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Supporting the Ukrainian Tech Ecosystem

Grant agreement nº:101104445

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Executive Summary

Abstract	This report presents and discusses the results of the 1st wave of the research of the deep tech sector in Ukraine. The research was conducted from April to July 2024 by combining quantitative and qualitative methods. It focused on the characteristics of the deep tech sector in Ukraine, the products and markets of the companies making up this sector, and their needs and experience in raising external funds. The report offers recommendations on supporting the development of the deep tech sector in Ukraine.
Keywords	Deep tech, research, technology ecosystem, startups

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Table of acronyms

Abbreviation	Definition
AgTech	Agricultural technology
AI	Artificial intelligence
AR	Augmented reality
B2B	Business-to-business
B2C	Business-to-consumer
B2G	Business-to-government
CEO	Chief Executive Officer
CRISPR	Clustered regularly interspaced short palindromic repeats — technology used to selectively modify the DNA of living organisms
EU	European Union
EV	Electric vehicle
FMCG	Fast-moving consumer goods
HPC	High-performance computing
HR Tech	Human resources technology
IPO	Initial Public Offering
IT	Information technology
MBA	Master of Business Administration

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ML	Machine learning
PhD	Doctor of Philosophy degree
ROI	Return on investment
R&D	Research and development
STEM	Science, Technology, Engineering, or Mathematics
UASEEDs	Seeds of Bravery project
UAV	Unmanned aerial vehicle
USA	United States of America
VR	Virtual reality

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Purpose of the document

This report presents and discusses the results of the 1st wave of the research of the deep tech sector in Ukraine that demonstrate the state of the deep-tech and innovation ecosystem in Ukraine and provides the needs assessment for Ukrainian deep tech startups.

Methodology

Techosystem is a civic union of the tech ecosystem actors in Ukraine with a special focus on product companies that aims to unite all market players to create more favourable business conditions in Ukraine, promote the tech ecosystem, and showcase its potential globally.

We have created an online database of IT-companies, people, investors and tech ecosystem in Ukraine.

In 2024, Techosystem carried out the first update of the research of the Ukrainian deep tech sector as a part of the Seeds of Bravery (UASEEDs) project.

The research was conducted by combining quantitative and qualitative methods. For quantitative research, Techosystem designed and sent out an online survey form (see Annex I) to Ukrainian startups working in the deep tech sector. The representatives of the startups — founders, Chief Executive Officers (CEOs), and others in decision making and leadership positions — filled in the survey form themselves. The data collection for the quantitative survey lasted from June 5 to July 12, 2024.

Overall, 44 companies participated in this survey. Techosystem cleaned the data for logic and clarity. Most respondents indicated that their company can be classified as a deep tech company. There was, however, one startup that did not believe this label applied to them and one

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company that filled in the questionnaire twice. Therefore, these two respondents were taken out of the sample and the final sample for the quantitative analysis is 42 companies. The quantitative survey results are presented and discussed in this report. We list the names of the companies that took part in the research and gave their consent to citing them in the survey report. Still, all the answers of the companies that took part in the quantitative survey are aggregated and presented anonymously and cannot be tracked to individual companies.

For qualitative research, Techosystem conducted in-depth interviews with the representatives of 10 deep tech startups in Ukraine. The interviews provide a deeper understanding of the background and current state of deep tech startups in Ukraine and supplement the information gathered through the quantitative survey. The in-depth interviews were conducted from April 24 to July 17, 2024. The information from the interviews is aggregated and presented anonymously, and quotes from the interviews are cited without naming the companies.

Overall, the first wave of this research contributes to better understanding of the types of deep tech companies in Ukraine, the amount and the sources of funding raised by these companies, and the current market conditions and behaviour of these companies. It will also serve as a baseline study for the next wave of the research planned within the UASEEDs project.

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Results of the research

1. UKRAINIAN DEEP TECH SECTOR: INDUSTRIES, MARKETS, AND ATTRIBUTES

This section of the report focuses on foundational aspects of the startups. It explores the years in which the startups were founded, the industries they represent, and the number of employees working in these deep tech companies. These questions aim to provide insights into the background, sector distribution, and workforce size of the surveyed startups.

1.1.Industry representation of startups

To understand the industry representation of startups, we asked the respondents to choose the industry that most closely corresponds to their startup.

Industries represented by startups:

- AI (Artificial Intelligence): 15 responses

- Information Technology: 6 responses

- Biotechnology: 2 responses

- Quantum: 2 responses

- Fintech: 2 responses

- Other (please specify): 14 responses

    - Defense
    - Social tech

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- Energy

- Legal Tech

- Agtech

- Building and construction

- EdTech

- Recommerce

- Photonics

- Cleantech/Carbontech

- Automotive

- Distributed energy generation

- MedTech AI

- Psy tech

● Don't know / Difficult to answer: 2 responses

Insights:

● Dominance of AI: AI became the most represented industry, with 15 startups indicating their focus in this area. This highlights the strong presence and growth of AI technology within the deep tech sector.

● Information Technology: Information Technology is also a significant category, with 6 responses, showcasing its importance in deep tech innovation. Typically, this category includes fields that do not fall into classical industries but directly create innovative IT products.

● The "Other" category gathered about a third of answers and with diverse startups operating in various fields such as defence, energy, fintech, legal tech, quantum, agtech, building and construction, edtech, ecommerce, photonics, cleantech/carbontech, automotive, distributed energy generation, medtech AI, and psy tech. This

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diversity reflects the wide range of applications and innovations within the deep tech landscape.

1.2.When was the startup founded?

To understand the timeline of startup formations, we asked the survey respondents about the year their startup was founded.
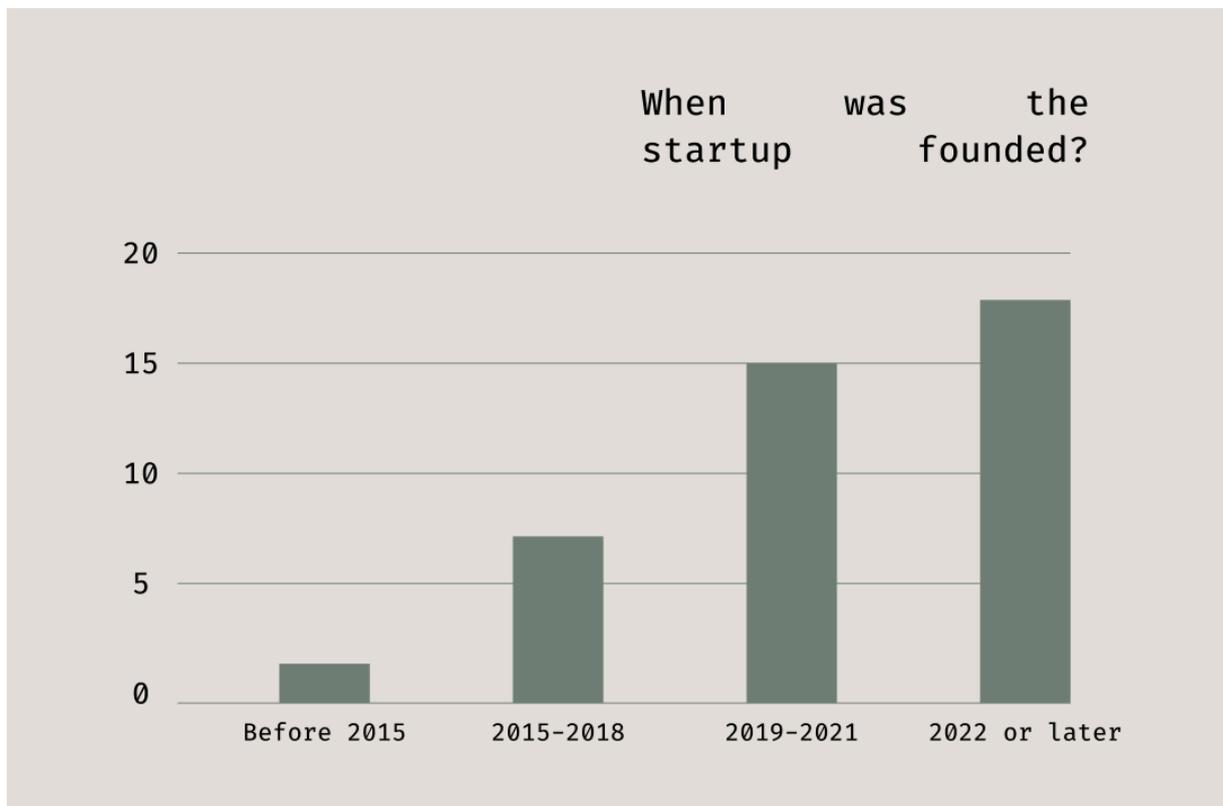
Figure 1 – When was the startup founded?

Findings:

- The majority of startups were founded in 2022 or later, indicating a surge in new ventures in the recent past.

- A significant number of startups were also founded between 2019 and 2021, reflecting a robust trend in the creation of new deep tech ventures over the last few years.

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- A smaller group of startups were founded between 2015 and 2018, while only one startup was founded before 2015, indicating fewer older startups in the survey sample.

1.3. Context and markets

The period when the most surveyed startups were founded – from 2019 to 2022 or later – coincided with COVID-19 pandemic and the beginning of the full-scale war in Ukraine.

The pandemic triggered a global shift in technology use leading to the rapid expansion of online solutions for learning and collaboration.

At the same time, the rising number of users during the pandemic posed a challenge for the interviewed startups. For example, one of the interviewed startups that offers online education services says they had to deal with a surge of about 80,000 new users over a 3-month period.

Due to the full-scale russian invasion of Ukraine, large numbers of Ukrainians, especially mothers with children, found refuge abroad. The interviewed startups also try to reach out to them as to a potential market. For example, the interviewed education platform offers courses to these clients.

Some of the products offered by the interviewed startups emerged or added features in response to the risks posed by the russian invasion. One example is an interviewed startup that provides information storage services. The information they store includes memorials for Ukraine's fallen military service members. According to this startup, this data is targeted by russia in attempts to obtain access to the fallen person's surviving relatives and to contact them for propaganda purposes. To counter this risk, the startup has set up advanced data encryption.

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Overall, most interviewed startups work both on the Ukrainian market and on international ones. The United Kingdom, the USA, and Middle East were mentioned among the markets where these startups currently work, while EU countries and Israel were mentioned as potential markets.

The interviewed startups have business clients (the business-to-business or B2B model) as well as private ones (the business-to-consumer or B2C model). Sometimes they have both. For example, apart from B2C school children clients, the interviewed education platform offers its services to companies as a staff care option – this way companies provide education opportunities for the children of their employees. The interviewed startup that offers VR immersion for mental health consulting sessions works with clinics but plans to start selling to individual consumers.

Several interviewed startups also work in the business-to-government (B2G) sector: by providing AI-driven solutions for the Ukrainian government to identify and counter russian informational attacks and propaganda, by offering innovative water filtering devices to be used by Ukrainian military in the field, or by setting up screenings for the population together with the Ukrainian Ministry of Health where their AI-based software helps with early diagnostics of chronic diseases.

1.4. Number of employees in deep tech companies

To understand the size of deep tech startups, we asked respondents about the number of employees in their companies.

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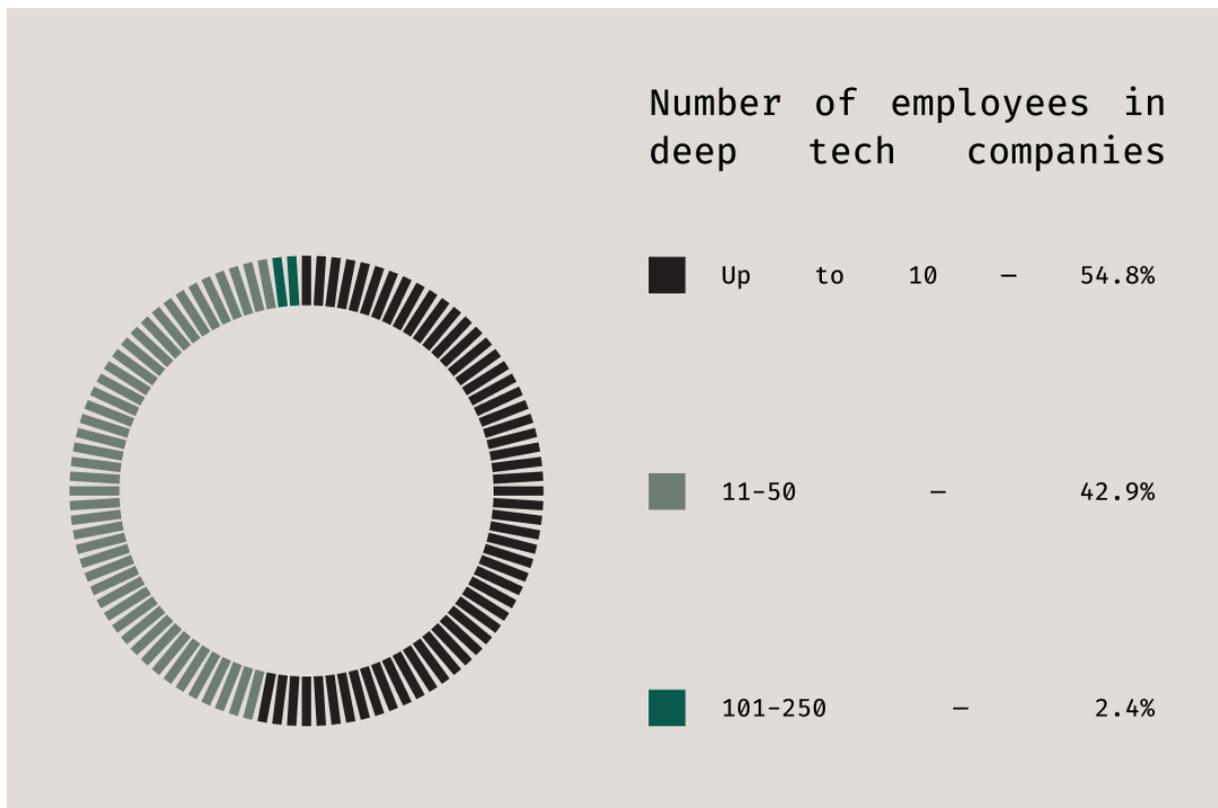
Figure 2 – Number of employees in deep tech companies

The majority of deep tech startups who took part in the survey have small teams, with 54.8% indicating they have up to 10 employees. This reflects deep tech startups' lean and agile nature, allowing for flexibility and rapid innovation.

A significant number of startups (42.9%) have between 11-50 employees, indicating growth and the need for a more structured team to support scaling operations and development.

Only one startup reported having between 101-250 employees, which suggests that larger teams are less common among deep tech startups.

1.5.Company attributes in deep tech

We asked companies to self-evaluate themselves regarding deep tech attributes we defined previously. To evaluate the accuracy of statements

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about the companies our respondents represent, we asked them to rate the following attributes from "very accurate" to "not accurate at all".

