Development Opportunities for the Hungarian Agricultural Startup Ecosystem

Áron József Borda

PhD student, Corvinus University of Budapest

Jeremiás Máté Balogh

Associate Professor, Corvinus University of Budapest

Abstract

Nowadays, the role of agriculture and the food industry is gradually gaining importance, although it will face many challenges in the future. Digitalisation and newly founded innovative companies can provide solutions to these challenges. The recently established agtech startups could significantly transform the sector. The Hungarian agtech startup ecosystem is a relatively underdeveloped community, but its impact is already notable. The research analyses the characteristics of the Hungarian agriculture technology startup ecosystem and identifies the directions for its future development. Within a qualitative research framework, in-depth interviews were conducted with nine Hungary-based agri-startups, as well as the Hungarian National Chamber of Agriculture TechLab staff members, based on semi-structured questions, between 20 March and 20 April 2021. The results show that there is a good financial environment for Hungarian agtech startups to achieve high performance levels. However, there exist some barriers to success, such as the lack of a culture of failure and relaunch, the low prestige of the agricultural sector, and limited sales capabilities. So far, few Hungarian agtech companies have been able to achieve significant results at the international level. With the advanced digitalisation, the sector is becoming increasingly attractive to young people. The ecosystem's experience of developing talent management and increased internationalisation over the years can help overcome the limits of the industry. If the startup sector manages to achieve

international recognition in the coming years, Hungarian agricultural startups may have a promising future.

**Keywords:** startup, agtech, startup ecosystem, Hungary, agriculture

JEL codes: M13, Q13, O13

Introduction

Nowadays, agriculture faces several global challenges. Healthy nutrition and the spread of quality food in high-income countries will play a vital role in the future. The steady decrease in arable land and the increase in water scarcity call for more efficient agricultural production techniques. In addition, we must take into account the continuous growth of the human population, and the fact that animal husbandry is made more difficult by the emergence of new viruses. In summary, today, better quality food needs to be produced for more demand on less land, under increasingly difficult conditions.

Figure 1 shows that agriculture accounts for around 4% of the global gross domestic product (GDP) each year and more than 25% of the GDP of developing countries (World Bank, 2022a).

**Figure 1: Agriculture, value added in per cent of GDP**
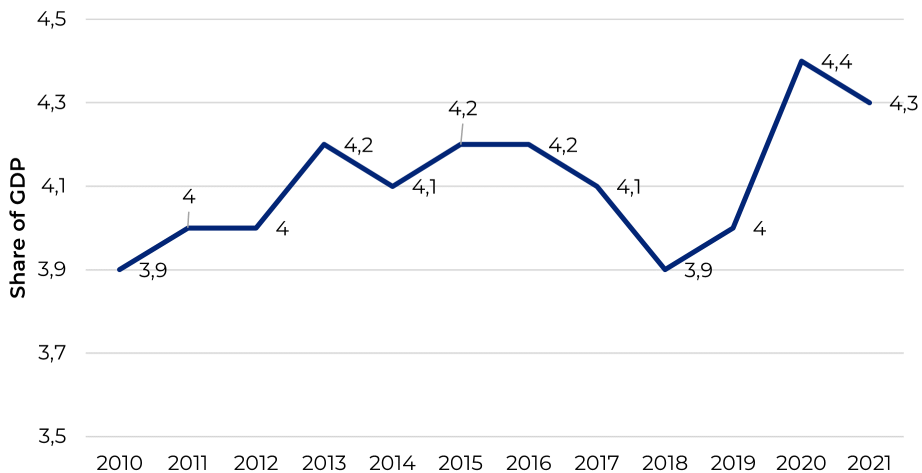
Source: Own composition based on World Bank (2022a)

The global food and agriculture sector is estimated to be worth ca. USD 8 trillion, employing more than 25% of the total population, while providing food for the entire global population (World Bank, 2022a).

The United Nations (2022) predicts that by 2050, the population will amount to 9.7 billion. To keep up with this growth, the agricultural sector is under pressure to significantly increase the amount of food produced. Digitalisation can address the challenges of quantity, efficiency, and profitability the sector faces.

Figure 2: Global employment in agriculture in per cent of total employment
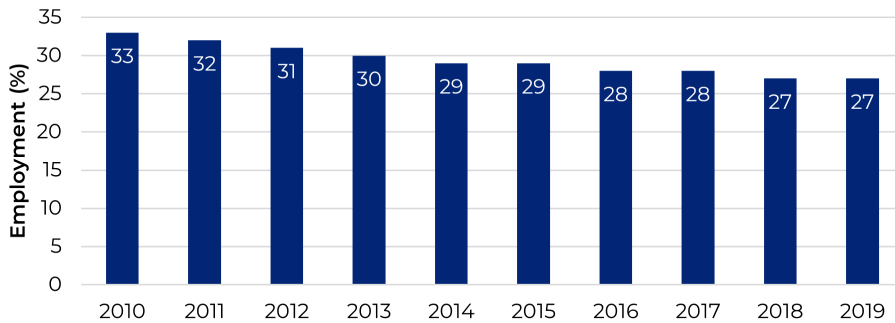
Source: Own composition based on World Bank (2022b)

According to Howarth (2022), the trends of the existing 5 major agricultural technologies should be watched out for in the coming period.

