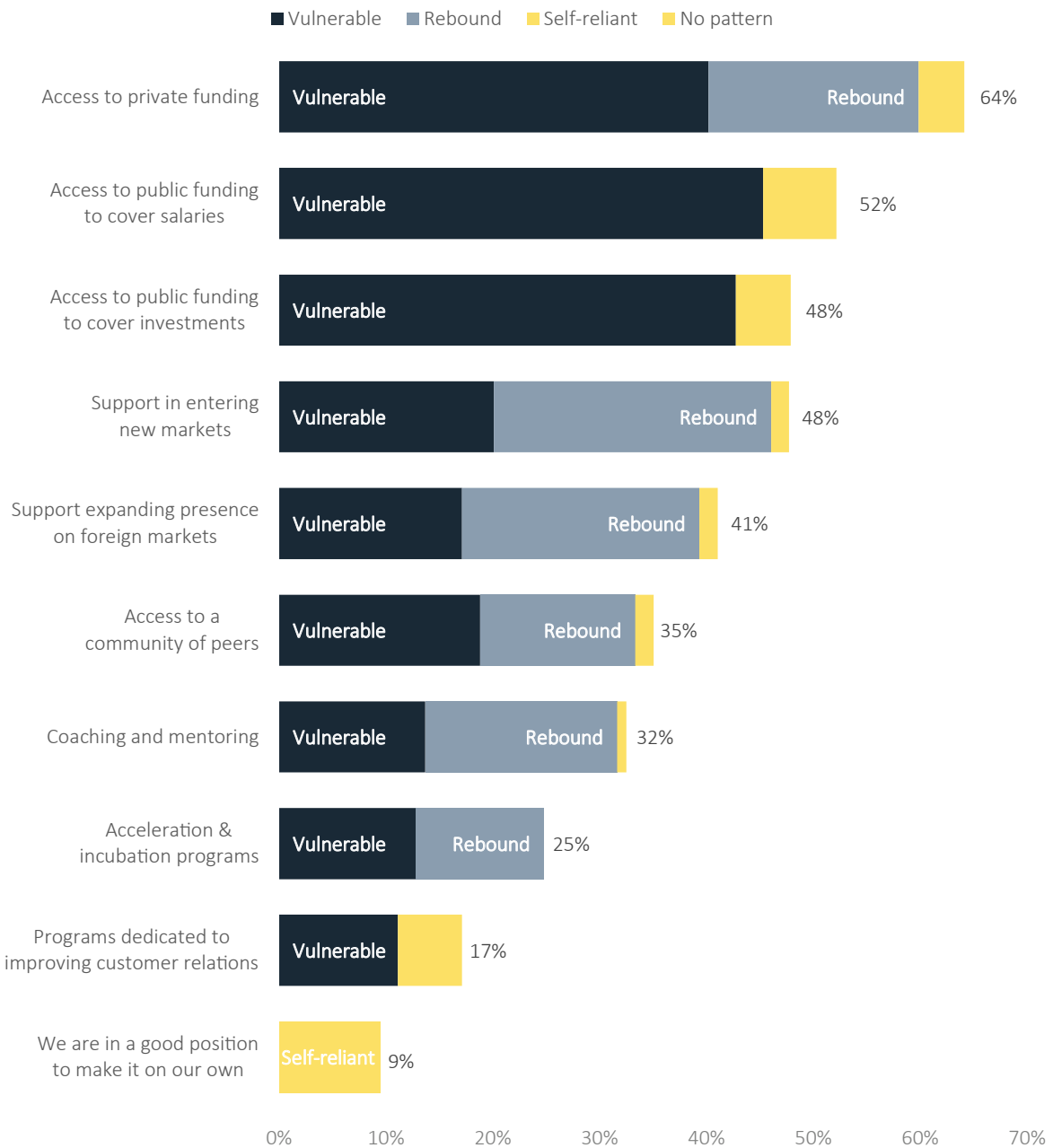
The Rebound is like the previous one. Although they usually generate revenue (72%), the volume is not significant (~120K euro). They are looking for support, both in terms of programs and finances. However, they are looking exclusively towards private funding. This relates to their need for support to expand market presence and enter foreign markets as private funding is traditionally associated with fast market expansion and (hyper) growth. The start-ups from this group are more prone to be oriented towards the customer. As the dominating verticals here are Health-Tech and Marketing, for these business models it is crucial to improve customer retention and increase customer adoption.