Approximately 78% of respondents (very accurate + mostly accurate) believe their companies are developing cutting-edge scientific or engineering solutions.

"We develop cutting-edge scientific or engineering solutions":
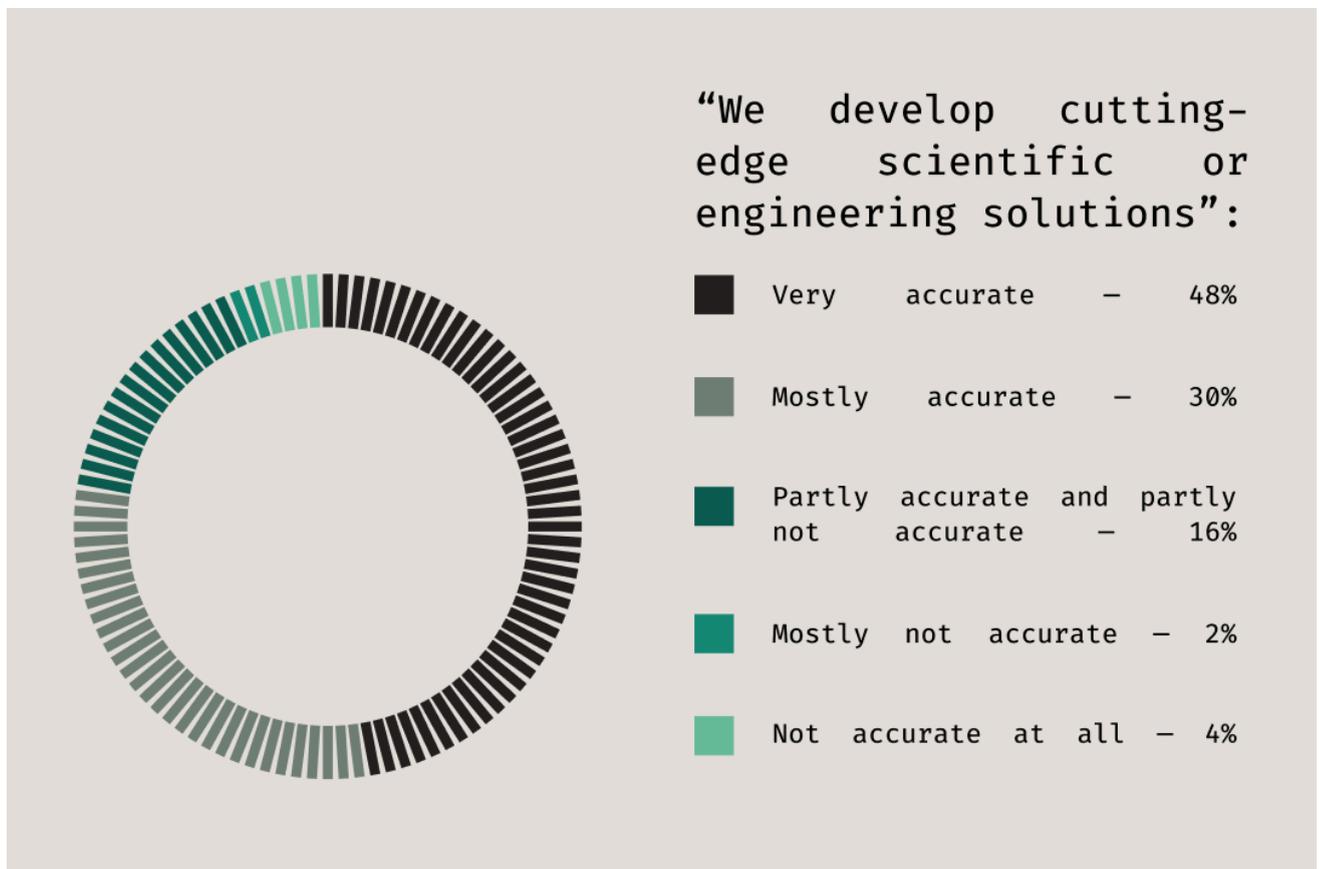
Figure 3 – Relevance of the statement "We develop cutting-edge scientific or engineering solutions"

About 94% of respondents (very accurate + mostly accurate) consider their companies to be tackling big challenges, highlighting the ambitious nature of these startups.

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"We tackle big challenges":

"We big tackle challenges":

- Very accurate — 64%
- Mostly accurate — 30%
- Partly accurate and partly not accurate — 6%
- Mostly not accurate — 0%
- Not accurate at all — 0%
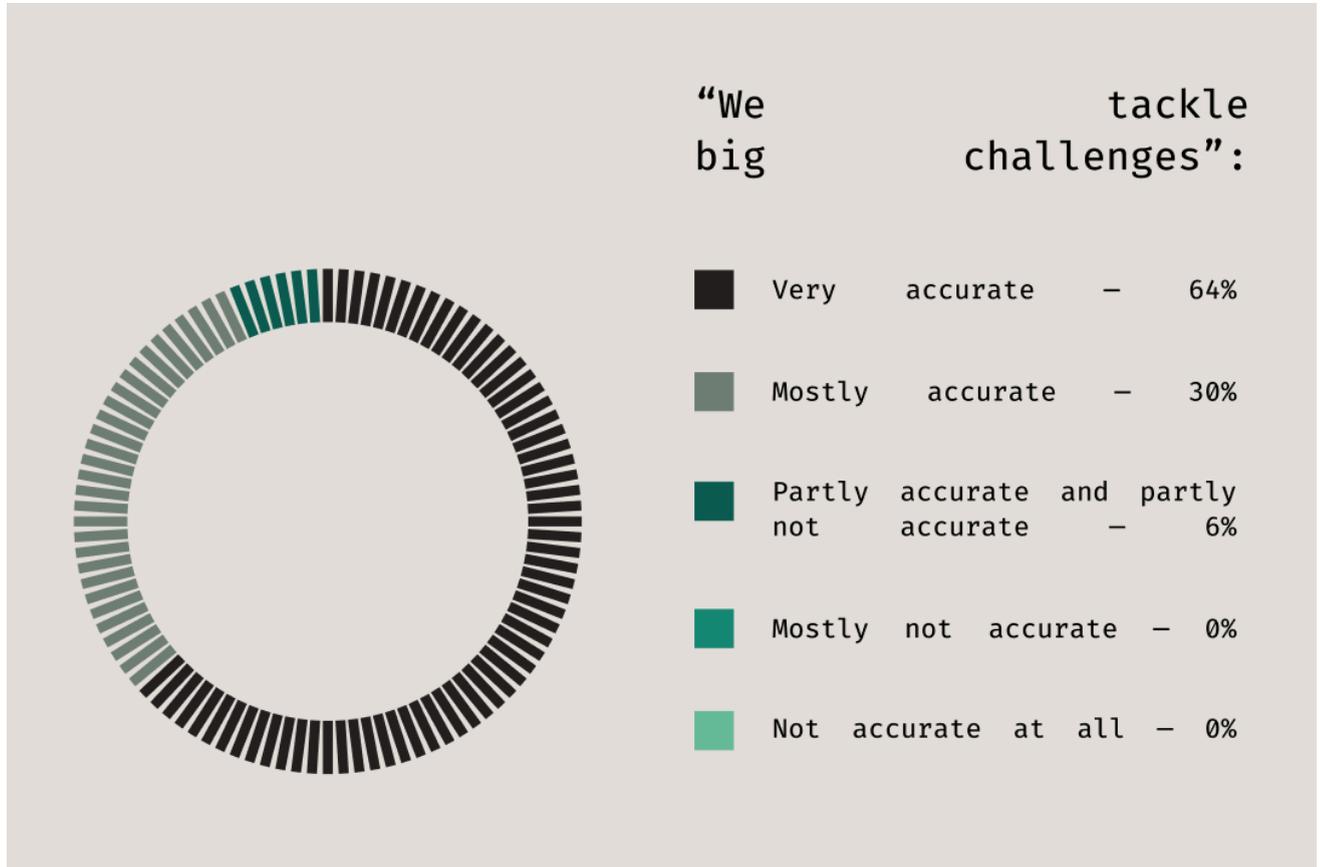
Figure 4 – Relevance of the statement "We tackle big challenges"

Around 82% of respondents (very accurate + mostly accurate) acknowledge their companies' involvement in the development of the startup community, showcasing a commitment to fostering innovation ecosystems.

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"We are involved in the development of the startup community":
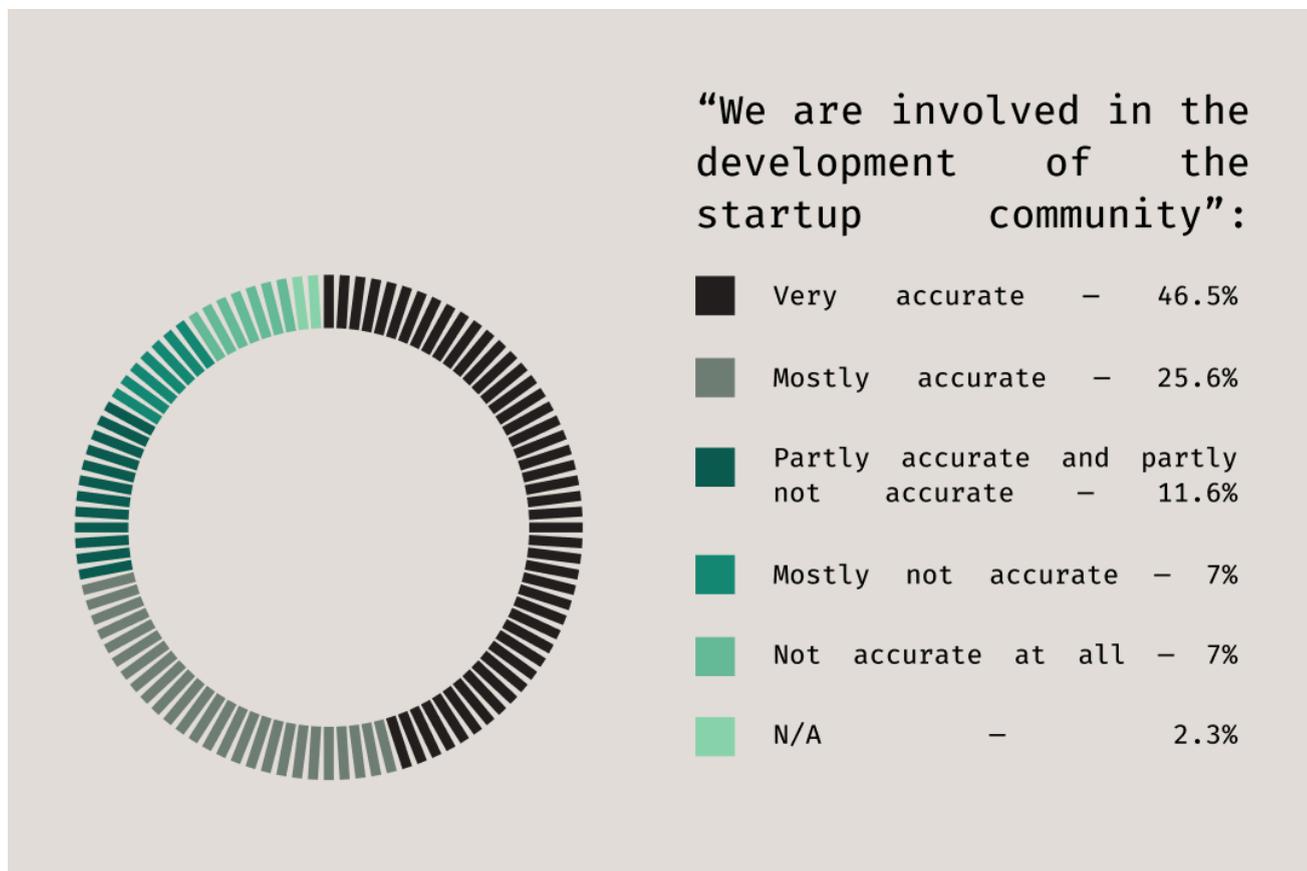
Figure 5 – Relevance of the statement "We are involved in the development of the startup community"

These results highlight that most respondents view their companies as highly involved in developing cutting-edge solutions and tackling big challenges. There is also a significant acknowledgement of their role in the development of the startup community.

2. PRODUCTS AND SERVICES PROVIDED BY DEEP TECH STARTUPS

This section delves into the core offerings of deep tech startups, exploring the products and services they provide, their business and revenue models, and their market strategies. By understanding these

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aspects, we can gain insights into the innovative solutions these startups bring to the market and their plans for growth and impact.

2.1.Primary application area of products/services

To understand the primary application areas of the products and services offered by deep tech startups, we asked respondents to specify the industry their product/service most closely corresponds to.

Application areas of deep tech startups

■	Healthcare	— 20.9%
■	Financial Services	— 9.3%
■	Manufacturing	— 4.7%
■	Transportation	— 2.3%
■	Agriculture	— 7.0%
■	Energy	— 4.7%
■	Education	— 4.7%
■	Social Tech	— 4.7%
■	Sustainability	— 4.7%
■	Other	— 37.2%
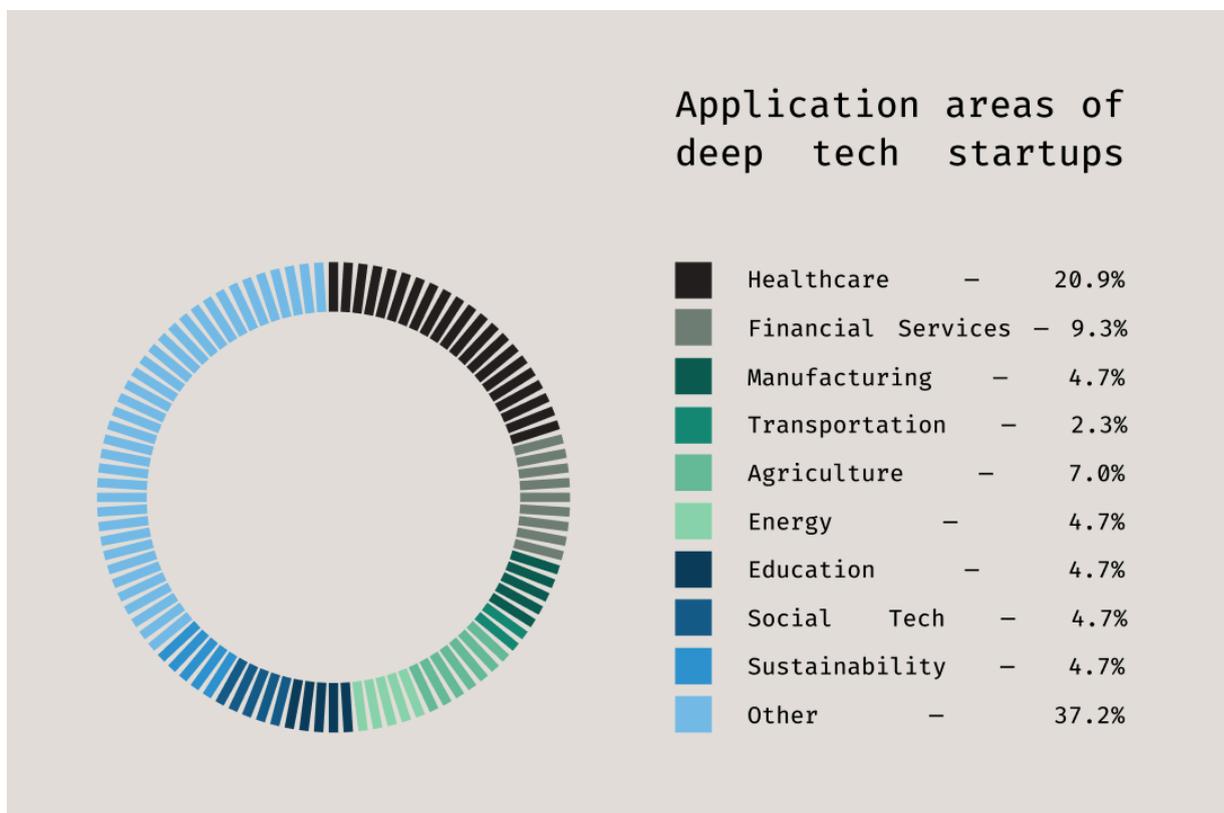
Figure 6 – Application areas of deep tech startups

Application areas of deep tech startups in our research:

- Healthcare: 9 responses

- Financial Services: 4 responses

- Manufacturing: 2 responses

- Transportation: 1 response

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- Agriculture: 3 responses

- Energy: 2 responses

- Education: 2 responses

- Social Tech: 2 responses

- Sustainability: 2 responses

- Other: 16 responses.