- The first issue is labour shortage, which poses a challenge for agriculture in many parts of the world, especially in labour-intensive branches such as fruit and vegetable production. In addition to the disappearing labour force, the ageing of farmers in developed countries is also a problem. According to the USDA (2019), the average age of US farmers was 57.5 in 2017, up 1.2 years from the average age in 2012. The situation is similar in Hungary, according to Hungarian Central Statistical Office (HCSO) (2020) which made the Hungarian Agricultural Census in 2020. Most farmers (55%) are aged 40 to 64 years, but there is also a significant share of those aged over 65 (35%). To address this problem, robots equipped with various artificial intelligence (AI) tools are becoming increasingly widespread. According to Howarth (2022), "Search growth for "AI machinery" has increased considerably (144%) over the past 5 years."

- Another prominent trend is vertical farming. The essence of the technology is to grow crops indoors, under fully controlled conditions, without soil, and under artificial light. According to Statista (2022), by 2026 the value of this industry is estimated to reach 1.4 billion in America.

- Next on the list are various water management solutions aiming to improve sustainable agricultural practices.

- Drones are changing entire industries today, with agriculture being no exception. According to Emergent Research (2020), the global market size for agricultural drones was $873.9 million in 2019, and the industry is expected to grow rapidly.

- And finally, the fifth of the top agtech solutions are those related to livestock (such as milking robots). These machines and devices are designed to increase animal welfare while improving efficiency.

The research focuses on the Hungarian startups that will shape the future of agriculture. In this study, the concept of startups and the ecosystem surrounding these companies are first clarified. Then, the Startup Genome (2021) survey, which ranks emerging startup ecosystems is presented, and the Hungarian startup ecosystem is introduced. Following this, the research focuses on Hungarian agricultural startups and the entrepreneurial environment surrounding them. The following questions will be answered through in-depth interviews:

- Is Budapest the centre of Hungarian agri-startups?

- Is there a difference between international perceptions and domestic opinions? How do Hungarian agri-startups evaluate the ecosystem around them? Based on the assessment of 4 factors (performance, funding, market reach, talent) defined in the Startup Genome (2021) research.

- Which factors of the Hungarian agri-startup ecosystem can be developed, and how?

1. Literature review

1.1. Defining startups and the startup ecosystem

The trend of startups emerged in the United States in the 1970s and spread to Europe 15-20 years later. In Hungary, its emergence is dated back to the beginning of the 21st century, precisely to 2008 (Márkus, 2016). Although this form of entrepreneurship has been prevalent for decades, there is not a fully developed, uniformly used definition of the term.

Steve Blank defines startups by emphasising scalability and sustainability: "A startup is a temporary organisation seeking a scalable, long-term sustainable and repeatable business model" (Blank, 2010).

The father of lean startup management, Eric Ries, defines this concept as follows: "A startup is a human institution organised to create new products or services under very uncertain conditions" (Ries, 2011).

Vecsenyi (2009) compares the term to an animal: "Dynamic, fast-growing, and highly vulnerable businesses are gazelles. Gazelle businesses usually start small but think big from the beginning, i.e., the founders have

the image of a big firm in their minds. The growth rate of gazelles is double that of the industry. But rapid growth also makes businesses increasingly vulnerable." (Vecsenyi, 2009, p. 57).

In the Hungarian Digital Startup Strategy of the Digital Prosperity Programme (2016, p22), several definitions of startups are synthesised as follows: "Startups are typically micro or small enterprises with high growth potential, requiring external investment, based on a product, organisational, business model or service innovation that is relevant in the global market".

To summarise the definitions, startups are young companies with high growth potential, which aim to conquer the international market in the short term. Digitalisation and innovation are the two main 'tools' of their operation. All of these companies aim to be significant players in their respective industries. They have a high-risk profile, but also high potential for future revenue.

The terms startup and ecosystem have been used together in the literature since 2005. The importance of the term is reflected in its rapid diffusion. This is partly due to digitalisation, which is driving all sectors to innovate, and thus the need for new types of business and solutions is growing (Cukier-Kon, 2018). Porter (2011) called the fissionable way of geographical concentration of different economic actors clusters. He attributed the emergence of competitive advantages of different firms to the growth of externalities associated with location. The definitions of clusters and ecosystems, while closely related, are far from identical. Cukier and Kon (2018) argue, the difference can be put down to system dynamics. Clusters are seen as more static, steady-state relationships, whereas an ecosystem is a set of clusters where participants evolve together in a mutually supportive way.

A startup ecosystem is a distinct, defined region, where stakeholders (e.g., business angels) and support organisations (e.g., chambers of commerce and industry, coworking spaces, incubators) work together to create new startups and support the development of existing ones. A study identified funding, demographics, market, education, human capital, technology, entrepreneurship, and support factors as the eight key elements of startup ecosystems, which directly or indirectly influence startup entrepreneurship (Tripathi et al., 2019).

In addition to startups at different stages, startup ecosystems are made up of people and different types of organisations, which interact with each other as a system at a given (physical or virtual) location to co-develop existing startup companies or, where appropriate, create new ones. The organisations can be grouped into the following categories: universities,

funding organisations, support organisations (e.g., incubators, accelerators, community workspaces, etc.), research organisations, service organisations (e.g., legal, financial, and other services), and large companies. These organisations typically focus on startups and the creation of an enabling environment in their development phase (Startup Commons, 2021).

1.2. The Hungarian startup ecosystem

In the Hungarian literature, the first research on the local startup ecosystem focused on the Joint European Resources for Micro to Medium Enterprises (JEREMIE) programme and its success. The objective of the programme was formulated as follows: "to provide venture capital support and management services to small and medium-sized enterprises (SMEs) in Hungary in order to increase the profitability and promote the development of the targeted enterprises" (European Commission, 2008, p. 2).