Table 5. The characteristics of tech start-ups based on their recovery

Group	#	Start-upsWith Income	Income (avg.)	Start-upsWith Employees	Employees (avg.)	Operating Years (avg.)	Dominating fields
Self-reliant	11	73%	877,870	73%	25	6.4	Automation
Vulnerable	56	54%	198,080	43%	5	3.1	Health-Tech, eCommerce
Rebound	50	72%	128,473	50%	4	3.0	Health-Tech, Marketing
Total	**117**	**63%**	**237708**	**49%**	**7**	**3.4**	

Technical data: K-means clustering using Hartigan and Wong (1979) algorithm based on the answers given to the set regarding support measures. All variables were coded as dummy and were used without further standardization. Evaluation metrics: maximum diameter is 3; minimum separation is 1; Pearson's γ is 0.489; the Dunn index is 0.354; the entropy is 1.013; the Calinski-Harabasz index is 23.327. All the values in the tables were computed as a second step after the clusters were created.

Figure 22. Recovery needs



Future development

We asked the companies how they see their start-up evolution in the next period and what are their priorities for the next 3, 6, and 12 months. Answers were analyzed in terms of common words used, which were subsequently given a meaning within a defining phrase. Recurring words were grouped in nine vocabularies, based on the way words were used together. We considered that two words are similar if they were used in the same response, and they are dissimilar if they do not appear together in a response. The nine vocabularies are, in fact, semantical networks that gives us an insight in the hopes, fears and plans of the companies. These semantical networks are highly embedded in the organizational and market position of the start-ups, structuring their expectation of the future.

Figure 23.

The semantical network used by larger and smaller start-ups to phrase their hopes for the post-pandemic months