The following insights have been found:

Healthcare is the most common primary application area, with 9 responses, indicating a strong focus on health-related innovations in the deep tech sector.

Financial Services is also a significant category, with 4 responses, showcasing the importance of technology in transforming financial systems and services.

The "Other" category is diverse, covering various fields such as defence, social tech, FMCG, HR tech, energy, security, document automation, HPC, proptech, cloud management, education, construction, agritech, sustainability, productivity, and more. This diversity reflects the wide range of applications and innovations within the deep tech landscape.

The products and services developed by the companies that were interviewed with in-depth interviews include online education services, visualisation with virtual reality (VR), management and optimization of digital infrastructure, secure storage of information, identification of minerals critical for supply chain, water purification, quantum computing solutions, identification of the information trends in the online media, and others.

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2.2. Stage of development of startup products and/or services

To understand the stage of development of products and services offered by deep tech startups, we asked respondents to specify their current stage.
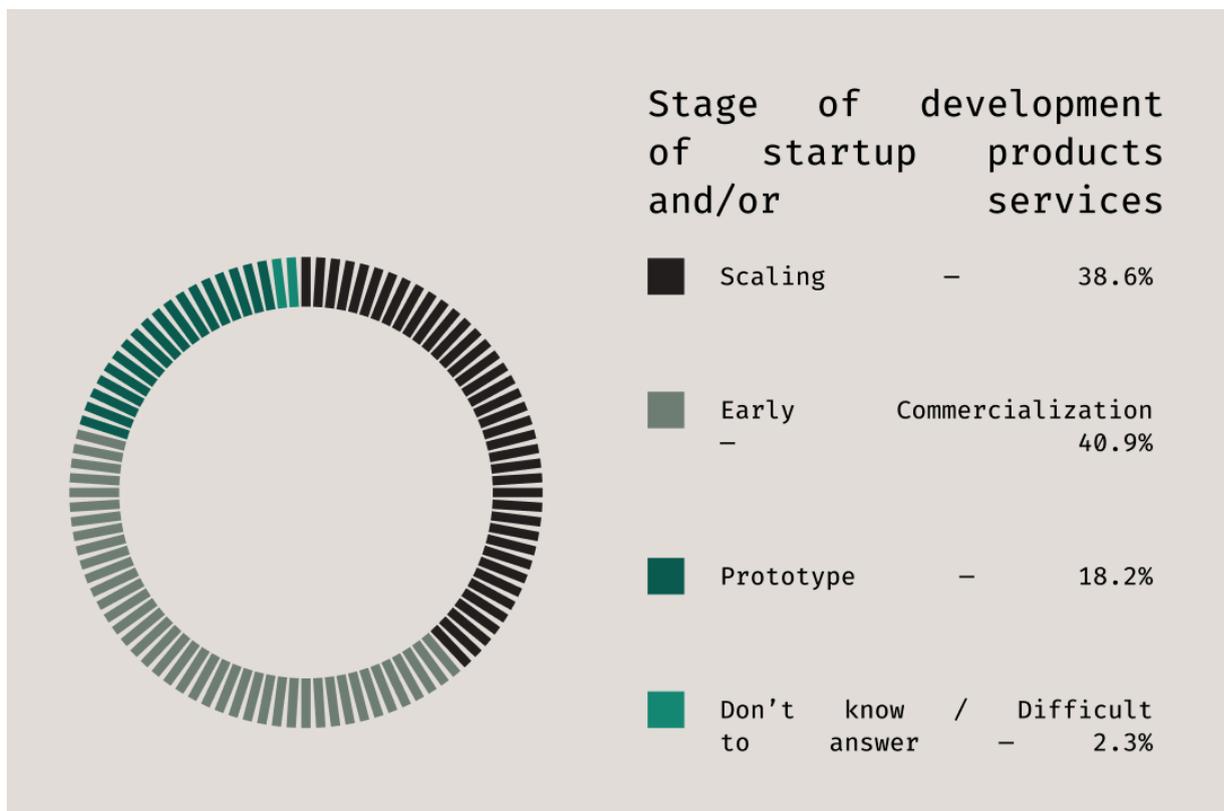
Figure 7 – Stage of development of startup products and/or services

Key trends:

The majority of deep tech startups are either in the early commercialization (40.9% responses) or scaling (38.6% responses) stages. This indicates that many startups have moved beyond the prototype phase and are actively bringing their products to market or expanding their operations.

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A smaller group of startups (18.2% responses) are in the prototype stage, suggesting that these companies are still developing and testing their products before commercial release.

2.3. Promising examples of deep tech products and services from our research participants

To gain insights into the deep tech products and services offered by startups, we collected detailed descriptions of their products and services from the respondents of the quantitative survey.

Their products and services cover a wide range of industries, including HR tech, AI, healthcare, finance, and energy. Many startups leverage advanced technologies such as AI to offer innovative solutions. Most startups aim to address specific market needs and societal problems, emphasising practical applications of their technologies.

Examples of promising deep tech products and services showcased in this survey are the following:

- Falcons — unmanned aerial vehicle (UAV) interception autopilot. An autopilot system designed for intercepting unmanned aerial vehicles.

- Mantis Analytics — deep tech stack for security. A platform leveraging deep learning models for propaganda detection, geolocation, and threat intelligence.

- Effie> (IPLAND) — AI platform with industry processes: An AI platform that consolidates data from various business systems, using image recognition and AI assistants to solve sales and trade marketing problems.

- Wolbe AI — career and personality test. A comprehensive career and personality test combining scientific research,

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big data, and AI matching to help users find passionate careers.

- Netex Cloud Technologies — business process automation. Automation solutions for business processes.

- NDI Foundation — natural hydrogen development. Developing solutions for natural hydrogen extraction and utilisation.

- Fondexx — algorithm for asset tracking. An infrastructure with algorithms to track and trade asset correlations live.

This summary shows that the products and services offered by Ukrainian deep tech startups are diverse and innovative and highlights their potential to impact various industries and address critical challenges.

Some of these and other deep tech startups were also interviewed in the qualitative study.

2.4. Technologies as the foundation of products and services

To understand the technological foundations of deep tech startups, we asked respondents to identify the core technologies underpinning their products or services.

Core technologies used:

- AI/Machine Learning: 38 responses

- Bioengineering: 4 responses

- Quantum Computing: 3 responses

- Don't know / Difficult to answer / Not applicable: 2 responses

- Other (please specify): 9 responses (1 response per technology)

    - Geological methods, modern drilling, energy storage

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- Microbiology, analytical chemistry

- Cloud management

- VR, spatial video, computer vision

- Robotisation of prefabricated building manufacturing and assembly

- Electrical engineering

- Crystal growth and processing technologies

- Wireless

- Mechanics, thermodynamics.

Key technological trends:

The AI/Machine Learning Dominance. AI/Machine Learning is the frontrunner, with 38 mentions, underscoring its central role in driving deep tech innovation. This overwhelming preference highlights how AI is revolutionising various industries, making it an indispensable component of modern technology.

Significance of Bioengineering and Quantum Computing. Bioengineering (4 mentions) and Quantum Computing (3 mentions) are also prominent, showcasing their importance in specialised applications. These advanced technologies are opening new frontiers, from healthcare breakthroughs to quantum advancements, pushing the boundaries of what's possible.

Diverse Technological Foundations. The "Other" category is a testament to the rich diversity in the deep tech sector. It encompasses a range of specialised technologies such as geological methods, microbiology, cloud management, VR, electrical engineering, and more. This variety reflects the innovative spirit and the multifaceted nature of deep tech startups, each carving out their niche with unique technological solutions.

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In essence, the deep tech landscape is a vibrant tapestry of cutting-edge technologies, with AI/Machine Learning leading the charge. This trend underscores the relentless pursuit of innovation, driving startups to explore and harness a wide array of advanced technologies to solve complex problems and create value in new and exciting ways.

The interviewed startups described the technologies their companies are driven by. Several use AI: an education platform for school children uses AI to generate daily logical challenges and to customise the activities for every child by mapping out an individual learning trajectory, while other startups look for raw materials or diagnose chronic illnesses in early stages with the help of AI. Other technologies mentioned by the interviewed startups include quantum computing, machine learning, VR, 3D printing, and blockchain.

The representatives of the interviewed deep tech startups pointed out that the technology their startups use requires a lot of research and creativity and does not promise straightforward results: "This technology is very research-heavy, it does not have a clear movement from point A to point B. It's a creative search, we are trying to find approaches that would build up our technology and would satisfy our clients", said a founder of one of the interviewed startups.

3. TEAMS

Understanding the team structure of deep tech startups is crucial to comprehending how these companies operate and succeed. This section will explore who is involved in these startups, their responsibilities, engagement limits, and the gender composition of the teams.

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3.1.   Number of founders in deep tech startups

To understand the typical founding team size of deep tech startups, we asked respondents to indicate the number of people who can be considered its founders.
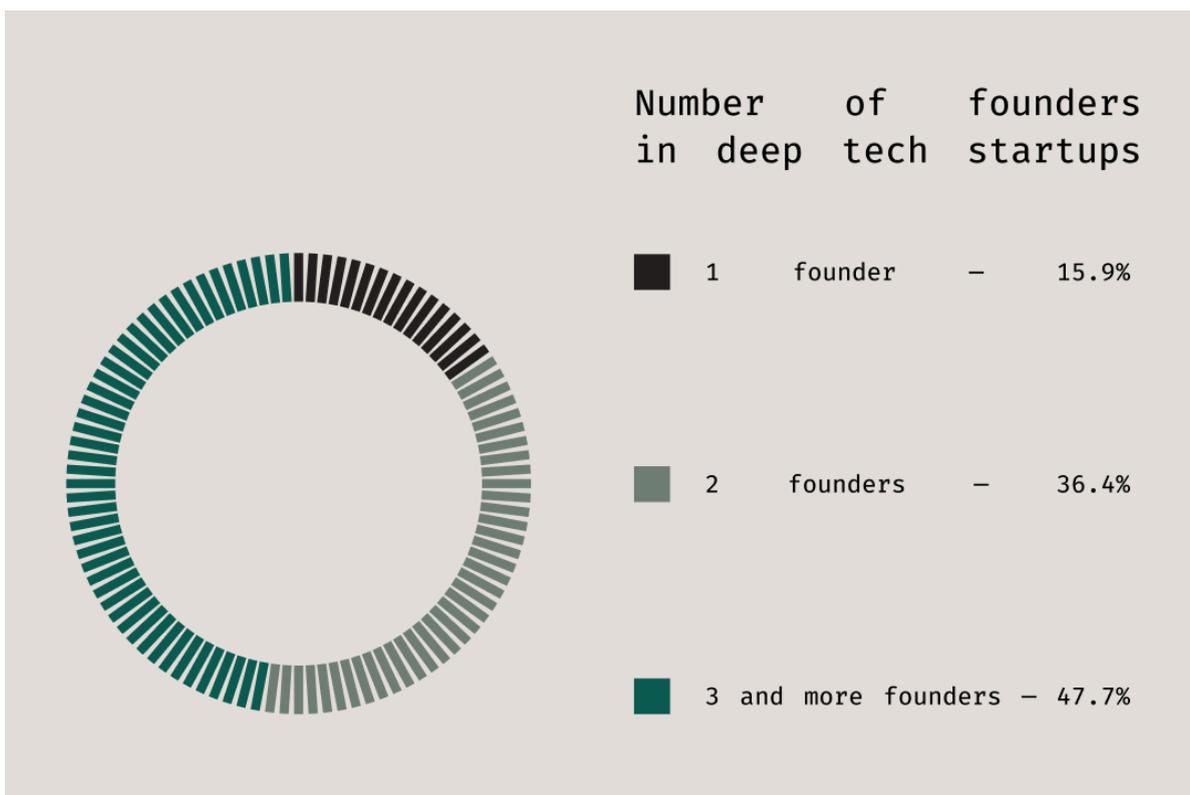
Figure 8 – Number of founders in deep tech startups

The majority of deep tech startups (47.7% of responses) are founded by teams of 3 or more individuals. This suggests that having a diverse and complementary founding team is common in the deep tech sector, possibly due to the complex and interdisciplinary nature of these ventures.

A significant proportion, 36.4%, have two founders, indicating a trend towards collaboration and partnership in founding teams, providing a balance of skills and expertise.

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Solo founders make up 15.9% of the responses, highlighting that while solo entrepreneurship is less common in deep tech startups, it is still a viable path for some entrepreneurs.

These findings suggest that deep tech startups often benefit from a collaborative founding team, leveraging the diverse skills and knowledge of multiple individuals to tackle the complex challenges inherent in deep tech innovation.