The total European Unio (EU) funding, together with national governmental support, amounted to HUF 200 billion in the first cycle of the programme (2007-2013). This was complemented by other forms of funding, such as refinancing from the Hungarian Development Bank and private sources from venture funds (Rácz, 2012).

The JEREMIE programme launched in 2009 kick-started the domestic startup market, but it also contributed to the beginning of the upsurge in information technology (IT) cloud services. Small IT teams, even with small financial investment, could achieve great results in both the B2B (business-to-business) and B2C (business-to-customer) sectors. The SaaS (software as a service) business model, with its fast growth and short development cycle, made the IT sector increasingly attractive to investors. Hungarian start-ups such as Prezi, LogMeIn, and Ustream achieved international recognition, which can serve as a great inspiration for the Hungarian ecosystem (Magos and Németh, 2014).

Lovas and Rába (2013) were among the first researchers who studied the impact of the operation of the JEREMIE programme in Hungary in 2012. They recognised the programme as the creator of the Hungarian startup ecosystem and the first venture capital outsourcing programme with public participation. It created funds for SMEs in a market environment where capital was scarce. The indirect impact of JEREMIE II, launched in 2012, was credited with the development of the Hungarian startup ecosystem and the stimulation of entrepreneurship. The number of startups and the entrepreneurial drive of young people fresh out of university increased during the programme period.

In their research, Jáki et al. (2019) investigated the Hungarian startup ecosystem by surveying startup investors, representatives of incubators,

accelerators, and community offices. According to their analysis, community events and meet-ups were what made the ecosystem vibrant. The gravest problems were re-launching after a failed experiment and the magnitude of administration required from entrepreneurs. Among the startups surveyed, 20% considered Hungary as their main target market and 70% believed that there was a global demand for their product/service.

A study by Kállay et al. (2016) shows that Hungarian startups have significant growth potential. According to their results, the majority of Hungarian startuppers are young men with entrepreneurial attitudes. They conclude that these companies could become even more successful by systematically validating their business ideas, developing their entrepreneurial skills, providing mentoring and engaging with more business angels. Some of Hungary's success stories show that talent exists, but the country urgently needs more startups to lead by example.

Csákné et al. (2020) conducted research on the factors influencing the survival and growth of Hungarian startups with the help of 14 expert interviews. They found little overlap between the experiences of Hungarian experts and the success factors identified in the international literature. The common elements were education (entrepreneurial skills), internationalisation, knowledge of the founding team and industry experience. The researchers concluded that the young age of the ecosystem could explain this divergence.

The literature on the ecosystem surrounding startups in Hungary shows that the efficiency and effectiveness of the JEREMIE Programme are subjects to criticism on several points. Despite the numerous shortcomings and negative results, it is undisputed that the Programme has been successful in laying the foundations of the Hungarian startup ecosystem (Csákné et al. 2020).

In 2019, the National Chamber of Agriculture (HNCA), with the support of Design Terminal, launched HNCA TechLab (TL), which provides professional support to niche agricultural startups. The organisation brings together all players in the sector, and aims to serve the most innovative solutions to the Hungarian agri-food industry, making it more competitive, sustainable, and environmentally conscious. TL's work has established the fundamentals of a well-defined Hungarian agricultural startup ecosystem (HNCA TechLab 2021).
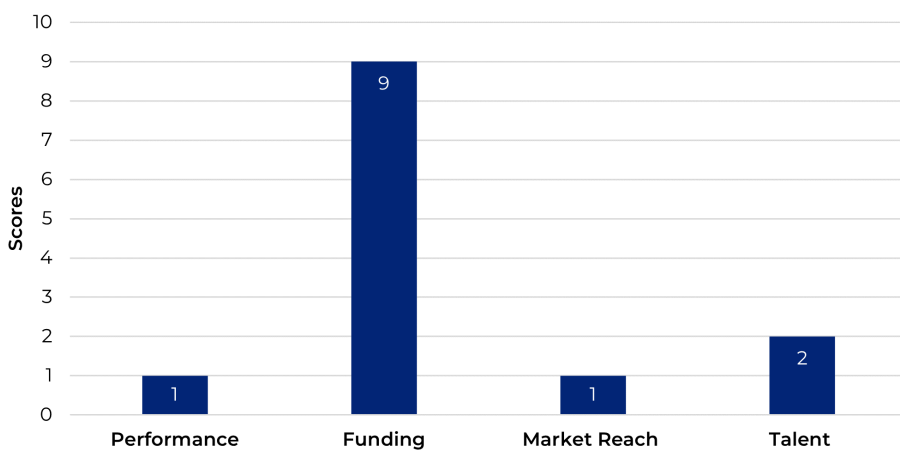
The Hungarian agri-startup ecosystem is credited with importance in the domestic innovation strategy; however, the analysis of the ecosystem and its growth potential is still limited in the literature. The research presented in this paper aimed to fill this gap in the literature by describing the charac-

teristics of the Hungarian agri-startup ecosystem and, based on the results, identify factors with the potential of making Hungarian agri-startups more prosperous in the future.

Startup Genome (2021) published the global ranking of startup eco-systems for 2020. The ranking was developed by analysing, scoring, and weighting the following factors: performance (30%), funding (25%), market reach (15%), connection (5%), experience and talent (20%) and knowledge (5%). Each factor was further broken down into sub-factors, and finally ranked on a scale of 1 to 10 by analysing these criteria. According to Startup Genome, the leading region among the top 30 startup ecosystems is Silicon Valley in the United States (US), home to many of the world's largest high-tech companies. Unsurprisingly, the US is home to the majority of the top 30 ecosystems, but cities in the Far East and Europe are also dominant players among the world's startup ecosystems. London is the best-performing city in Europe, Stockholm is the best-performing city on the continent, and Jerusalem stands out in the Middle East. Budapest is not among the thirty most significant ecosystems in the world.