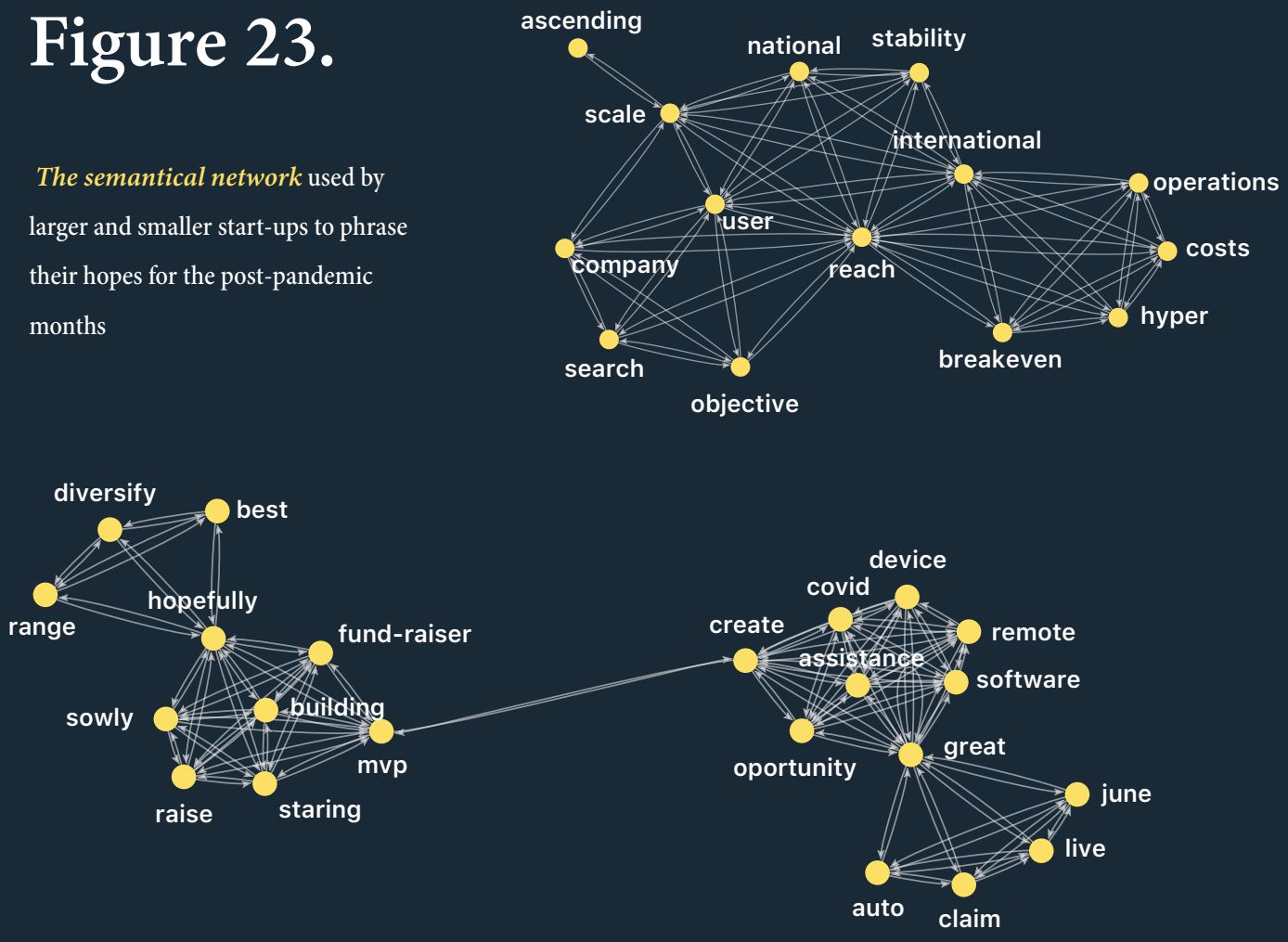


Table 6. Nine vocabularies of hopes for the future (top ten most used words of a vocabulary)

Vocab.	#	Employees	Revenue	Word 1	Word 2	Word 3	Word 4	Word 5	Word 6	Word 7	Word 8	Word 9	Word 10
1	4	12	228,947	scale	reach	international	ascending	company	operations	user	national	stability	objective
2	59	10	355,097	new	market	product	launch	business	team	service	focus	get	work
3	7	9	164,872	sell	develop	accelerate	slow	delays	looking	country	fast	adapt	high
4	11	7	174,181	grow	plan	rate	partner	strategy	constant	evolution	according	immense	keep
5	11	3	147,088	will	next	month	still	pivot	finance	contracts	survive	offer	likely
6	7	2	81,103	year	expand	going	good	manufacture	order	industry	end	predict	towards
7	8	2	99,357	continue	expect	see	start	can	profit	become	funding	digital	funds
8	3	2	20,768	invest	round	readiness	finish	receive	raising	preparing	current	important	application
9	4	1	6,212	mvp	create	covid	hopefully	great	best	remote	opportunity	building	software

Table 7. Nine phrases using the top ten words from a vocabulary. *No company gave these answers. These are styled sentences to capture the nine types of repertories of post-pandemic expectations.*

1. *After the company reaches national stability, the next objective will be to scale the business at international level to grow the user number and expand operations.*
   For the larger start-ups, in terms of employees, the hope is to rescale their business at an international level.

2. *The focus of our business, team and work is on a product/service launch to get to new markets.*
   For the larger start-ups, in terms of revenue, the main objective are to reach new markets and to diversify.

3. *The country's economy slowed down with high delays for business, forcing us to adapt fast, to accelerate the development, and sell more.*
   After the delays following the pandemic, the seven companies using this vocabulary are looking to adapt, to accelerate their development, and increase their sales.

4. *According to our growth strategy, we plan to rate our evolution and keep it constant by adding a new partner to the business, which is an immense opportunity.*
   These middle-sized start-ups hope to grow using strategic alliances and new partners to enter and secure markets.

5. *To still survive in the next few months, we want to attract new financial sources and sign new contracts, while trying to pivot to offer the best to our investors.*
   These small-sized start-ups hope to survive in the next months by pivoting the business through new financial sources a new contract.

6. *We predict that this year is going to be a good one for manufacturers to end the pandemic caused damage, while also expanding towards new industries.*
   The start-ups using this vocabulary put their hopes in the expansion of post-pandemic demand trickling down the supply chains, given their B2B business model.

7. *We continue to expect good times and more funds, but for the moment we want to start making profit from the digital update and try attracting new funding to improve our business.*
   The start-ups using this vocabulary are looking for public and private new funds to kick start their operations

8. *Our current readiness gives us the green light to prepare the application to raise a new round of important investment, while finishing to collect feedback from the customers.*
   These small start-ups are currently preparing to receive or to apply for new rounds of investment.

9. *Remote work, as a COVID-19 side-effect, hopefully offered us the possibility to create a great MVP and build the best software.*
   For the smallest start-ups, in terms of employees, the hope is to put the first version of their products on the market

Conclusions

The COVID-19 pandemic shook the world in an unprecedented way and brought many businesses to a halt, dividing the industry into winners and the ones struggling to survive or already losing the battle. The idea of a research on tech start-ups came with the need for identifying future trends on how the ecosystem will function after being hit by the pandemic. Another direction was to assess the needs of the start-ups and how they can be helped to survive and see how technology start-ups in Romania adjusted their business strategy and what decisions they made in managing their business.

To better understand the main activity of the start-ups participating in the study, data regarding the business domain were collected. Strangely, there is a mismatch between the official nomenclature of economic activities and the self-declared vertical of start-ups. According to NACE codes, most of the incorporated responders are active in the Information and Communications sector, while the three most mentioned verticals based on self-classification were Health-Tech, Automation and Marketing.