3.2. Co-founders number dynamics in deep tech startups

To gain insight into the team dynamics of deep tech startups, we inquired about the current number of co-founders in each respondent's startup and compared it with the initial number of co-founders at the startup's inception.
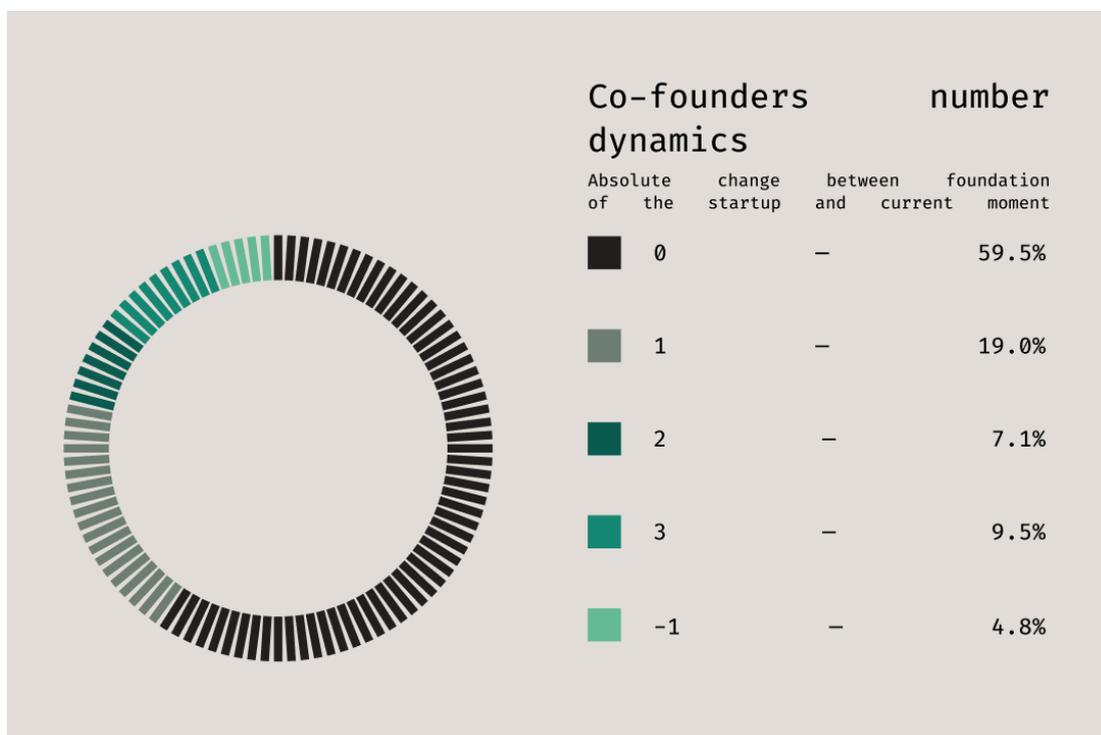
Figure 9 – Co-founders number dynamics

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As the chart shows, most companies (59.5%) have the same number of co-founders as at their inception. However, 36.6% have one to three more co-founders now.

- 19.0% of startups have one more co-founder than at the start.

- 9.5% of startups have three additional co-founders compared to their initial number.

- 7.1% of startups have two additional co-founders since their inception.

Only 4.8% of startups have one fewer co-founder than they did initially.

In the interviewed startups with several co-founders, the co-founders usually divide the responsibilities: one person can take up a technical or research role, while another one is responsible for marketing, sales, or business development.

3.3. Hiring

The interviewed founders of deep tech startups said they are looking for employees through personal networks and by posting vacancies on such platforms like LinkedIn, DOU, Djinni (mostly for tech jobs), Work.ua and Robota.ua (mostly for non-tech jobs), HappyMonday.ua (for creative industries jobs). As reported by the interviewed founders, the opportunity to work in the high-tech sector and with cutting edge technologies is an important factor of motivation for the potential employees.

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3.4. Average work experience in the field among team members

To understand the level of expertise within deep tech startups, we asked respondents about the average work experience in the field among their team members.

Average work experience in the field among team members

- ■ 7 or more years — 72.1%
- ■ 4-6 years — 16.3%
- ■ 1-3 years — 9.3%
- ■ Don't know / Difficult to answer — 2.3%
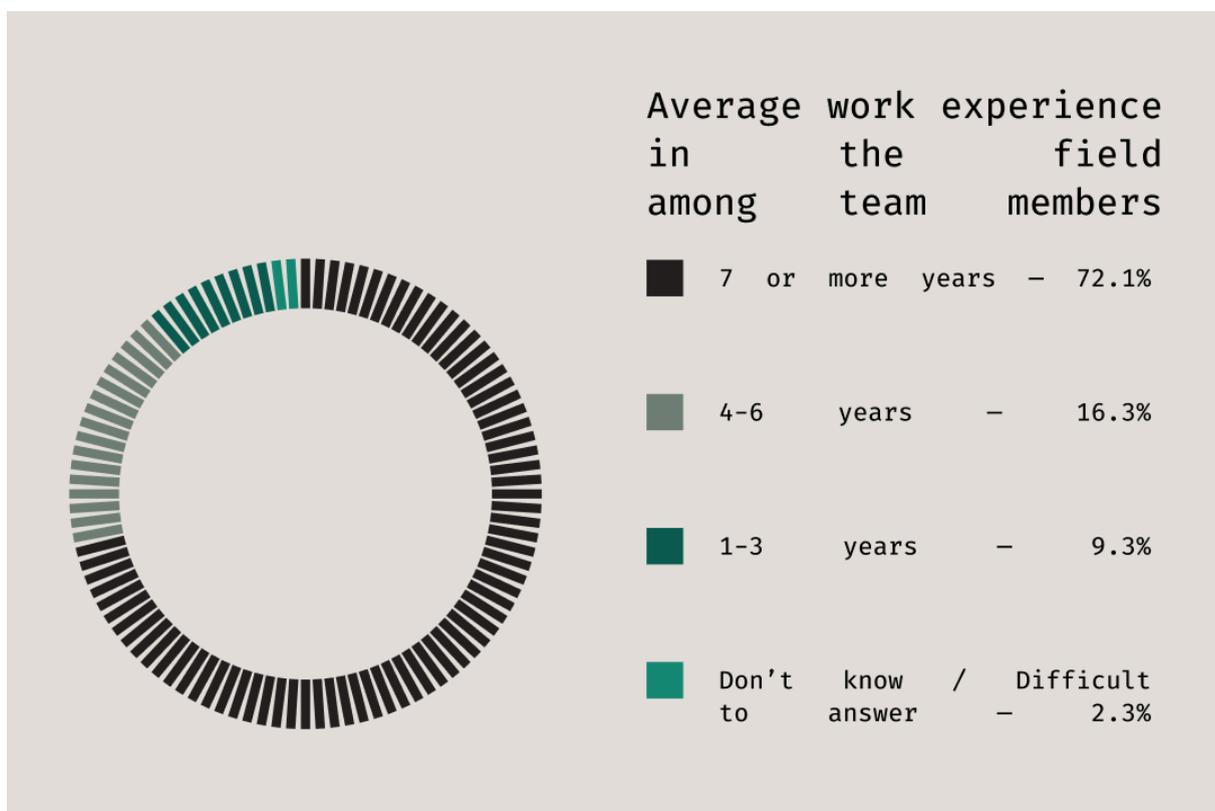
Figure 10 – Average work experience in the field among team members

72.1% of respondents reported that their team members have an average work experience of 7 or more years. This indicates that the majority of deep tech startups are built on the expertise of seasoned professionals, relying heavily on extensive knowledge and experience in the sector.

16.3% of respondents indicated that their team members have 4-6 years of work experience. These teams, while less seasoned than the top category,

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still possess substantial experience, contributing significantly to their ability to drive innovation and development.

9.3% of respondents have teams with 1-3 years of work experience on average. These teams likely include newer professionals who bring fresh perspectives and innovative ideas, adding a dynamic element to their startups.

Overall, deep tech startups in Ukraine have highly experienced teams, with 72.1% of teams having professionals with 7 or more years of industry experience. This extensive experience base is a key factor in driving the innovation and success of these ventures.

3.5.   Education level of key team members

To understand the educational background of key team members in deep tech startups, we asked respondents about the highest education level attained by their team members.
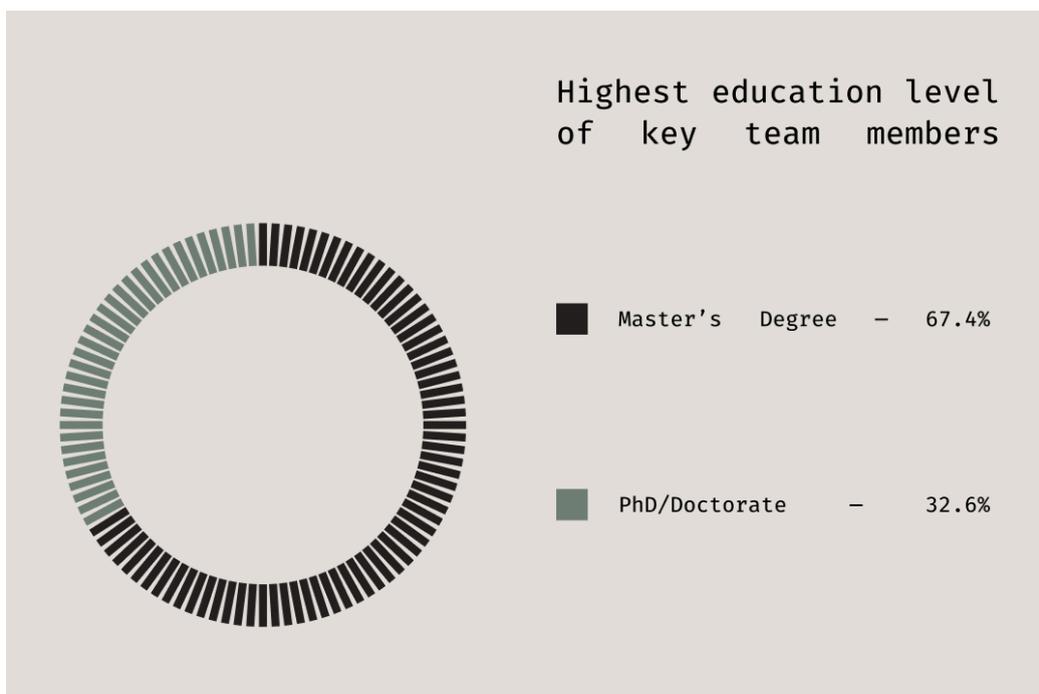
Figure 11 – Highest education level of key team members

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Overall, deep tech startups in Ukraine are characterised by a high prevalence of advanced degrees among key team members.

67.4% of respondents reported that key team members in their deep tech startups hold a master's degree. This indicates that the majority of teams rely on professionals with advanced education, highlighting the importance of specialised knowledge in the sector.

32.6% of respondents indicated that their team members hold the Doctor of Philosophy degree (PhD) or doctorate. This further emphasises the high level of expertise prevalent in deep tech startups, underscoring the critical role of advanced degrees in driving innovation and development.

This advanced educational background is a key factor in the expertise and specialised knowledge required in the deep tech sector.

The interviewed deep tech startup founders point out the unfavourable state of the education relevant for the deep tech sector in Ukraine: universities are closing down STEM programmes, and there is lack of financing. Also, Ukraine lacks state-funded grant programmes that could invest significant sums into startups, according to the interviewees, who list the EU, Israel, and Australia as the examples in this regard.

The emergence of the National Research Foundation of Ukraine was called a positive development as it provides grants for R&D.

Other positive features of STEM in Ukraine are strong schools of thought, such as the quantum mechanics school and the aerospace engineering school, according to the interviewed founders.

At the same time, the interviewed deep tech startups partner with other companies to pilot their products. For example, one of the interviewed startups partnered with a computer hardware manufacturer to enhance this hardware's quantum computing performance. They also participate in

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consortiums together with other companies and the EU universities to obtain more visibility and to gain access to more data.

3.6. Critical skills and qualities for hiring in deep tech startups

To identify the most critical skills and qualities that deep tech startups look for when hiring, we collected responses to open-ended questions[1].

These are the most important skills, according to the representatives of the surveyed startups:

Soft Skills (46.6%). Soft skills, including interpersonal skills, emotional intelligence, and the ability to adapt to various situations, are crucial. These skills enable team members to work well with others, manage stress, and handle conflicts constructively.

Technical Expertise (16.3%). Many respondents highlighted the importance of technical expertise. This includes proficiency in relevant technologies and the ability to understand and apply complex concepts. For deep tech startups, having a team with strong technical skills is crucial for innovation and effective problem-solving.

Innovative Thinking (11.6%). Innovative thinking is essential for driving creativity and finding unique solutions to complex problems. Respondents emphasised the need for individuals who can think outside the box and challenge conventional approaches, enabling the startup to stay ahead in a competitive market.

Experience in the Niche (7%). Having experience in a specific niche or field is highly valued. Respondents mentioned the need for team members

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[1] The answers were coded and grouped for analysis, but the sum of the answers does not equal 100%, as the respondents could name several skills and only the skills most frequently mentioned are listed here.

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who have a deep understanding of the industry, which allows them to navigate challenges more effectively and contribute valuable insights.

Overall, deep tech startups look for a combination of technical expertise, innovative thinking, and strong soft skills when hiring. They prioritise candidates with substantial experience in their field, a passion for their work, and the ability to adapt and grow in a dynamic environment. These attributes are crucial for driving innovation and achieving success in the deep tech sector.

4. DEEP TECH STARTUPS' ORIGINS

How do startups decide to start? Who comprised the core team? What came first: an idea or a market need? How long have they been operating?

We aimed to uncover the ways and patterns of startups' origins to enhance the capabilities of newcomer teams. Understanding these foundational elements can provide insights into the early stages of startup development and help guide new entrepreneurs through the process of establishing their ventures. This exploration will delve into the motivations, team compositions, and initial inspirations behind successful startups, offering a blueprint for aspiring founders.

4.1.Previous roles before joining the company

To understand our respondents' backgrounds before joining their current companies, we asked them about their previous roles.

Before founding or joining their current company, most respondents were either entrepreneurs and founders or employees with managerial authority, such as executives, managers, or team leads.

Most popular previous roles of founders of deep tech startups:

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- Employee with managerial authority (manager, team lead, executive): 22 responses

- Entrepreneur, founder: 17 responses

- Employee without managerial authority (specialist): 5 responses

- Scientist: 3 responses

These results highlight the respondents' diverse professional backgrounds, with many having managerial experience or entrepreneurial backgrounds.

The founders of the startups interviewed come from diverse backgrounds.

Some founders were employed by other information technology (IT) companies before venturing out on their own. They used to lead R&D teams working on high-tech solutions for clients and launched new services within their previous companies. Some of the interviewed founders have a STEM (Science, Technology, Engineering, or Mathematics) degree, and some have graduated from MBA (Master of Business Administration) programmes. This background was conducive in their role in the current deep tech startups.

Others were entrepreneurs before, but not necessarily in the IT or tech sectors. Some of the interviewed founders started their current companies as hobbies or side hustles, and some had worked on their business ideas as their thesis projects in academia.

4.2. Current role and level of involvement of startup leaders

Most (28 respondents or 66.7% of the sample) of the representatives of the startups who participated in this survey are founders or owners of these companies with the CEO role. Much fewer (5 respondents) are

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founders or owners without CEO functions, while others have other managerial or leadership roles.