The organisation also presented a ranking of emerging ecosystems listing Hungary's capital as well, giving increased weight to four of the previously mentioned criteria (performance, funding, market reach, and talent). Budapest ranked 71-80, and the scores are shown in figure 3. In a regional comparison, only Vienna (ranked 41-50th) and Warsaw (ranked 61-70th) performed better (Startup Genome, 2020).

Figure 3: Scores of the Hungarian startup ecosystem

Source: Own composition based on Startup Genome 2020

2.Methodology

In the process of assessing the current state of the Hungarian agri-startup ecosystem and exploring the directions of development, we were confronted with the fact that as the ecosystem is relatively young, there is not enough data available on the topic. Other than that, there is no comprehensive database that delineates which Hungarian agri-startups are emerging and thus, naturally, there is no multi-year time series data. Given these factors, quantitative research had to be discarded and only qualitative research was possible.

The strength of qualitative field research is its validity, as it allows for a deep understanding of the phenomena under study, which would remain inaccessible through simple questionnaire surveys. However, the literature suggests that the results of qualitative surveys are less reliable, mainly due to biases caused by the individual perceptions of the researchers (Babbie, 2003).

Based on Horváth and Mitev (2015), qualitative research, in contrast to quantitative research, is subjective, it examines the given topic in depth, due to the small sample size it is not suitable for generalisation and determining statistical results, but it is suitable for understanding phenomena, and a confidential, close relationship can be established between the researcher and the researched.

From the fully structured, unstructured, and semi-structured interviewing techniques defined by Fossey et al. (2010), we chose the semi-structured interviewing technique, which is based on the category of in-depth interviewing, where questions are pre-defined, but there is the possibility to explore certain topics in more depth during the interview if necessary and relevant to the topic.

For this research, we conducted one-hour in-depth interviews with 9 Hungary-based agri-startups and TL staff members, based on a semi-structured set of questions between 20 March and 20 April 2021. The best-known and most successful Hungarian agricultural startups were selected upon the recommendation of TL. The startuppers were asked to talk about the founding and basic information on the startups, operations, achievements so far, network of contacts, relationship with HNCA TechLab and opinion of the organisation, and finally, they were requested to evaluate four aspects of the Hungarian agri-startup ecosystem (performance, funding, market reach, talent). In this case, regrettably, we did not have the same depth of data and analytical tools as Startup Genome, so we could only rely on the interviewees' responses for the analysis.

Table 1: Interviewed startups' data

| Startup Number	Area of operation	Year of foundation
Startup1	Digital insect trap	2020
Startup2	Pig monitoring	2016
Startup3	Production synchronisation	2014
Startup4	Knowledge Generator Platform	2018
startup5	Insect farming	2019
Startup6	Indoor farming	2019
Startup7	Agricultural business management system	2007
Startup8	Digital cattle weighing	2017
Startup9	Agricultural droning	2013

Source: Own composition

3. Findings and discussion

3.1. Startups and their founders

The selected companies are well-established in the industry and represent different areas of agriculture, and to our lament, did not contribute to the publication of their names. Their respective products could be best characterised as digital insect traps, swine monitoring systems, crop synchronisation systems, knowledge generation platforms, insect farming, indoor farming, agribusiness management, digital cattle weighing and agriculture droning.

In terms of education, the founders all have a university degree or are in the process of obtaining one. Only two of the nine managers have an agricultural degree (Startup 9, Startup, 7), and only two other interviewees have an agricultural family background (Startup1, Startup6). This is in line with a statement by one of Startup6's leaders, namely that agri-professionals will not solve the challenges of today's agribusiness. According to the interviewees, companies have agribusiness expertise because they typically work with employees and consultants who have the necessary agribusiness skills and knowledge. In most cases, startuppers were trained in IT, but the number of managers with a degree in economics was also outstanding. In addition, natural science fields (e.g., bioengineering, veterinary medicine) were also among the educational backgrounds represented.

Figure 4: Startup founders by gender
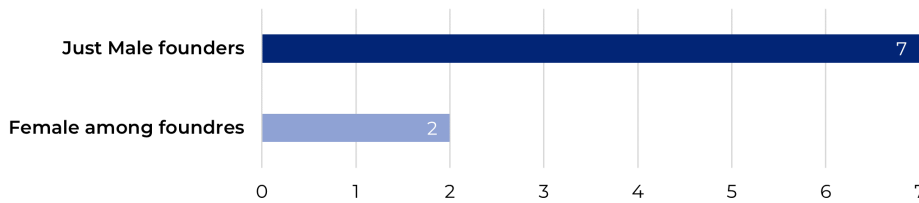
Source: Own composition based on the responses

Figure 4 shows the gender distribution of founders, which is nearly homogeneous, with only two companies having women in management since their start. Kállay et al. (2016) previously found that men had stronger entrepreneurial attitudes. In the case of this study, the gender ratio can be attributed to the fact that both agriculture and IT, and hence the agtech sector, are highly dominated by male workforce.

