Supporting Entrepreneurship with Hackathons - A Study on Startup Founders Attending Hackathons

Maria Angelica Medina Angarita[1](✉) and Alexander Nolte[1,2]

[1] University of Tartu, Ülikooli 18, 50090 Tartu, Estonia
{maria.medina,alexander.nolte}@ut.ee
[2] Carnegie Mellon University, 5000 Forbes Avenue, Pittsburgh, PA 15213, USA

Abstract. Entrepreneurial hackathons are generally perceived to foster the creation of new startups, support networking, and acquire entrepreneurial skills. Current research work about entrepreneurial hackathons focuses on reporting the perceived benefits of the participants. However, little is known about why startup founders initially participate in hackathons, how they perceive the impact of participating on their entrepreneurial journey, and how different hackathon settings can affect their perception. To address this gap, we conducted an interview study with startup founders who have participated in hackathons. Our findings indicate that founders are mainly motivated to participate in hackathons in relation to their startups to learn about the topic of their startup and train the prototyping skills of their startup team. Moreover, we found that the initial intentions of startup founders could change during the hackathon.

Keywords: Hackathon · Startup · Entrepreneurship

1 Introduction

Hackathons are time-bounded, themed events where participants gather in teams and work on a project of their interest. They originated as weekend-long events in the early 2000s as an agile approach for corporations to foster innovation [37]. Nowadays, they are organized by, among others, by universities [15, 18, 33] hosting academic hackathons, and private corporations [14, 41] hosting corporate events. In addition, there are also entrepreneurial hackathons that are often organized as a means to promote entrepreneurial practices [6], such as networking [10, 18, 40], learning [7, 15], providing participants with early-stage entrepreneurship guidance [39], interdisciplinary collaboration [25], funding [10], the formation of a team [27], and the creation of a prototype or a minimum viable product (MVP) [10]. Such events are often perceived as the starting point for startup creation [40], as they allow for designing an initial product that can be validated by potential users, which is essential for startups [38]. Prior work provides indications that hackathons can also be useful for startups in the later stages of their development to find potential employees, acquire investment, and validate or

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promote their projects [31]. Most existing work has focused on the organizer perspective and the perception of participants during and after an event, instead, we focus on how startup founders have experienced hackathons as their means for supporting their startups, and if startup founders have indeed been motivated to attend entrepreneurial hackathons to foster their startups. Thus, we propose our first research question **(RQ1): Why have startup founders attended hackathons?** In addition to understanding the goals of startup founders for attending hackathons, we also aim to study whether and how they achieved them. Thus, we also propose our second research question **(RQ2): What are the perceived benefits of entrepreneurial hackathons to startup founders?** Finally, to understand how entrepreneurial hackathons have supported entrepreneurs, we aim to study how the hackathon setting has supported or hindered startup founders to achieve their goals. Thus, we propose as our third research question **(RQ3): How did participants perceive the hackathon setting to have influenced the achievement of their goals?** To answer these questions, we conducted an interview study with startup founders about their motivations to attend hackathons, their perceived benefits, and how the setting supported or hindered them. Our findings indicate that the startup founders we studied attended hackathons in relation to their startups to receive feedback about an idea related to their startup, learn technological skills, network with experts, develop the prototype of their startup, and develop the skills of the startup team.

2 Background

We perceive entrepreneurial hackathons as events that focus on turning an idea into a product, and later into a new, independent, and profitable startup [9]. Most of these events offer prizes that may include tools and resources, mentorship, or tickets to startup incubators [12, 32]. Prior work has identified various motivations for individuals to attend such events that include entrepreneurial goals, such as **building a product, finding a team to work with** [5], **networking** [4], **learning** [5], and **finding investors** [26]. There are also motivations unrelated to entrepreneurship though, such as free pizza [5], status and reputation [21], having fun [26], and career concerns [9]. Our research expands this line of research by focusing on the goals of startup founders and how these goals could be related to the development of their existing startups.

Prior work has established that startup founders are motivated to attend hackathons to receive feedback about an idea, promote their idea to the general public, attract funding, find suitable partners or employees, or construct an initial prototype [31]. We expand on these findings by addressing why startup founders have participated in hackathons and whether or not their expectations have been met.

Prior work in the context of start-ups discusses various stages of development. Some include three stages [11, 42], while others include four [22, 36, 45] and more than four stages [43]. We chose the model of four startup stages of development [22] as it describes specific challenges inherent to each stage. These four startup stages consist of inception, stabilization, growth, and maturity [22]. During the early stages, the main challenges consist of forming a team with the right skills to create the first version of the startup product, while in later stages, the focus is centered on business growth [2] in the market share [22]. While prior research about hackathons focuses on stage one of startup development, we aim to expand to other stages.