To understand the level of involvement of respondents in multiple startups, we asked them to indicate the number of startups they are currently working on.

Involvement in multiple startups

■ 1	Startup	— 67.4%
■ 2	Startups	— 20.9%
■ 3	Startups	— 4.7%
■ 5 and more Startups		— 7.0%
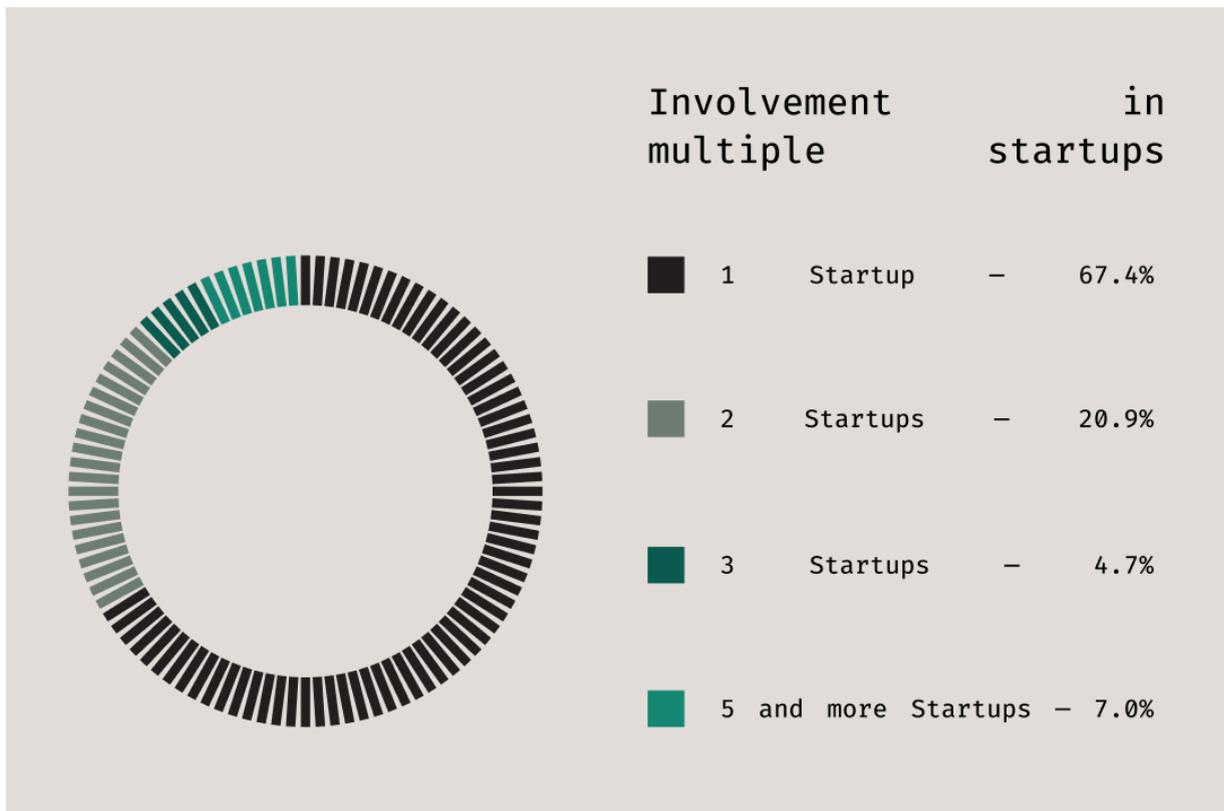
Figure 12 – Involvement in multiple startups

These results indicate that most respondents are focused on a single startup, with a smaller group managing multiple ventures simultaneously.

4.3.What are the origins of startup ideas?

To understand where the ideas for deep tech startups originated, we asked respondents whether their ideas stemmed from academic research, personal experience, market demand, or other sources.

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35% of respondents indicated that their startup ideas originated from personal experiences. These experiences ranged from combat situations to professional challenges encountered over years of work.

Another major source of inspiration was market demand, mentioned by 33% of respondents. These founders identified gaps and opportunities in the market that their startups could address, often combining this with personal insights.

Academic research played a crucial role for 16% of respondents. These founders leveraged scientific studies and academic knowledge to create innovative solutions for existing problems.

14% of respondents mentioned that their ideas originated from a combination of academic research, personal experience, and market demand. They often conducted extensive research, identified market needs, and drew from their own experiences to develop their startups.

These findings highlight that the origins of startup ideas are often multifaceted, involving a blend of personal experiences, market needs, and academic research. Founders utilise their diverse backgrounds and insights to identify problems and opportunities, driving the creation of innovative solutions in the deep tech sector.

4.4. Primary motivation for starting the startup

To understand the primary motivations behind starting deep tech startups, we asked respondents to select all relevant reasons.

This question is close to the previous one about the startup origin but highlights the motivation to turn the idea into a working business.

Meeting specific market needs and solving societal problems are the top motivations for starting deep tech startups, with 51% of respondents

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indicating they aimed to meet a specific market need and 49% focusing on solving societal or country-specific problems.

Additionally, 44% of the respondents are driven by the potential of entering promising niches, emphasising the forward-looking and innovative nature of these startups.

Implementing new technology is a significant driver for 21% of the respondents, showcasing their aim to capitalise on emerging opportunities and technological advancements.

Personal interest motivates 28% of founders, indicating that many are driven by passion and a personal connection to the problems they aim to solve.

Other motivations include self-development and the desire to create something great, reflecting a desire for personal growth and achievement.

4.5. Deep dive into inspiration behind founding deep tech startups

To understand what inspired the founding of deep tech startups, we collected responses to open-ended questions . Here's a summary of our respondents' motivations.

Key themes and examples that were discovered.

Addressing personal or observed problems:

- "I saw a problem that didn't have a complete solution."

- "The problem that I faced myself."

- "My experience in sales consulting and the desire to solve the problem of bad lead conversions for medium and small businesses."

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- "Understanding of market demand from photographers to automate high quality retouching processes."

Passion for innovation and technology:

- "Getting scientific results in unique technology."

- "Disruptive and innovative technology."

- "Our company was founded to make charging electric vehicles (EVs) easier and better for the environment."

Career and industry experience:

- "While working in the HR tech and career tech industry for the last 10 years, I conducted extensive research and discovered that many people struggle to find jobs that match their passions, impact, goals, and skills, especially when changing careers after the age of 30."

- "As a cloud architect in the past I saw how many startups didn't make it not because of lack of innovation but due to drowning in operational complexity which we are tackling."

Desire to make a positive impact:

- "Mission to empower millions of schoolchildren worldwide by innovative, engaging learning."

- "The challenge that was not solved before and the mission to change the status quo."

- "History shows that the demining of territories has been going on for decades. In Ukraine, existing demining technologies will last more than 700 years. We have no other way out than to create technologies that will allow us to restore Ukraine in our time, in an adequate time."

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Opportunities and market demand:

- "Big market opportunity."

- "Right moment and right time to connect deep expertise in the topic
  with matured potential market demand."

- "Opportunities, perspectives, knowledge and experience."

Personal passion and hobbies:

- "My hobby is mechanics and inventions. I worked in tech companies.
  Deep technology is my life. A startup is only a consequence."

- "This is my life calling."

Global and national challenges:

- "Full-scale russian invasion in Ukraine."

- "Nation/world-scale challenges."

Specific use cases and applications:

- "Productivity solutions."

- "To solve complex data analytics problems."

- "Own challenging experience in building a house for my family."

These motivations reflect a combination of personal experiences, career
insights, passion for innovation, and a strong desire to address
significant challenges and opportunities in various fields. The diverse
inspirations underscore the multifaceted nature of deep tech startups
and their founders' drive to create impactful solutions.

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4.6.Importance of research or academic foundation for deep tech startups

To gauge the perceived importance of having a vital research or academic foundation for deep tech startups, we asked respondents to rate its significance.

Importance of research or academic foundation for deep tech startups

- Very important — 29.5%
- Mostly important — 31.8%
- Somewhat important — 27.3%
- Mostly not important — 6.8%
- Don't know / Difficult to answer — 4.5%
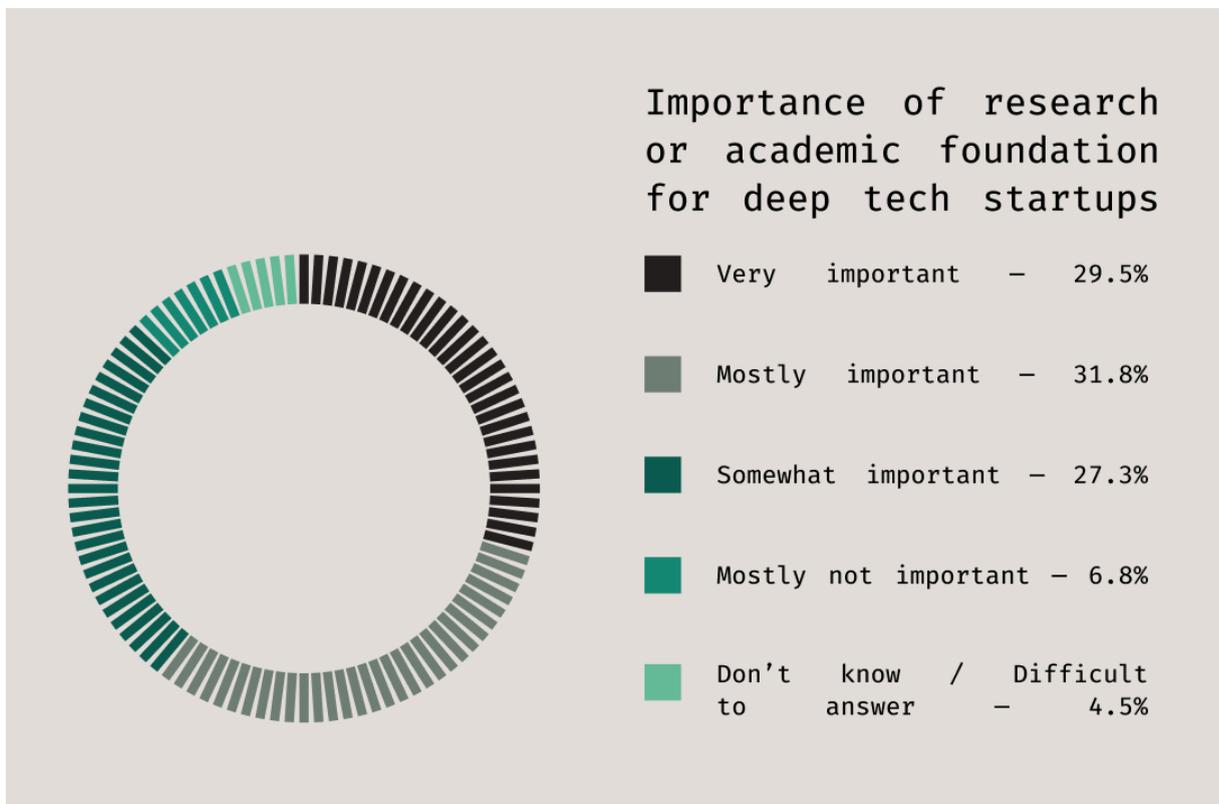
Figure 13 – Importance of research or academic foundation for deep tech startups

61.3% of respondents consider a strong research or academic foundation to be either "very important" or "mostly important" for deep tech startups. This underscores the value placed on rigorous scientific and academic grounding in developing innovative and cutting-edge solutions.

27.3% of respondents rated the importance as "somewhat important", indicating that while it is beneficial, it may not be the sole factor determining a startup's success.

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Only 6.8% of respondents felt that a research or academic foundation is "mostly not important", suggesting that for some, other factors might play a more critical role.

These findings highlight the general consensus that a solid research or academic foundation is crucial for deep tech startups, with most respondents recognising its significant role in fostering innovation and credibility. However, there is also acknowledgment that its importance can vary depending on the specific context and nature of the startup.

5. ATTRIBUTES OF DEEP TECH STARTUPS

What differentiates shallow tech companies from deep tech companies? How are these differences manifested in our respondents' companies? To assess the true deep tech market in Ukraine, we analysed the levels of innovation and market applicability within our respondents' companies.

5.1. What is "deep tech" in the context of startups

This question was aimed to understand the key characteristics that define deep tech startups.

The responses of the quantitative survey respondents reveal a diverse understanding of "deep tech" among the participants. The most commonly mentioned attributes include:

● Strong scientific foundation: 85% of respondents highlighted that deep tech startups are characterised by technologies with a strong scientific basis. This includes substantial scientific or engineering challenges and science-driven innovation.

● Unique features and high barriers: 78% of respondents mentioned that deep tech startups possess unique features, defensible intellectual property, and high barriers to entry, often requiring high capital investment to commoditize.

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- Innovation and R&D focus: 90% of respondents emphasised innovation, extensive research and development (R&D), and cutting-edge technology. These startups are seen as heavily reliant on in-house developed technologies and long R&D cycles requiring deep expertise.

Additional key terms included:

- Artificial intelligence (AI) and advanced technologies: 65% of respondents cited AI and related technologies as central to deep tech startups.

- High risk and long development: 70% of respondents noted the long development cycles and high risks associated with bringing deep tech products to market.

- Academic spinouts and scientific approaches: 55% of respondents pointed out that deep tech startups often stem from academic research and involve a high level of scientific rigour.

This broad spectrum of definitions underscores the complex nature of deep tech and highlights the critical elements that distinguish these startups from more traditional tech companies. The focus on significant scientific challenges and breakthrough innovations positions deep tech startups as critical players in driving technological advancements and solving complex problems.

The interviewed founders of the startups mentioned quantum computing, space tech, robotics, human-computer interaction technology as the industries that can be classified as deep tech.

At the same time, technologies like augmented reality (AR) were named among the ones that do not require unique technology anymore and are used on a consumer level. It is not enough to be an innovative tech company to be considered a deep tech startup, according to the

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interviewed representatives of this sector: the company needs to be driven by technological innovations such as quantum computing and AI.

Deep tech was described by the interviewed representatives of the startups in the following ways:

●   a unique methodology of work that uses AI or any other know-hows and gives competitive advantage;

●   science-intensive technologies, which have a longer development cycle, but may lead to a bigger disruption on the market and, consequently, higher long-term multipliers;

●   a desire to commercialise scientific-intensive knowledge;

●   hardware products that are based on scientific research;

●   and products build upon academic know-how that use complicated proprietary algorithms and provide solutions to an important problem of consumers or businesses.

Several interviewed founders said that "deep tech" is rather a buzz word used to drive investments or used interchangeably with AI. Deep tech companies existed before, according to one of the interviewees: "IBM and Apple were deep tech companies." This founder believes that for investors, deep tech could be classified as complicated technologies with no immediate return, for which different metrics and analysis approaches are used, but which may become a game changer and bring back billions of dollars. At the same time, deep tech startups can more easily obtain non-equity funding and grants, because they have a potential impact on the future.