Figure 5: Year of foundation of the Hungarian agtech ecosystem startups
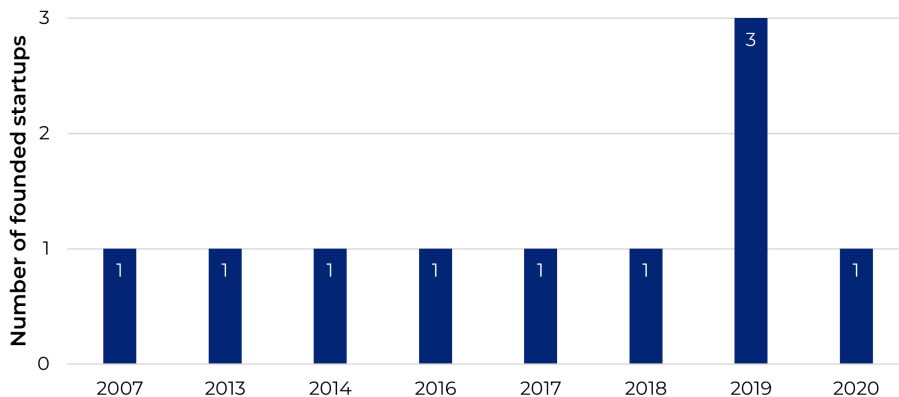
Source: Own composition based on the responses

Figure 5 shows how many of the organisations surveyed were founded each year. It includes the foundation of TL in 2019, as the efforts of this organisation led to the creation of one venture in 2019 and one in 2020. The graph shows that we were able to reach companies of different ages, so we were able to analyse the ecosystem along a sufficiently diverse range of experiences. The company founded in 2007 stands out in terms of age. When it was founded, the concept of startups was still unknown in Hungary. Among others, the company attributed the slow development to a lack of knowledge on how startups worked. In their study, Csákné et al. (2020) mention several weaknesses in Hungarian startups including the immature age of the domestic ecosystem, which also applies to agtech.

figure 5 shows that there are noticeably young companies in the sector – despite that, many of them have already achieved great results throughout their short lifetime.

3.2. Budapest is the centre of the Hungarian agricultural startups

According to Startup Genome's (2020) survey, the Hungarian startup ecosystem is associated with the country's capital, Budapest. In our research, through interviews, we investigated whether the centre of the agri-startup ecosystem was in fact in Budapest.

The Digital Startup Strategy (2016) also highlights the importance of the city. It is noteworthy that the startup community, which is the innovation engine of domestic agriculture, was formed in Budapest rather than in Gödöllő, where higher education in the field of agriculture is well-known. One of the Hungarian founders interviewed, who can be connected to the swine monitoring startup (startup2), runs his firm in the Netherlands, so this company is an exception to the previous statements – nevertheless, it has Hungarian customers. Eventually, once its presence is more established in the domestic market, an office in Budapest will be needed. Startup5 is also an exception, as its head office is in Szeged and its established plant is located in a nearby village. The firm has relocated to this city for personal reasons in addition to easier access to the plant and the fact that it can also count on much cheaper real estate rents.

During the discussion, startup leaders repeatedly mentioned that the registered headquarters are in the countryside, while the actual operations are in the capital, as companies based in Budapest or the suburbs are often not eligible for tenders. Similar responses were given to the Digital Startup Strategy (2016), which states that the hubs of the ecosystem are apparent in the big cities, as those are where the financial resources, knowledge, and a sufficiently high concentration of well-educated, enthusiastic young workforce necessary for the development of the companies are located. It was also highlighted that Budapest has the largest population out of all cities in Hungary, and is also the country's intellectual centre, so innovative thinking could develop and get the necessary impulse.

The importance of universities was also mentioned. In addition to having the highest number of university students, Budapest is home to students from almost all fields (e.g., veterinary studies, agricultural engineering, computer science, and economics). The founder of a startup active in the field of indoor agriculture (startup6) pointed out that 'there are challenges in agriculture that agricultural engineers cannot solve.' In today's modern economy, there is a greater need for an open mindset and the skills needed for digitalisation, than for agricultural expertise. People with

outstanding skills in IT, microbiology and mathematics are likely to achieve great recognition in the sector. However, we see that a company cannot operate in the field without agricultural skills, an issue which can be solved by hiring employees possessing such skillset.

Budapest provides young people with excellent opportunities to meet and converse in informal settings and thus generate exceptional ideas. The founders of Startup6 first met at the assembly of a Budapest-based student union, and it was thanks to their discussions that they ended up launching a startup together. Another important aspect is that from the capital, it is easy to access any location in the country. In the case of many of the startuppers interviewed, most added value is generated in the countryside, so there is a great amount of travel involved at certain times. Also, a large proportion of customers are rural, but the capital is still the easiest origin when it comes to accessing them. Valuable workforce often does not want to leave the capital and its surroundings, which is also a crucial motive in this respect. Furthermore, according to the digital insect trap developers (startup1), those potential partners or employees who truly understand startup building are all based in the capital, which also makes it worthwhile even for agri-startups to operate here.

Another benefit of being based in Budapest for the agri-startup ecosystem is that it allows them to collide with the ecosystems of other industries, which often facilitates innovative thinking. In the agribusiness sector, it has been common for founders who originally launched their companies with a different direction planned to discover the potential of the sector and realise that they can make excellent use of their development here. This phenomenon is an advantage of being based in the biggest city in Hungary. Unsurprisingly, the TechLab within the National Chamber of Agriculture is also based in Budapest.

3.3. Ecosystem scores

According to the Startup Genome survey, the Hungarian startup ecosystem (based in Budapest) is ranked 71-80th in the ranking of emerging startup ecosystems. Scores were presented earlier in this study (performance: 1, funding: 9, market reach: 1, talent: 2).

In our research, we asked startups and TL's staff to rate the Hungarian agricultural startup ecosystem along the same four criteria as Startup Genome's survey has done previously. The results are summarised in figure 6. A detailed analysis of the four attributes is presented below.