The perceived benefits of hackathon participants that have been addressed by previous research include the validation of ideas [19], startups [4], exercising entrepreneurial thinking, and learning entrepreneurial skills [3, 44]. The entrepreneurial skills participants have learned at hackathons involve "*leadership, negotiation, team working and communications skills*" [3], as well as "*the basic processes of assumption validation, stakeholder analysis, and root cause analyses*" [39], and "*a greater ability to come up with a viable business idea*" [44]. Team formation supports networking, as it presents an opportunity "*to make contacts and grow networks that would otherwise be difficult to achieve outside of hackathons*" [34]. Hackathons also allow participants to validate their ideas into prototypes and have "*proof of the potential market demonstrated with the first viable product*" [19]. Our research contributes to these findings by focusing on the perceived benefits of startup founders.

Certain aspects that make up the hackathon setting have been found to influence the achievement of the goals of the participants. These include the duration of the hackathon, its theme, team formation, ideation, additional feedback, and competition [27], and they have been found to be related to goal achievement. The presence of stakeholders at hackathons has also been found to positively influence [16, 28, 35] the quality of the final prototypes, as having stakeholders at hackathons allows participants to validate their prototypes. Certain aspects of the setting, however, have been found to affect the goals of participants negatively. Hackathons are often weekend-long events, and thus, "*too short of an event to generate lasting enthusiasm and progress*" [39]. The short duration of hackathons has also been found to hinder the quality of the final prototypes [27]. In addition, more often than not, the ideas, projects, teams, and connections made at the hackathon are not sustained after the hackathon ends [20].

3 Research Method

To answer the research questions, we conducted an interview study. We selected semi-structured interviews as our main research method as they are appropriate for describing the perspective of an individual of a situation or set of events [24]. Our aim is to study the perception of startup founders (**SF**) attending hackathons. We thus excluded hackathon participants who have not founded a startup because they would not be able to provide insight about their experiences at hackathons in relation to the development of their startup. We identified suitable study participants by intersecting a database [31] of hackathon events from 2010 to 2019 with a database about startup founders and contacted individuals within that intersection. From the responses obtained we selected six participants (**SF1–SF6**). Their startups had contrasting traits (see Table 1), such as focusing on either software ("*Soft*") or hardware ("*Hard*") products. While most startup founders are still working in their startups, two of the founders are no longer part of their startup (SF3, SF5). In Table 1, "*Y*" ("*Yes*") indicates startup founders that are still part of their startups. At the time each founder attended the hackathons, their startups were in various degrees of development. Some went to hackathons before founding their startups (SF1, SF4, SF5), while others attended when the startups were at later stages (SF2, SF3, SF6).

The hackathons our study participants attended had a similar setting. With the exception of SF1, who attended an entrepreneurial hackathon that focused on business model

Table 1. Startup traits at the year 2020.

Startup traits	SF1	SF2	SF3	SF4	SF5	SF6
Startups founded	2	1	1	1	2	1
Active startup	Y/Y	Y	N	Y	N/Y	Y
Founder in startup	Y/Y	Y	N	Y	N/N	Y
Team size	7	3	0	4	7	25
Product type	Hard	Soft	Hard	Soft	Hard	Soft/Hard
Startup stage	3	3	0	3	0/3	3

development, all founders attended hackathons that were organized by the same north-eastern european institution that specializes in events related to entrepreneurship. They were all weekend-long events that followed the common hackathon schedule [29] where participants pitched their ideas for projects at the beginning and were free to join a team based on the ideas that interested them. To ensure that participants would stay on track the organizers provided access to mentors and held regular checkpoints. The hackathons were focused on the completion of a prototype, but the teams were also given mentorship about how to pitch their projects with a business-focused format, which included addressing how to monetize their prototype. We created an interview guide[1] before interviewing the participants. The guide covered questions related to their motivations to attend the hackathons (**RQ1**), their perceived benefits (**RQ2**), and their perception of how the setting has helped them achieve their goals (**RQ3**). Some of the questions included "*Tell me about why you went to the hackathon*" in reference to **RQ1**, and "*At the hackathon, what helped you to achieve (your aforementioned goals)?"* in relation to **RQ2** and **RQ3**. We analyzed the interview findings by coding and clustering the interview answers into themes. The clusters were based on the relationships between the hackathon settings and outcomes [27]. There were first-level clusters, such as "*hackathon outcomes*" that contained second-level clusters, such as "*networking*" and "*learning*".