Another founder interviewed said that understanding deep tech in the US differs from the European one. According to her, in the US, deep tech means cutting edge technology startups that need more time and investment to develop a product and are not targeting end users. In the

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European understanding, however, deep tech includes applications that are complicated in terms of architecture, but they may target end users, according to this interviewee.

One founder whose startup has an environmental impact said that this startup could be categorised either as a deep tech or a clean tech one depending on the audience for which they present it – such as the type of a programme they participate in.

5.2. How startups see key deep tech attributes and challenges

We gathered responses to identify the key characteristics that define deep tech startups. These responses reveal a consensus on several attributes and challenges associated with deep tech startups. The following points summarise the areas of agreement:

● Deep tech startups are focused on creating innovative solutions: 90% of respondents agree that deep tech startups focus on creating innovative solutions, which highlights the strong emphasis on innovation within these companies.

● High levels of technological and commercial risks: 85% of respondents agree that deep tech startups face uncertainty and high technological and commercial risks. This underscores the challenging environment these startups operate in.

● Long, uncertain R&D cycles: 80% of respondents agree that deep tech companies are positioned at the knowledge frontier with long, uncertain R&D cycles. This indicates the fundamental nature of innovation and exploration in deep tech startups.

● Specific strategies for R&D focus: 70% of respondents agree that deep tech startups require specific strategies because they focus on R&D

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before scaling up. This reflects the need for tailored approaches to managing and supporting these companies.

● Problem-oriented and mission-driven: 70% of respondents agree that deep tech startups are always problem-oriented or mission-driven, reflecting a strong alignment with solving complex challenges.

We also encountered responses that reflected significant disagreement. Conversely, the statements with the greatest levels of disagreement include:

● Access to financing: 25% of respondents disagree that access to financing is a challenge for deep tech startups, pointing to mixed experiences in securing funding.

● Integration with academic ecosystems: 20% of respondents disagree that deep tech startups are an integral part of higher education or academic ecosystems. This suggests some variability in the perceived connection between deep tech startups and academic institutions.

● Complexity due to undeveloped applications: 20% of respondents disagree that deep tech startups encounter complexity due to undeveloped commercial applications, highlighting varying opinions on market readiness.

● Tangible products and industrialization: 15% of respondents disagree that deep tech startups are linked to tangible products and industrialization processes, indicating differing views on the product development focus of these companies.

Overall, the data suggests that deep tech startups are characterised by their innovative nature, strong ties to academic research, and significant challenges related to R&D and commercialization. These insights provide a comprehensive understanding of the unique landscape

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in which deep tech startups operate, highlighting both their potential and the obstacles they face.

5.3. Deep tech icons worldwide recognized by Ukrainian startups

We asked respondents, "What are the "deep tech" startup icons in your industry worldwide?" and this is what we heard from them.

This question seeks to identify the well-known deep tech startups recognized by our respondents.

Most mentioned prominent deep tech companies:

● OpenAI: It has been mentioned five times. OpenAI is frequently cited as a leading company in artificial intelligence and deep learning research.

● Tesla: mentioned 3 times. Known for its innovations in electric vehicles and energy storage.

● SpaceX: mentioned 2 times. Recognized for its groundbreaking work in aerospace and space exploration.

● Boston Dynamics: mentioned 2 times. Known for its advanced robotics technology.

● DeepMind: mentioned 2 times. Acquired by Google, DeepMind is one of the leaders in AI research.

Other notable mentions include:

● Bear and Dragon AI

● Genome Compiler

● Renaissance Technologies

● Document Crunch, Aatos, Lexolve

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- IQM, Xanadu

- Alphabet

- Portworx, Kubermatic, D2iQ

- synthesia.io

- CropX (AgTech)

- Moderna, CRISPR Therapeutics, BioNTech

- Climeworks

- Microsoft Healthcare, Philips Healthcare, Google Health/DeepMind, Siemens Healthcare

- Witricity

- Quantum Machines

- Nvidia

The data indicates that OpenAI is the most frequently mentioned deep tech startup, significantly more than other companies. Tesla and SpaceX follow, highlighting their prominent roles in their respective fields. The variety of companies mentioned reflects the diverse areas of innovation and advanced technology that define the deep tech landscape.

Overall, these companies are perceived as pioneers in their fields, driving significant technological advancements and addressing complex challenges through innovative solutions. This recognition underscores their influence and the critical role they play in the deep tech industry.

5.4. Deep tech startup icons in Ukraine

To understand which companies are considered leading examples of deep tech innovation within Ukraine, we asked respondents to name any "deep tech" startup icons in the country.

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The list of most mentioned prominent Ukrainian deep tech companies includes:

● Reface: mentioned 7 times. Reface is known for its advanced AI-based face-swapping technology.

● Esper Bionics: mentioned 6 times. Recognised for its innovative work in bionics and medical technology.

● Haiqu: mentioned 5 times. A prominent company in the quantum computing space that is also noted for its contributions to AI and technology development.

● Grammarly: mentioned 4 times. Famous for its AI-powered writing assistance tool.

● Carbominer: mentioned 2 times. Known for its innovative carbon capture technology.

Other notable mentions include:

● Himera

● Ajax Systems

● 3DLOOK

● Aspichi

● elai.io

● Meredot

● effie> (IPLAND)

● ColMatEk

● stackbooster

● UADAMAGE

● Knowledgator

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- Deus Robotics

- Osavul

The data indicates that Reface is the most well-known and frequently mentioned deep tech startup in Ukraine among deep tech founders who participated in the survey. Esper Bionics and Haiqu follow, highlighting their prominent roles in this respective field. The variety of companies mentioned also reflects the diverse areas of innovation and advanced technology in the Ukrainian deep tech landscape.

5.5. Industries most conducive to deep tech innovations

To understand which industries or sectors are considered most conducive to deep tech innovations, we asked respondents to identify the areas they believe are most favourable for deep tech advancements.

Key sectors for deep tech innovations

- Artificial intelligence and machine learning — 24.5%
- Advanced material science — 20.4%
- Quantum computing — 19.0%
- Biotech — 17.0%
- Robotics — 15.6%
- Other — 3.4%
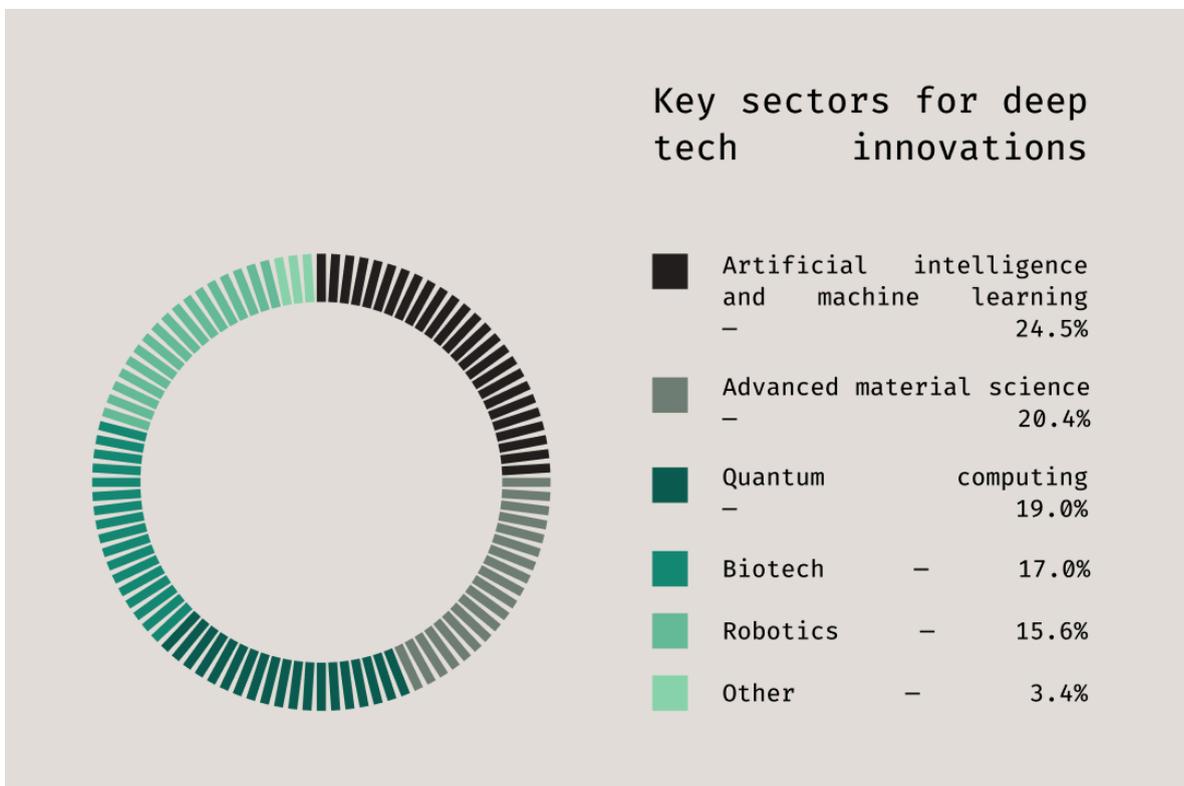
Figure 14 – Key sectors for deep tech innovations

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Key sectors for deep tech innovations (according to our respondents' vision)

● Artificial intelligence and machine learning: mentioned 36 times. This sector is widely regarded as a prime area for deep tech innovation due to its transformative potential across various applications.

● Advanced material science: mentioned 30 times. This sector is critical for the development of new materials with unique properties that can revolutionise multiple industries.

● Quantum computing: mentioned 28 times. Recognised for its potential to solve complex problems beyond the capabilities of classical computers.

● Biotech: mentioned 25 times. Known for its significant impact on healthcare and medical research through the development of advanced biological technologies.

● Robotics: mentioned 23 times. Highlighted for its advancements in automation and the creation of intelligent machines.

Other notable mentions include:

● Big data: Frequently mentioned along with AI and ML, highlighting its importance in processing and analysing vast amounts of information.

● Photonics and electronics: Recognised for innovations in light-based technologies and electronic components.

● Language processing: Critical for advancements in natural language understanding and communication technologies.

● Vision and speech algorithms: Important for the development of technologies that can interpret and respond to visual and auditory inputs.

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- Blockchain: Mentioned for its potential to provide secure and transparent solutions in various applications.

The data indicates that artificial intelligence and machine learning are the most frequently mentioned sectors, significantly more than other industries. This reflects the widespread recognition of their impact on deep tech innovations. Advanced material science and quantum computing follow closely, highlighting their critical roles in driving technological advancements.

5.6. Comparing the state of deep tech industries in the USA, the EU, and Ukraine

To understand the state of deep tech industries across different regions, we asked respondents to rate the deep tech industries of the USA, the EU, and Ukraine on a scale from 1 to 10, where 1 represents a very poor state of the industry and 10 represents a very good state of the industry.

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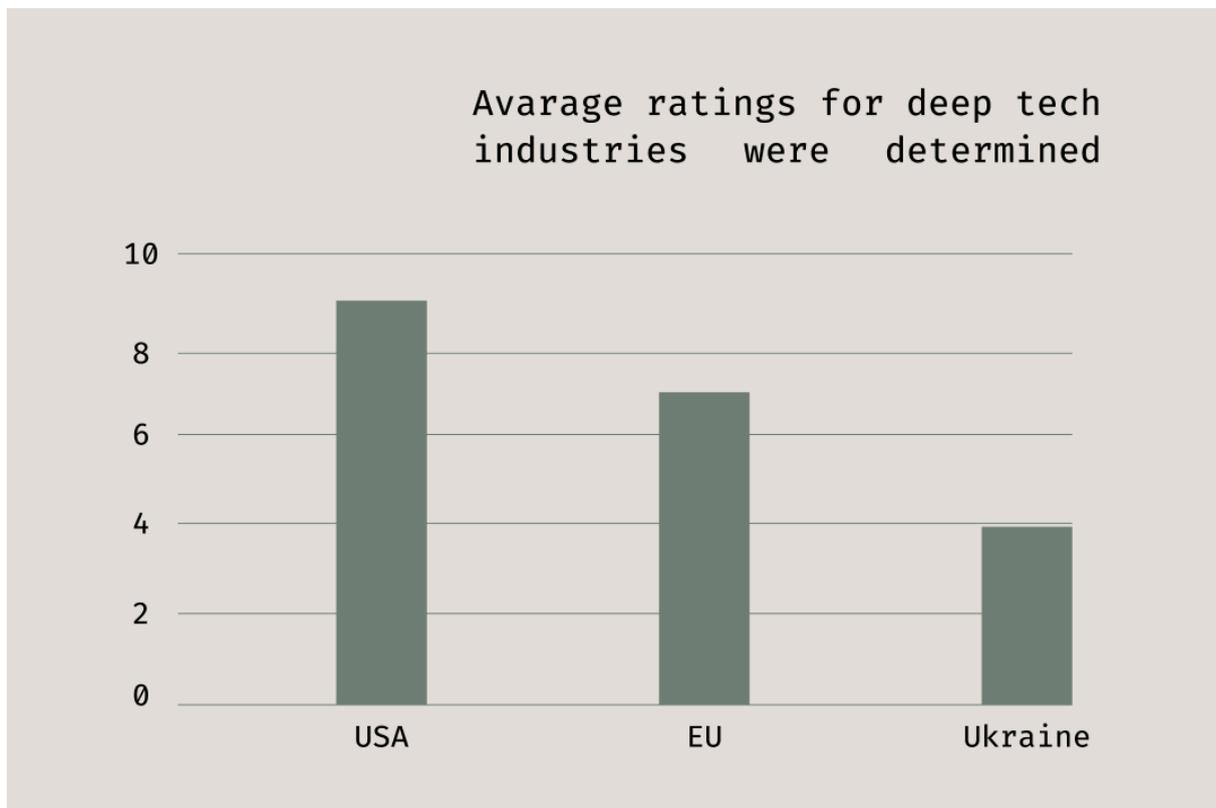
Figure 15 – Average ratings for deep tech industries were determined

Average ratings for deep tech industries were determined as follows:

● 8.9 for the USA.

The average rating for the deep tech industry in the USA is 8.9. Respondents consistently rated the USA highly, with several ratings of 10 indicating a very good state of the industry. High ratings dominate, with multiple respondents giving a perfect score of 10. The lowest rating is 5, highlighting a generally strong perception of the industry.

● 7.2 for the EU.

The average rating for the deep tech industry in the EU is 7.2. While still rated positively, the EU's scores are slightly lower than the USA, indicating room for improvement. The EU received a mix of ratings, with a notable number of 8s and 9s. The lowest rating is 3, suggesting some variability in perceptions.

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- 3.9 for Ukraine.

The average rating for Ukraine's deep tech industry is 3.9. This significantly lower rating reflects challenges and areas needing development in Ukraine's deep tech sector. Ukraine's ratings vary widely, with several low scores of 1 and 2. The highest ratings are 7 and 8, indicating that while there are positive aspects, the overall perception is less favourable compared to the USA and the EU.