Figure 6: Average scores of the Hungarian agri-startup ecosystem by four attributes
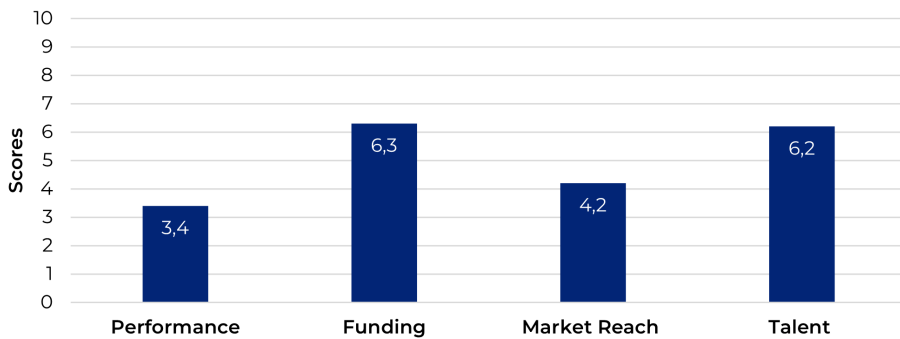
Source: Own composition based on the responses

Startup Genome's (2020) survey is partially supported by the results in figure 6. Both performance and market reach underperform in our case. The funding is prominent in the results of both surveys. In the Startup Genome survey, the score is considerably better (9) than the score based on the agtech startup entrepreneurs' answers (6.3). The biggest difference between the two surveys is in talent, with Hungarians perceiving themselves as more talented than the international survey shows. In the following, each criterion is explained in more detail.

3.3.1. Performance

In the Startup Genome (2020) survey, this criterion was only rated 1. Local insiders in the field are also unimpressed with performance, with an average score of only 3.4.

In the case of Hungarian agtech startups, no significant exit has been observed yet. In many cases, a high price is an appropriate indicator of the success of an exit, but this has not been noted in Hungary. Therefore, maturity is based on the market value of the organisations and their potential.

The highest score, 5, was given by Startup4. In the founders' opinion, within territorial constraints and the level of development, TL and startups are putting a lot of effort into succeeding. According to the responses, the reason the sector cannot score higher and perform better is that large companies have a monopoly in Hungary and are therefore less open to innovation.

Figure 7: Average performance score in the Hungarian agtech ecosystem
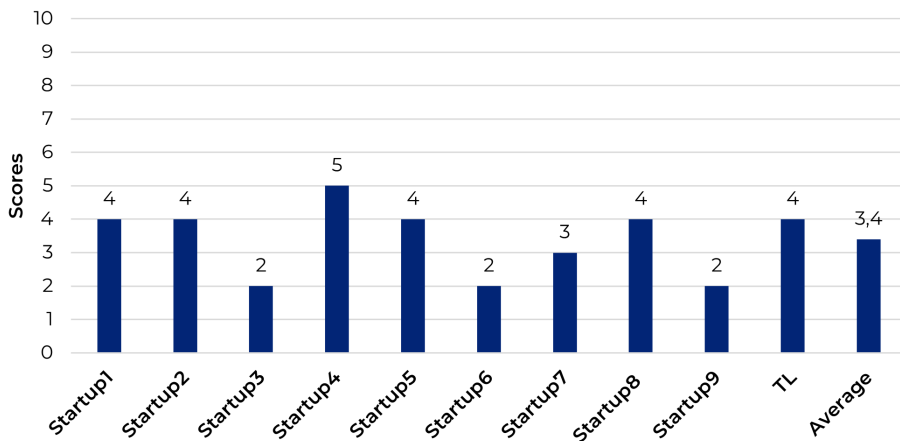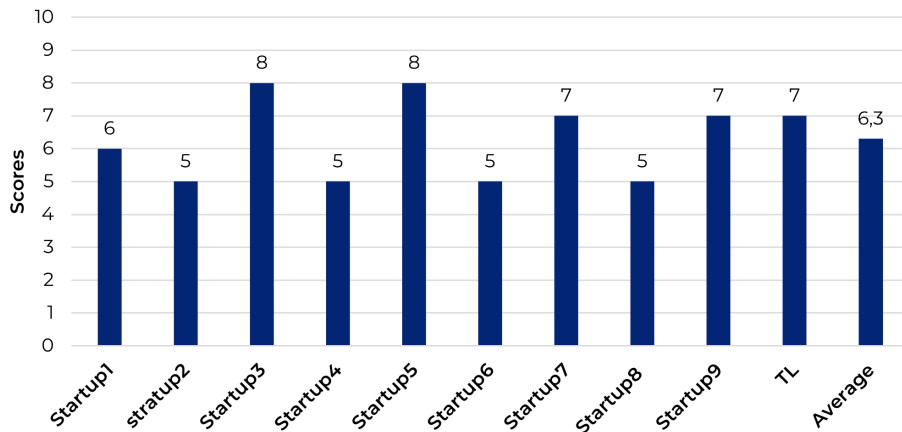

Source: Own composition based on the responses

The lowest score was 2, given by three companies. They mentioned the lack of international success to justify their rating. Startups, by definition, aim to change the industry globally; however, the respondents feel that there is still a shortage of such solutions. Startups often forget in the process of development that they are operating a company, the core objective of which is to make money. The respondents stressed that the ecosystem is still in its infancy and are rather optimistic about the future.

Other managers also think that there is no shortage of promising ideas and initiatives, but are unsure of how far one can get with only these. "Our performance is comparable to our neighbours, and TL is helping to drive innovation. This will eventually pay off, but the current performance is not up to international standards, and the interviewees were self-critical in admitting this."