4 Experiences of Startup Founders at Hackathons

In this section, we present a detailed description of the hackathon experience of each startup founder (Sects. 4.1, 4.2, 4.3, 4.4, 4.5 and 4.6) before comparing their findings (Sect. 5).

4.1 SF1 – Meeting a Temporary Startup Team Member at a Hackathon by Accident

The startup team of SF1 developed a hardware product and launched it in 2016. Since then, they have been producing and selling the product to clients. At the time SF1 attended a hackathon in 2015, however, this startup had not been founded. SF1 thus did

[1] The complete guide is accessible here: https://tinyurl.com/33krjvd9.

not participate in a hackathon with a motivation related to the startup but rather attended a hackathon as a mentor: "*I was actually asked [to participate] as a mentor*" (SF1). But soon after the hackathon started s/he talked to one of the teams, found their idea "*really interesting*" (SF1), and joined that team. S/he mentioned that s/he could switch roles at the hackathon because there were no restrictive participation guidelines: "*If there's [a] very strict guideline as to what the mentor should do or should not do, then perhaps this would not have happened"* (SF1). During the hackathon, s/he worked together with the team on a website for their project. They won the main prize of the hackathon: a mentoring program and "*a place in the top 100 [of a business accelerator competition]*" (SF1). The team took part in the competition, where SF1 made new contacts, but they did not become part of the top 30 finalists and eventually stopped working on their hackathon project. In addition, SF1 met one of the designers of their startup product at the hackathon: "*we got to know each other on this hackathon for the first time*" (SF1). SF1 also met the CEO of an enterprise and talked about a product which later got turned into a product: "*We had an initial agreement already on the hackathon […] and then we went on to try to develop something*" (SF1). To develop the product, SF1 created a company: "*I still have the company. And that one carried on quite long*" (SF1). Overall, networking and the creation of a company were the main benefits for SF1: "*The main positive effect for me was the networking. That I made longtime friends from that. And also, yeah, just spinning a few startups*" (SF1).

4.2 SF2 – Learning Through Networking at a Hackathon

The startup of SF2 focuses on entry access technologies. It was founded eight months before the hackathon and consisted of a small team of people. The startup was at an early stage, where the main challenges related to "*how to finally make this prototype a product that is sustainable*" (SF2) and how to "*find a business model that works…because development is costly*" (SF2). But SF2 did not attend a hackathon to solve these challenges. Instead, SF2 attended a hackathon to have fun, receive feedback about an idea related to the field of her/his startup, and network and learn from people who are experts in that field. To SF2, these goals were connected, and s/he achieved them by pitching an idea that would allow her/him to meet and learn from experts in the field of the startup: "*That particular idea attracted the people we were interested in"* (SF2). Weeks before the hackathon took place, SF2 met with colleagues who would become part of her/his hackathon team: "*We had a meeting with our team members…[we] made some preliminary plans"* (SF2). S/he then sent the project idea and the pitching presentation to the hackathon organizers. At the hackathon, the different ideas that participants had sent were displayed on posters. Participants gathered around the posters with the ideas they were interested in to form teams. SF2 recruited team members, but s/he also took advantage of this setup to network. S/he stated that s/he approached the posters about ideas of her/his interest and talked with people who were also interested in those ideas: "*these ideas attract people who are knowledgeable in that field. So, when I go to meet this team… I can meet people who are really good at this*" (SF2). On the second day of the hackathon, s/he visited other teams to meet with people again and "*to see what they have done and just talk and hopefully it gives them good ideas… [and to] contribute and also learn by experience*" (SF2). Overall, SF2 was able to learn by

meeting *"people who were very knowledgeable about access control systems and we got some ideas about how to develop our prototype"* (SF2). In addition to learning from participants from other teams, SF2 learned from the mentors and her/his team members, who were knowledgeable in the field related to the hackathon project: "*there were some good mentors, and also my team members that are very good on this field*" (SF2). S/he also learned new skills by working on their prototype: "*I learned also, from my own experience, building this mesh network, I learned some new skills*" (SF2).