These insights highlight the strengths of the deep tech industry in the USA (at least according to respondents' opinions), the relative competitiveness of the EU, and Ukraine's developmental challenges. The data underscores the need for targeted efforts to support and grow the deep tech sector in Ukraine to achieve a more favourable perception and performance comparable to the USA and the EU.

However, it should be noted that Ukrainians tend to have high expectations for their market and often a slightly more optimistic perception of other markets. This is common among many nations but particularly noticeable in surveys conducted in Ukraine. Therefore, the actual figures for market development in Ukraine may be somewhat better than the provided assessment.

5.7.Future of deep tech

When discussing the future of deep tech, the interviewed startup founders see a tendency towards customization and more individualised approach: "There is going to be a maximum adaptation to a person, meaning the education will become focused on a person. Psychology will consider the interests of children and adults," said a representative of an online education platform.

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The respondents saw the development of technologies such as augmented reality (AR) and VR as the sign of the shift towards more visualisation, gamification, and observation of human behaviour.

Some interviewed founders see the potential in corporate investment into the deep tech sector when large companies invest in promising smaller companies.

5.8.Risks and challenges for deep tech

There might also be some risks among the trends, according to the interviewed representatives of deep tech startups, especially when it comes to AI. AI-based products should be created with the wellbeing of human beings in mind, according to the respondents.

Currently, the investment in startups has decreased, according to the interviewed representatives of the startups. "It is more profitable for investors to invest not into startups, but into more secure assets" – said one of the interviewed founders. However, the deep tech sector is more resilient to this downturn across the technology sector overall, because the cycle of financing is longer here: from 7 to 10 years. This smoothes out temporary market fluctuations. The return on investment (ROI) is also bigger in the deep tech sector, according to the interviewees.

As other companies in Ukraine, the interviewed deep tech startups face challenges due to the ongoing russian invasion of the country.

Defence spending takes up a large part of Ukrainian public funds. Therefore, the government currently cannot offer meaningful financial support to the country's deep tech sector.

The interviewed deep tech startups aim to be bought out rather than to go public and issue an IPO, because they fear that their position on the

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stock exchange may be affected by the public perception of Ukraine as a high-risk country.

The war also undermines the trust of foreign investors in the startups: they are concerned that the founders might be mobilised or that the company might not operate to a full extent due to electricity cuts.

Possible conscription of employees is a risk, too, which the interviewed startups mitigate by trying to obtain military draft deferral for the employees and a strategic status for their companies.

Some challenges described by the interviewed founders stem from the nature of deep tech startups. As these startups require more time to build their product compared to other tech companies that do not need as much R&D, deep tech startups find it harder to raise investment in the early stages of product development. "The first thing that is needed is the product and again the product – and only then, all the rest. We have talked to more than 150 investors – and everybody needs the product-market fit, everybody needs clients. And this is super difficult in deep tech", said one of the interviewees.

On the other hand, some interviewed founders observe a positive tendency of investment recovery – they expect venture investment to rise globally in 2024.

6. FUNDRAISING STATE IN DEEP TECH

This section focuses on the fundraising activities of deep tech startups, examining the amount of capital raised, future fundraising needs, strategies for raising additional capital, and company valuation assessments.

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6.1.External funding status

To understand the funding status of deep tech startups, we asked respondents whether they have raised external funding.
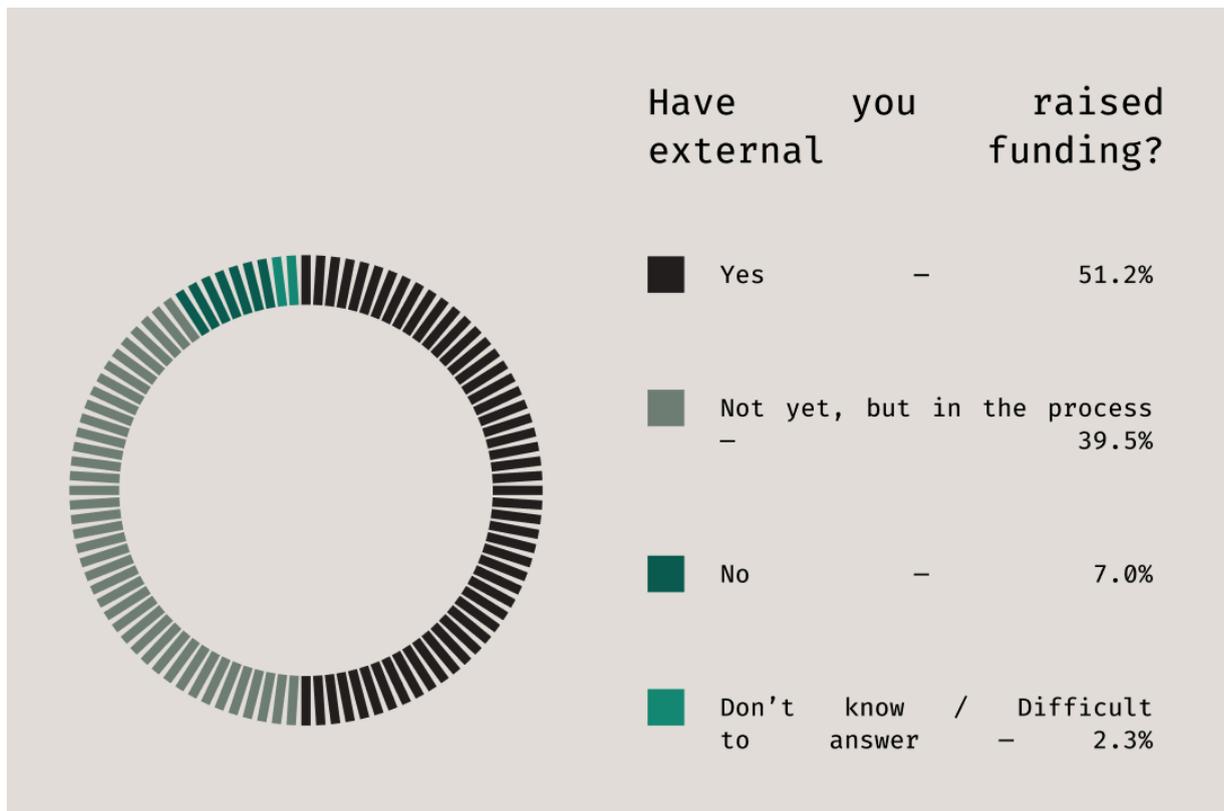
Figure 16 – Have you raised external funding?

More than half (51.2%) of the respondents have already raised external funding, demonstrating strong investor interest and support for deep tech startups. Additionally, 39.5% are currently fundraising or planning to raise funds, indicating a robust pipeline of startups seeking investment to fuel their growth and development. Only a small fraction (7%) have not pursued external funding, and 2.3% are uncertain about their funding status.

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6.2.Total amount of investment raised

For startups that have raised external funding, we asked them to specify the total amount of investment raised so far.

Investment amounts:

- Have not attracted investments yet: 39.5%

- Less than $1 million: 39.5%

- $1-5 million: 20.9%

The majority of startups (17 responses) have raised less than $1 million, indicating that many deep tech startups are still in early funding stages or operating with modest investment levels. However, a notable number of startups (9 responses) have raised between $1-5 million, showcasing successful fundraising efforts and a higher level of investor confidence in these ventures.

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6.3.Sources of funding utilised

To understand the various sources of funding utilised by deep tech startups, we asked respondents to specify their funding sources.

Figure 17 – Sources of funding utilised

Sources of funding:

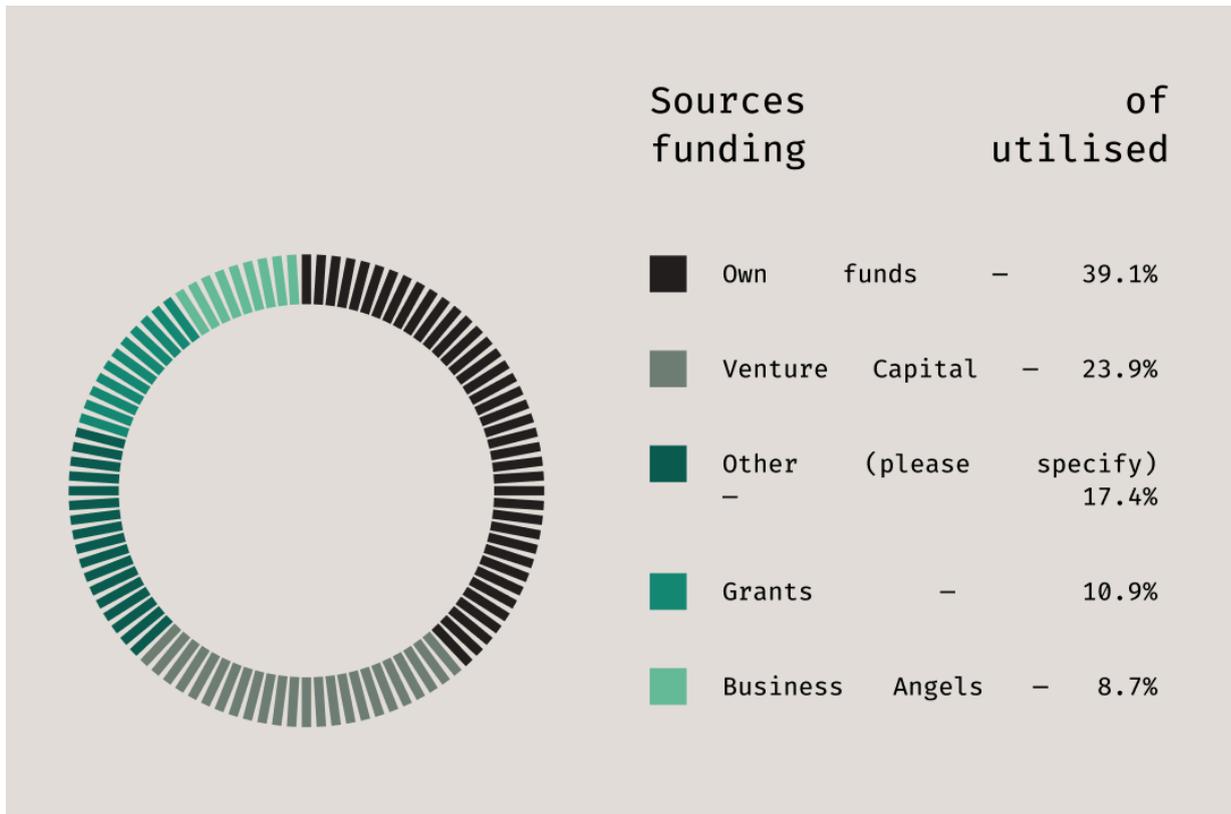- Own funds: 39.1% responses

- Venture Capital: 23.9% responses

- Other (please specify): 17.4% responses

- Business angel + own funds + grants

- Bootstrapping from previous business-model revenue

- 50/50 private and public funds

- First paying customer

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- Own, Business Angels, VC, Grants

- Family, Friends, Followers

- Own, angels, crowdfunding

- Grants: 10.9% responses

- Business Angels: 8.7% responses

Insights:

The majority of startups, around 39.1%, have leaned heavily on their own funds to get off the ground. This shows a significant commitment from the founders, who are willing to invest their personal resources into their ventures, reflecting both confidence and dedication to their ideas. On the other hand, this suggests that some of these startups may be experiencing difficulties with fundraising.

Venture capital has played a pivotal role for 23.9% of the startups. This funding source is crucial for those looking to scale rapidly, as it provides not just capital but also valuable networking opportunities and strategic support from experienced investors.

Grants have supported 10.9% of the startups. This non-dilutive funding is particularly important in deep tech, where substantial research and development costs can be a barrier. Grants enable startups to innovate without giving up equity.

Business angels have been instrumental for 8.7% of the startups. Usually, these individual investors bring more than just money to the table — they offer mentorship, industry connections, and, often, invaluable advice that helps startups navigate the complexities of the early stages.

Overall, the funding landscape for deep tech startups is diverse and multi-faceted. Founders combine personal investment with external

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sources to build and scale their companies, showcasing a blend of resilience, innovation, and strategic planning.

Some startups that we spoke with during in-depth interviews started by raising funding from their closest social circles: "Family, friends, and fools", as put by one interviewee.

They were followed by business angels, non-equity funds, and government-supported funds, such as the Ukrainian startup fund. Some raised the funds through the Seeds of Bravery project.

The interviewed founders view grants as non-dilutive funds: the ones that don't require founders to give away equity in their company. They also can be used for more high-risk and longer term goals and the products in the early stages of development – those that investors are less likely to support.

To showcase their product and establish partnerships, the interviewed startup founders try to go to industry events in person: online meetings or cold emails do not have the same effect, they say. "Big investment funds invest in people. No matter how cool the technology, they invest in founders and in the team, and they need to see it", said a founder of one of the interviewed startups.

Accelerators, conferences, and hackathons helped the founders of the deep tech startups to pick, validate, and polish their business ideas. They also help the startups connect with investors.

These events are quite niche and "boutique", according to the interviewed companies, as they gather a limited number of those who work in the deep tech sector or the industries that use these technologies. But, due to their specialised nature, they are more likely to lead to partnerships: "We have been here for four days, we are communicating, we are generating ideas on how to apply quantum computing to these

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industries. Therefore, we have in-depth discussions and we are building close connections and a ground for potential projects", said one of the interviewed founders.

However, under the martial law, conscription-age men are generally prohibited from leaving Ukraine, which hampers the startups' efforts to be present at international events to pitch their products and network with the worldwide deep tech community.

An ideal accelerator, according to one of the interviewed founders, does not take away equity, does not require personal presence, they are providing only what the startups need, have expertise in the areas with which the startups need help, and have a vast network of investors.

6.4.Usage of funds

The startups used the external funds they raised to conduct market research, to test hypotheses, to find product-market fit, to create additional features, to localise their products, to pay salaries, and to reach new markets.

"Now we know very well what does not work, we know where we should go with the product we have and how to localise it. With the help of the Seeds of Bravery project, we are developing a step-by-step go to market strategy", said one of the interviewed founders commenting on the use of external funds.

6.5.Further needs

Speaking about their further investment needs, the interviewed startups mention such priorities as matching with investors and partners, localising their product, hiring experts on external markets, and carrying out marketing campaigns.

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They are also seeking funds to support their startup development by developing their technology, conducting feasibility studies, and to improve their cash flow.

One interviewed founder said that currently their startup needs a bridge round rather than a full round of funding – to help them with a final push to enter a new country.

Another founder said partial grant coverage would also work for her startup – where the investment would be co-financed by the grant and by the startup itself. In her opinion, it would make startups more accountable in using the grant and tracking its returns.

The interviewed founders also suggested that programmes such as Seeds of Bravery could offer matching Ukrainian startups with mentors who are experienced in funding or in specific industries to guide them through the next steps in their growth.