3.3.2. Funding

In this section, the source of funding available to the ecosystem was evaluated. This characteristic scored high on Startup Genome's scorecard (9), but the average score of our respondents was only 6.3.

Startup3 gave the highest score, where a separate budget is attributed to agricultural development within the company, so its funding position is secure. The other high score was given by the company which has received an investment of more than EUR 1.5 million, which might explain its positivity.

Figure 8: Average score of Funding in the Hungarian agtech ecosystem

Source: Own Edited based on the responses

The high volume of public funding behind venture capital investments was highlighted the most times. Opinions on the usefulness of this vary. A benefit is that a significant amount of money is flowing into innovation. However, many have criticised the fact that less-than-viable ideas have received funding. It facilitates the functioning of startup ecosystems so that there is a possibility to fail and experiment, and so that ideas receiving funding do not necessarily have a negative impact. One of the interviewees (startup6) described this phenomenon as preparing entrepreneurs for real market conditions. According to Jáki el at. (2019), the startup ecosystem lacks a culture of failure and relaunch. The interviewees made the same observation about the agri-tech startup sector.

At the same time, it should be seen that there are venture capital institutions which will not let nonviable ideas fail and will make additional investments, simply to allocate more funding in the startup sector. Lovas and Rába (2013) found that small resources that are easy to access help strengthen entrepreneurial thinking, which is also confirmed in this section. The founders also pointed out that it is relatively easy to get small amounts of investment, and a good idea is enough to convince a venture capitalist to grant that. Opinions are divided on how successful and how effective it is for a startup to commit to a larger investor at a young age.

Many fives were awarded because access to larger amounts of funding was described as difficult. A valuable remark on this was made by one of the leaders, namely that only big and great innovation receives significant financing, and there is not much of this in the domestic ecosystem. Raising funds from abroad was also mentioned, but the potential for this was considered very low, as leading agricultural startups are not yet sufficiently

developed and smaller companies prefer to raise the necessary funds from the domestic market. In summary, startup money is readily available, but large investments are hard to come by.

3.3.3. Market reach

Figure 9 shows how respondents evaluated the market reach of start-ups in the domestic ecosystem. The dispersion of the evaluations was the largest here, which can be explained by the different experiences. The average was 4.2, which means that the chances of startups reaching the market are rather poor.

The startup based abroad (startup2) granted an outstanding score of 7. The reason behind the leaders' opinion may be that they usually encounter innovative-minded farmers, since Hungarian farmers are open to new ideas and startups can easily appeal to them if they are motivated. Startup7, which has been operating in this sector for an extended amount of time, scored highly. The reason behind its opinion may be that it usually meets innovative-minded farmers due to its operations, and it has already achieved breakthrough success in foreign markets, so it gave a 7 based on its own good experience.

Figure 9: Average score attributed to market reach in the Hungarian agtech ecosystem
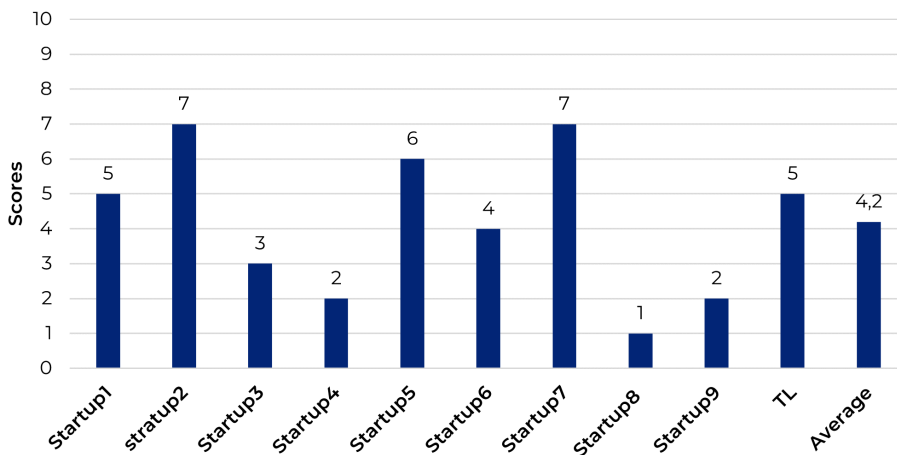
Source: Own composition based on the responses

TL has rated this factor as mediocre, which shows that they see issues and good examples alike in this area. Due to their activity, they are in contact with many farmers and large agribusinesses, so they have a lot of experience in this area. Through several of their programmes, they aim to

match the needs of farmers and large companies with the solutions pro-vided by startups, and they also organise a special competition for startup teams to look for solutions to the needs arising.

Managers gave low scores in this area (1, 2, and 3) reflecting a malfunc-tion. In Startup3's view, the domestic business community is not open to innovation in general, as it is not sufficiently pushed to be more efficient. There are few platforms where farmers can be addressed effectively, a problem which could be improved by various exhibitions and conferences. Innovative businesses should be encouraged to participate in such events. The other reason is that there is no other country where Hungarian is spo-ken as the native language, so it is much more difficult to enter foreign mar-kets than for native speakers of other languages. We have got no chance of establishing a relationship such as that of Spain and South America, or Austria and Germany. According to Jáki et al. (2019), not all Hungarian start-ups think globally, and the agricultural sector is no exception.

Many startups are facing difficulties because they are not considering extending their activity further than the Hungarian market, where scala-bility is limited. Startup founders must understand that they need to think globally from the start.

3.3.4. Talent

The last factor (talent) scored 2 by the Startup Genome survey, the same as Funding. The average score for talent in our survey was 6.2. Kállay et al. (2016) also argue that the ecosystem does exist, but the country urgently needs more internationally successful companies and examples.