4.3 SF3 – Participating in a Hackathon to Create a New Startup

The startup team of SF3 used to develop and sell hardware products to clients. However, at the time of the hackathon that SF3 recounted, the startup was not generating enough profit to become sustainable "*the startup I was already with was not getting traction fast enough"* (SF3), which motivated SF3 to attend a hackathon to create a new startup. In order to create a new startup at the hackathon, SF3 joined a team and worked on a project with people s/he did not know beforehand, and they won the main award of the hackathon: "*we won the first prize*" (SF3). The prize consisted of a team-building hike with the hackathon team: "*one of the prizes was a hike*" (SF3). After the hackathon ended, some team members left the team, but SF3 and the remaining members continued looking for funding, as "*developing hardware…costs awfully"* (SF3). They found financing with a "*public procurement thing*" (SF3) but eventually ceased working on their project, as the amount of funding they obtained was not enough to start production and keep the project afloat. The hackathon was thus helpful for SF3 to find a new startup team, although they did not continue working on their project afterwards. SF3 also recounted two other hackathon experiences. SF3 stated that s/he first took part in a hackathon for the first time because the hackathon "*seemed interesting to me*" (SF3). On another occasion, SF3 attended a hackathon to connect a topic of her/his interest with hackathons: "*I wanted to see what happens if I take [topic of interest] to a hackathon*" (SF3). S/he pitched an idea related to her/his job in a field of her/his interest, formed a team, and won a prize at that hackathon: "*for that, we won… 500 kg of processed steel*" (SF3). However, this prize has not been claimed yet: "*this is still valid, if I would want to, like, make something out of steel*" (SF3).

4.4 SF4 – Learning and Networking at a Hackathon

The startup team of SF4 developed an educational app that is currently active. The original prototype was developed at a hackathon. SF4 attended this hackathon in 2014 where s/he met the initial members of the startup team *"[I] met the initial teammates there. But basically, everybody has changed from that original team"* (SF4). At the hackathon, they developed and presented a prototype *"we got out a really ugly prototype"* (SF4). Albeit the team did not win any prizes at the hackathon, after the hackathon their prototype was uploaded to an app store and was downloaded at least a thousand times *"we could use this prototype to prove that there was need and demand on the market. So [the] prototype got 1000 downloads, which was nice*" (SF4). This motivated the team to continue working on their project: "*it proved to us that at least somebody is looking for it, and somebody wants to try this out*" (SF4). Albeit the startup of SF4 originated at a

hackathon, there seems to be no further connection between the startup and hackathons. SF4 added that s/he would not attend a hackathon with her/his current startup because of potential problems that could arise concerning the ownership of intellectual property: "*if I have [an] already established startup, then everybody – all the new people who would join in another hackathon would have rights to the IP*" (SF4). After founding the startup, SF4 attended a hackathon that focused on a topic of her/his interest because s/he is currently working as a volunteer in that field "*I like [topic] and [topic] hackathons I've always enjoyed because they're really interesting*" (SF4). At the hackathon, SF4 learned by talking to experts in the field: "*I have contacts now I can turn to"* (SF4), including mentors and organizers. S/he learned *"some things about [topic] industry in [country], what companies are there and how they work together*" (SF4). SF4 also mentioned that s/he won the second prize at the hackathon, which consisted of "*hardware tools*" (SF4). But the prize did not contribute to the sustainability of the project, as the tools "*wouldn't have helped*" (SF4).

4.5 SF5 – Learning About Business Management at a Hackathon

SF5 has co-founded two startups. Less than six months after the foundation of a startup, SF5 and the startup team went to a hackathon to develop their startup product. Before the hackathon took place, SF5 organized a meeting with the team to discuss what they would do at the hackathon and answer questions such as "*Why are we going there?… What do we want to do?*" (SF5). S/he mentioned that the hackathon was "*an excuse to sit down with the team for two days and talk about stuff*" (SF5), and that s/he was also motivated to attend because of the tools and facilities provided at the hackathon: "*free stuff, free food, free equipment*" (SF5). Albeit SF5 took part in the hackathon to develop the prototype of their startup product, those plans soon changed: "*we built nothing, because we understood that building was not the problem*" (SF5). Soon after the hackathon started, SF5 learned that business management was a relevant aspect that could support the startup: "*we could have, like, a shelf full of the best product in the world, but we still wouldn't have a company*" (SF5). S/he learned this while preparing for the final pitching session: "*the thing that has taught me the most is preparing for the final pitch*" (SF5). In addition to learning from the feedback given by the mentors, SF5 also learned about business management from a document supplied by the organizers: "*in the end, you have to do a pitch. And it has to be it has to be structured. And there is a document that helps you to write this thing well"* (SF5). After the hackathon ended, SF5 stated that the startup team focused more on the business management of the startup: "*We… focused on another direction after that*" (SF5). The startup team of SF5 continued to share what they learned at the hackathon when they talked with "*some investors or potential clients"* (SF5). However, SF5 would not like to pitch again at hackathons because s/he perceived the feedback to be similar at different hackathons: "*I have done that pitch training a couple of times… and that gets repetitive*" (SF5).