Several interviewed founders shared their positive experience with mentoring they received as a part of grant programmes or business incubators that helped them grow their business. "I like mentoring meetings. I had mentors who told me a lot and practised pitchings with me. It started showing results, I began to pitch more, began to win at the events and in different opportunities", – said one of them.

One more suggestion offered by an interviewed founder was to supplement grant programmes with training on leadership and investment for founders, including how to protect the company from risks associated with investments.

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Discussion and conclusions

The 1st wave of the research of the Ukrainian deep tech sector showed that this sector is made up of a wide variety of companies working in a range of industries. Their products are based on technologies such as AI/ML, blockchain, quantum computing, VR, bioengineering, and others.

These companies are involved in cross-country networks of the deep tech sector, participate in international grants programmes and business incubators, and pitch their products to investors across the globe. At the same time, a lot of them are motivated by contributing to the defence and recovery of Ukraine by developing products that are used by the Ukrainian military and government.

The state of the deep tech sector in the US was rated by Ukrainian deep tech companies the highest compared to the EU and Ukraine, with some of them pointing out that the definition of this sector is more narrow in the US as it includes only B2B solutions. Ukrainian companies that participated in this research view deep tech as the sector with a strong scientific foundation that uses cutting-edge technology and invests extensively in R&D.

This creates high barriers to entry in this sector as R&D requires significant investment of time and capital. Consequently, it complicates seeking external funding for Ukrainian startups that work in this sector, as they observe investors preferring market-ready products. For this reason, Ukrainian deep tech startups appreciate grant opportunities as those that can support them during the R&D phase.

Ukrainian deep tech companies have raised external funding from investors and grants programmes. They have used it for a variety of needs, from developing strategies to enter foreign markets to covering operational needs. In addition to funding, grants programmes and

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incubators offer mentoring for deep tech companies – an opportunity valued by the interviewed founders and the one that made a difference for their businesses.

Most of the deep tech startups that participated in this research were started over the last 5 years – a period marked by the global pandemic and the beginning of the full-scale russian invasion of Ukraine. Apart from the danger and destruction that the war brings to the whole country, it has a negative impact on the deep tech sector in many other ways. It takes away the country's resources from supporting this sector and, due to the restrictions connected with international travel of conscription-aged men, reduces the mobility of the startups' founders and staff preventing them from effectively presenting their products on global platforms.

In addition, Ukraine is facing electricity deficits due to russian attacks on its energy infrastructure – most of the fieldwork in this research was conducted during daily electricity cuts that impact businesses and households in virtually every city and region. Facing these challenges, the deep tech sector in Ukraine continues to develop innovative solutions and drive technological change worldwide.

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Recommendations

Based on the findings of this research and on the analysis of the context in which Ukrainian deep tech startups work, we have identified the following needs and based on them offer the following recommendations to the governments and institutions in Ukraine and in the EU:

Ukraine:

1. Need: Protection of property rights and ability to work in a stable and predictable business environment is essential for all businesses in Ukraine and especially critical for the deep tech sector, which needs to be able to invest and innovate without the risk of property takeover and intellectual property theft.

   Recommendation: Improve legislation to better protect businesses and to guarantee their property rights and fair judicial process.

2. Need: Businesses in Ukraine need to be able to operate in a level playing field that ensures fair competition, including transparent and fair legislative framework and equitable public procurement, taxation and regulatory practices. This improves the confidence of businesses and the likelihood that they will continue to work and grow in Ukraine.

   Recommendation: Identify and eliminate the possible avenues for corruption and unfair treatment in terms of public procurement, taxation, and other areas.

3. Need: Russian attacks on energy infrastructure in Ukraine have caused significant damage to energy generation and led to country-wide electricity cuts. Reliable energy is crucial for

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continuous operations of the deep tech startups and for their technological advancements.

Recommendation: Support digital infrastructure by protecting energy generation and implementing alternative and decentralised energy infrastructure solutions.

4. Need: Travel restrictions for the conscription-age men in Ukraine affect founders and employees of deep tech startups preventing them from accessing global markets and building international networks.

Recommendation: Improve the mechanisms for business and educational travel outside the country for persons who can be conscripted.

5. Need: Deep tech is a sector that requires a highly skilled workforce. Education and training programmes need to be aligned with these requirements to ensure that the startups have access to personnel equipped with the skills and knowledge relevant to emerging technologies.

Recommendation: Modernise and invest in the education and training in technology that would supply skills for the deep tech sector.

The EU institutions and governments of the EU countries:

1. Need: Russian full-scale invasion that has been lasting for more than two years and has affected all aspects of the society in Ukraine, including the economy and the technology sector. Peace, security, and territorial integrity of Ukraine are fundamental conditions for the economic recovery of the country and the development of sectors like deep tech that strongly rely on research, investment, and human capital.

Recommendation: Support peace building efforts of Ukraine, help Ukraine strengthen defence, provide military and diplomatic

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assistance to achieve the cessation of hostilities and withdrawal of russian federation from Ukraine.

2. Need: Russian attacks on energy infrastructure in Ukraine have caused significant damage to energy generation and led to country-wide electricity cuts. Strengthening Ukraine's defences against russian air attacks and supplying equipment for energy infrastructure can help prevent further damage and disruptions and help restore the country's energy supply, which is essential for uninterrupted operation of the technology sector and broader economy.

   Recommendation: Support energy infrastructure restoration needs of Ukraine by strengthening its defence against long-distance air attacks and by supplying equipment for Ukrainian energy infrastructure objects.

3. Need: While deep tech startups need sufficient upfront investment to develop their cutting-edge technology products, they face the reluctance of investors to provide funding until the product is ready for the market. At the same time, the companies that already have developed products find bridge rounds and co-financing of grants more suitable to their needs as this type of financing would help them to faster scale their operations and bring the product to their target markets.

   Recommendation: Include Ukrainian startups in grants and investment programmes, including bridge rounds and co-financing of grants;

4. Need: Mentorship and guidance from investors or fellow founders is valued by the founders of Ukrainian deep tech startups as an opportunity to receive relevant advice, learn from their experience, and build partnerships.

   Recommendation: Supplement programmes that offer financial support with opportunities for mentorship and networking.

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Annex I The Deep Tech Startups Survey questionnaire, 2024

Deep tech startups survey Ukraine 2024

This is a part of a study of the Ukrainian deep tech community and the startup community in general. This study is a part of the UA Seeds of Bravery project that aims to support Ukrainian deep tech startups and bring them closer to the European Union. The project is funded by the European Union under the European Innovation Council (EIC).

By default, all responses are confidential. The results of this survey will be presented as generalised and aggregated data.

However, if you agree, we would like to use quotes from your answers to this survey for the report, mentioning the name of your company. To select if you agree or not, please select the respective option in the last question of this survey. Selecting either option will not affect how we analyse and report the generalised results of this survey. Answering this questionnaire will take about 15 minutes. Thank you for your time and participation!

The survey is funded by the European Union under the European Innovation Council (EIC), paving the way for the participation of Ukrainian start-ups in future EIC calls. Views and opinions expressed are however those of the author(s) only and do not necessarily reflect those of the European Union or European Commission or EIC. Neither the European Union nor the European Commission can be held responsible for them. UASEEDs project has received funding from the Horizon Europe Framework Programme under grant agreement № 101104445.

First of all, let's talk about you!

1. **Name of your company / startup:**

   _____

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2. What is your role at the company?

- Founder/owner and CEO
- Only founder/owner without CEO functions   Only CEO, not a founder/owner
- Other managerial/leadership role   Other (please specify):

Now, let's talk about Deep Tech.

3. How would you define "deep tech" in the context of startups? Please write up to three words or phrases that best describe the "deep tech startups".

- 1: _____
- 2: _____
- 3: _____

4. Below, you'll find some attributes and challenges that deep tech startups can be associated with. Please indicate how much you agree or disagree with each of these statements.

PLEASE SELECT ONE ANSWER IN EACH ROW

	Fully agree	Mostly agree	Neither agree nor disagree	Mostly disagree	Completely disagree	N/A
Deep tech companies are positioned at the knowledge frontier with long, uncertain R&D cycles						
Deep tech startups are linked to tangible products and industrialization						

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	Fully agree	Mostly agree	Neither agree nor disagree	Mostly disagree	Completely disagree	N/A
processes						
Deep tech startups are an integral part of higher education or academic ecosystems						
Deep tech startups are always problem-oriented or mission-driven						
Deep tech startups are focused on creating innovative solutions						
Deep tech startups are faced with uncertainty and high levels of technological and commercial risks						
Deep tech startups encounter complexity due to yet-to-be-developed commercial applications						
Access to financing is a challenge for deep tech startups						

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	Fully agree	Mostly agree	Neither agree nor disagree	Mostly disagree	Completely disagree	N/A
Deep tech startups require specific strategies because they focus on R&D before scaling up						

5. **Are there any "deep tech" startup icons in your industry worldwide? Please write the name of this company or companies: _____**

6. **Are there any "deep tech" startup icons in Ukraine? Please write the name of this company or companies: _____**

7. **In your opinion, what industries or sectors are most conducive to deep tech innovations?**
   MULTIPLE ANSWERS POSSIBLE
   ☐ Artificial intelligence and machine learning
   ☐ Big data
   ☐ Language processing
   ☐ Vision and speech algorithms
   ☐ Robotics
   ☐ Blockchain
   ☐ Advanced material science
   ☐ Photonics and electronics
   ☐ Biotech
   ☐ Quantum computing
   ☐ Other

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8. Let's compare the state of deep tech industries in the USA, the EU, and Ukraine. Please rate the deep tech industries of the USA, the EU, and Ukraine on a scale from 1 to 10, where 1 represents a very poor state of the industry and 10 represents a very good state of the industry.

PLEASE SELECT ONE ANSWER IN EACH ROW

	1 – Very poor state	2	3	4	5	6	7	8	9	10 – Very good state	99 – Don't know / Difficult to answer
In the USA	1	2	3	4	5	6	7	8	9	10	99
In the EU	1	2	3	4	5	6	7	8	9	10	99
In Ukraine	1	2	3	4	5	6	7	8	9	10	99

9. Do you agree that the company you represent can be classified as a deep tech company?

- Strongly agree
- Agree
- Neutral
- Disagree
- Strongly disagree
- Don't know / Difficult to answer

Now, we will ask you to evaluate certain parameters of the company you represent. We ask that you respond honestly. These questions are not a test but an attempt to understand the essence of the deep tech industry in Ukraine.

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10. **How accurate are the following statements about the company you represent? Please range them from "very accurate" to "not accurate at all".**

PLEASE SELECT ONE ANSWER IN EACH ROW

	1 – Very accurate	2 – Mostly accurate	3 – Partly accurate, and partly not accurate	4 – Mostly not accurate	5 – Not accurate at all	99 – Don't know / Difficult to answer
Our company is involved in developing cutting-edge scientific or engineering solutions	1	2	3	4	5	99
Our company tackles big challenges	1	2	3	4	5	99
Our company is involved in the development of the startup community	1	2	3	4	5	99

11. **What was your role before you joined the company?**

- I was a scientist
- I was an employee with managerial authority (manager, team lead, executive)
- I was an employee without managerial authority (specialist)
- I was a public servant
- I was a serviceman/veteran
- I was an entrepreneur, founder
- I was a venture capitalist

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- Other

12. How many startups are you involved in?
PLEASE INDICATE THE NUMBER OF STARTUPS YOU ARE CURRENTLY WORKING ON:
_____

13. What inspired the founding of your deep tech startup?

_____

_____

14. Did the idea originate from academic research, personal experience, market demand, or elsewhere?

_____

_____

15. How important is it, in your opinion, for deep tech startups to have a vital research or academic foundation?
- Very important
- Mostly important
- Somewhat important
- Mostly not important
- Not important at all
- Don't know / Difficult to answer

Team

16. How many people founded the startup?
PLEASE INDICATE THE NUMBER OF PEOPLE WHO CAN BE CONSIDERED ITS FOUNDERS:
_____

17. What was the primary motivation for starting the startup?
MULTIPLE ANSWERS POSSIBLE
- Meeting a specific need on the market
- Solving a specific problem for the society or country
- Implementing new technology
- Entering a promising niche with high potential
- Personal interest
- Other (please specify)

18. How many co-founders does your startup have currently?

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- 1
- 2-3
- 4-5
- 6 or more
- Don't know / Difficult to answer

19. **What is the average work experience in the field among your team members?**
    - Less than 1 year
    - 1-3 years
    - 4-6 years
    - 7 or more years
    - Don't know / Difficult to answer

20. **What is the highest education level of key team members?**
    - Bachelor's Degree
    - Master's Degree
    - PhD/Doctorate
    - Other (please specify)

21. **What are the most critical skills or qualities you look for when hiring for your deep tech startup?**

    _____
    _
    _____
    _

Company

22. **When was your startup founded?**
    - Before 2015
    - 2015-2018
    - 2019-2021
    - 2022 or later
    - Don't know / Difficult to answer

23. **Which industry does your startup represent?** *PLEASE SELECT THE INDUSTRY THAT MOST CLOSELY CORRESPONDS TO YOUR STARTUP*
    - Biotechnology
    - Information Technology

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- Robotics
- AI (Artificial Intelligence)
- Materials Science
- Other (please specify)
- Don't know / Difficult to answer

24. **How many employees does your company have?**
- Up to 10
- 11-50
- 51-100
- 101-250
- More than 250

Product or Service

25. **What is the primary application area of your product/service?**
- Healthcare
- Financial Services
- Manufacturing
- Transportation
- Other (please specify)
- Don't know / Difficult to answer

26. **What stage of development is your product/service at?**
- Idea/Concept
- Prototype
- Early Commercialization
- Scaling
- Don't know / Difficult to answer

27. **Can you provide an overview of the deep tech product or service your startup offers?**

_____
_
_____
_

28. **What technologies are the foundation of your product/service?**
   MULTIPLE ANSWERS POSSIBLE
- AI/Machine Learning

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- Bioengineering
- Quantum Computing
- Nanotechnology
- Other (please specify)
- Don't know / Difficult to answer

Fundraising Needs

29. **Have you raised external funding?**
    - Yes
    - Not yet, but in the process of raising or planning to raise
    - No
    - Don't know / Difficult to answer

30. **If yes (Q29 = 1), what is the total amount of investment you have raised so far?**
    - Less than $1 million
    - $1-5 million
    - $5-10 million
    - More than $10 million
    - Don't know / Difficult to answer

31. **What sources of funding have you utilised?**
    - Own funds
    - Venture Capital
    - Business Angels
    - Grants
    - Crowdfunding
    - Other (please specify)
    - Don't know / Difficult to answer

32. **Do you agree to cite the name of your company together with your answers in the report based on this survey?**
    THIS WILL NOT AFFECT HOW WE ANALYSE YOUR ANSWERS, ONLY HOW WE CITE THEM
    - Yes
    - No

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Thank you for your participation in the survey. Your insights are invaluable to our study!