Another important information was the geographical distribution of the start-ups. While the Capital of the country remains the main pole for start-ups, with 49 start-ups, the West is overcoming its disadvantage with 30 start-ups in Cluj, 10 in Timiș and 6 in Bihor. Although Iași is the most developed city in the Eastern part of Romania, unfortunately it was not represented by any start-up in our study, while the South-Eastern and South-Western part of the country had a weak representation.

The study revealed that the pandemic's effects were nonlinear depending on the industry and on the start-up size, however over 70% of the start-ups confirmed that COVID-19 affected their business to some extent. Considering the gravity of the situation and the future of the business, to make sure they were making the best decision to mitigate the impact of the pandemic, founders consulted with the entire

team (50%) or the advisory board, mentors, and coaches (49%), while 39% took advice from other entrepreneurs.

The start-up ecosystem in Romania started to grow in 2017, when the number of newly founded tech start-ups tripled compared to the previous year, with the most thriving local tech start-up ecosystem being based in Bucharest, followed by Cluj, Timiș and Bihor. It was shown that the highest earners were in Automation (38.1%), Fintech (31.8%) and Marketing (12.1%).

Most of the new businesses are locally incorporated, with under 4 years on the market and no more than 4 employees. The annual turnover is of €150K and the biggest employers in fields such Fintech (35.2%), Automation (35.2%) and Marketing (14.2%).

A significant part of start-ups included are providing their services and products to other businesses (B2B, 43%). In addition, one fourth of the start-ups use a mixt business model, addressing its services and products to both individual and organizational consumers, while also using subscriptions. The start-ups reported the European markets as main expansionary target, especially France, Spain, Italy, and Poland, while also pursuing the opportunities in North America and South-East Asia markets.

To sustain operations growth funds are necessary. For Romanian tech start-ups, self-financing is the main source of funding, while 36% of them have raised private funds. The main need expressed is the access to funding. Be it public or private, the surveyed start-ups are looking for investments to fund their operations and expansion. Due to the lack of information in this area, accessing funds is a main challenge for tech start-ups.

Start-up life is very dynamic and requires a lot of stamina, flexibility, vision, and capacity to adapt. The pandemic brought not only a lot of challenges and constraints, but also opportunities for MedTech start-ups, fintech or tech start-ups using AI technologies, also revealing some good examples of reinventing, and coming up with new products.

The study illuminates the responses of the start-up ecosystem to the severe economic contraction caused by the COVID-19 pandemic and captures the hopes of the community for the post-pandemic months to come. The pandemic is not yet over, new waves are still possible with their threats on mobility and face to face interactions. Nontheless, we have a better grasp on the fragile points and strongholds in our tech start-up community and, more importantly, we better understand its complex needs. We are grateful to the entire community for its generous response to our inquiry.

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About Romanian Tech Startups Association (ROTSA)

Romanian Tech Startups Association has risen from the need of bringing together and building a community around technology start-ups in Romania. Even though the name and public communication were created this year, the organization is assembled on a foundation started in 2010. Since then, the organization has joined as a partner or implemented a series of large-scale projects in the area of entrepreneurship development in Romania.

The most known projects are: REplasticHack (2021), EduHack (2020), Techcelerator (2017 - present), Nasa Space Apps Challenge (2016 - present), TechFest (2016 - 2018), Danube Energy + (2018-2021), Transilvania Start Up (2018 - present) or Innoenergy Power Up Romania (2017 - 2018). Romanian Tech Startups Association is a non-profit, apolitical and non-governmental organization that aims to promote, support and represent the interests of tech start-ups in Romania.

ROTSA's vision is to develop and support the ecosystem of technology start-ups, aiming to become at the same time a connector for its main actors and a link with other already existing international ecosystems. Consequently, the organization has a catalytic role and aims to become the unitary voice of Romanian Technology Start-ups built on programs of practical education, transparency, mutual trust, collaboration`, and knowledge sharing.

Although at the level of the start-up ecosystem, we can boast in Romania with some famous names, an investment environment that develops from year to year, with several well-cohesive local communities, the difficulty comes from the area of pre-acceleration,

access to resources and a unitary framework. Specifically, to stimulate this pipeline of innovation and technology start-ups, it is necessary to coagulate the initiatives that support start-ups at the beginning of the road, those that are in the pre-acceleration stage. Otherwise, the efforts in this area are expensive from all points of view and, to see the results, a continual joint effort is needed. Here ROTSA interferes, by facilitating the communication and creating a better connection between the actors of the ecosystem.

Together with the ecosystem we belong to, we constantly encourage initiatives that inspire and produce change, while also assessing the performance of start-ups both individually and at ecosystem level by using unitary, measurable methodologies. By doing so, we can benchmark progress yearly, while uncovering areas of development and developing corresponding solutions.

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