Figure 10: Average score for talent in the Hungarian agtech ecosystem
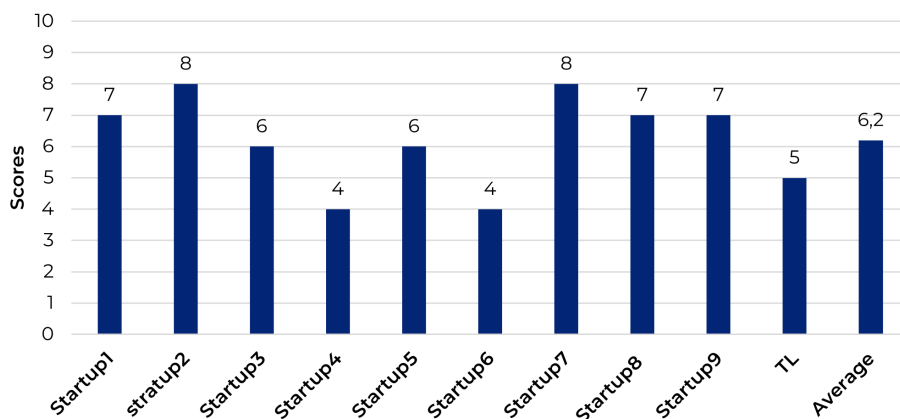
Source: Own composition based on the responses

Two companies gave the lowest score (4). Among the weaknesses highlighted, the absence of good sales skills were mentioned the most regarding the ecosystem. In addition, a detailed analysis of each industry revealed that IT skills were outstanding, business skills were good, marketing skills were moderately weak, and sales skills were particularly weak. Agricultural skills were also rated low. Undoubtedly, there is a talented potential workforce, but there is still room for improvement compared to international benchmarks. Responses suggest that there is talent in Hungary, but the issues with market access can leave talent undiscovered. In addition, the poor image and perception of the agricultural sector are well known. There could be far more talent in the sector if it were more socially popular, and a pleasant work environment dealing with animals and crops could also improve people's overall performance.

A rating of 7 was given by the experienced leader of Startup8. In his opinion, there are not necessarily more good ideas abroad than locally. Ideas are present in the Hungarian ecosystem, but they are less successful in the long run. As an example, he cited the case of IWIW and Facebook, where the basic concept was similar, nevertheless, Facebook succeeded, partly because of the larger market that was easier to reach.

Another point worth noting is that Startup2 and Startup7 both awarded a high score of 8 for talent. These two companies have sufficient international experience (along with Startup8), so their insights are certainly a cause for optimism. Talent is not necessarily seen by Startup7's management as a skill which humans are born with, so they believe that an innovative environment might have a positive impact on young people.

At this point, it is worth shedding light on the outstanding work of TL. Through their various events and competitions, they aim to involve young people in the world of agtech startups and raise awareness of this sector. As Lovas and Rába (2013) note, the JEREMIE programme has attracted a great number of young students, as has the TL's activities.

Conclusions

A Hungarian agri-startup ecosystem was first observed in 2019 with the establishment of TL and has already achieved notable results in a short time. The ecosystem has so far lacked international recognition, but the results show that it is on the right track. Among several factors examined, what needs to be improved the most is the market reach. The international links of the Hungarian ecosystem need to be better developed to make this attribute even more valuable in the future. Although the Hungarian market is small and language differences limit opportunities, there are possibilities of forming relations with The Visegrad Group (V4) and EU

member countries. Hungarians are employed in startups or have founded successful startups in many parts of the world. These international networks should be better exploited. TL has an important role to play in this, as more foreign professionals should be involved in their competitions and events. It would also be useful to involve foreign experts as mentors or jury members. In addition, there should be more incentives (including financial support) for Hungarian companies to treat entering the global market as a priority. If increased successes (exits and international investments) are achieved over time, the international profile of the ecosystem may also be more prevalent. Reaching global markets should be considered and identified as a key objective from the moment of launch. Looking at funding, the Hungarian agri-startup ecosystem is relatively strong. An issue is that many young people find it difficult to let go of their failed ideas, either because of expectations from the investor or because of their own misjudgement. Ecosystem actors have a great responsibility in preparing young people for failure in the future, allowing them to do so and teaching them how to start again. This will allow them to build on their existing experience while creating a company with more potential for success. This could be helped by education and shifting the mindset of the founders. Venture capitalists should realise that the failure of a startup is an opportunity to establish a new business. Looking at the aspect of talent, the responses to the survey show that there is great talent in Hungary. In general, regrettably, the agricultural sector is not appreciated enough and does not have a good public image. This should be improved, and agriculture should be promoted so that the best talent will consider choosing this sector. Digitalisation in agriculture can be attractive to young people. In universities, students should be shown the potential of agriculture in various courses, including engineering, IT, and economics. TL aims to raise awareness to the potential of agribusinesses among startups, venture capitalists and others outside of the sector. In summary, according to the actors of the ecosystem, the Hungarian agri-startups are in a favourable position, several funds are available, even though certain skills are still absent, but this can be improved by gaining experience and knowledge. If players in the sector manage to take advantage of its potential and improve its weaknesses, the future will look promising. Due to the novelty of the ecosystem and the scarcity of literature, further research is needed on this topic, and this survey can be repeated regularly with more participants to monitor the development of the ecosystem. It would be useful to investigate the functioning of agricultural startups and compare them with similar companies in other fields. Finally, the Hungarian agri-startup ecosystem should be compared with the ecosystem in neighbouring countries in Central and Eastern Europe.

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