Currently, learning a new technology is one of the main reasons SF5 attends hackathons: "*when I go to hackathons now I go because I want something that is technically challenging, but new*" (SF5). The second main reason SF5 currently attends hackathons is "*to network with everybody*" (SF5). SF5 attended another hackathon that a private company had funded. SF5 initially attended as a mentor but soon joined a

hackathon team s/he was familiar with: "*a couple of my friends were doing a radio project [and] I helped them because I like radio stuff*" (SF5). The idea for the project originated from a client of the startup company that sponsored the hackathon: "*this idea was given to the startup by a big client*" (SF5). At the hackathon, s/he met with one of the project managers of the company with whom s/he had also worked beforehand: "*I had worked with her/him, like, for a couple of years*" (SF5). They talked about a potential job opportunity if their project obtained funding: "*I said…I need a good-paying job*" (SF5). A few months after the hackathon ended, the project manager contacted SF5, and s/he soon started working in his company: "*My now[sic] boss called me… [and said] we need somebody who can build this. Come and build this*" (SF5).

4.6 SF6 – Hackathons as a Means to Develop the Skills of the Startup Team

The startup of SF6 creates prototypes for clients and helps other companies build their hardware projects. Since the creation of the startup in 2013, SF6 and various members of the startup team have attended at least four hackathons together for at least three consecutive years. SF6 mentioned that s/he attended various hackathons with some startup team members to improve their prototyping skills "*we want… our team to grow their skills and see, like, a little bit more projects*" (SF4). SF6 also added that s/he was motivated to take part in the hackathon with the startup team to "*focus on working together with these different, smaller teams to just build their relationships*" (SF6). The startup team developed their skills at the various hackathons by working on projects "*we really developed our own skillset*" (SF6). They worked on any project that they considered interesting because the project itself was not of core interest to them because "*the hackathon itself is not that serious*" (SF6).

5 Comparison of the Hackathon Experiences of Startup Founders

In this section, we provide a comparison of the different experiences of startup founders we interviewed. We address their motivations to attend (Sect. 5.1), whether they reached their goals (Sect. 5.2), and the aspects of the hackathon setting that they perceived as beneficial to the achievement of their goals (Sect. 5.3).

5.1 Motivations of Startup Founders to Attend Hackathons (RQ1)

We found that startup founders attended hackathons for motivations related and unrelated to their startups (see Table 2). SF2 attended a hackathon to receive feedback about an idea related to the startup, SF5 attended a hackathon to develop the initial startup product, and SF6 attended to develop the skills of the startup team. This points towards hackathons being perceived as beneficial to startup founders not only in terms of supporting product development but mentoring and skills training as well.

Some startup founders, however, also attended hackathons based on personal interests unrelated to their startups: SF1 participated in a hackathon as a mentor, and SF3 participated in a hackathon to create a new startup in addition to an already existing startup. Moreover, some of the motivations of startup founders to attend hackathons

Table 2. Motivations of startup founders to attend hackathons.

SF1-6	Related to existing startup	Unrelated to existing startup
SF1	No	Participating as a mentor to provide feedback to teams
SF2	Learning/Networking/Getting feedback about an idea related to the startup	No
SF3	No	Creating a new startup
SF4	No	Developing a prototype/Learning about a topic of personal interest
SF5	Developing the prototype of the startup product	Participating as a mentor to provide feedback to teams
SF6	Developing the skills of the startup team	No

changed over time: SF4 developed the first prototype of their startup at a hackathon but currently attends hackathons to learn about topics of her/his interest. Similarly, SF5 once attended a hackathon to develop a startup prototype but since then has attended hackathons to network and meet new people. This may indicate that startup founders go to hackathons but do not necessarily work on their startup, and that building a product is only one of many motivations.

5.2 Perceived Benefits of Startup Founders (RQ2)

Most startup founders achieved their goals, both related and unrelated to their existing startups at the time of the hackathon (see Table 3). SF2, who attended a hackathon to receive feedback about an idea related to the startup and was able to do so by teaming up with people who were knowledgeable in that field. In addition, SF6, who attended hackathons to develop the skills of the startup team, was also able to create various prototypes with them. This points towards hackathon participants being able to achieve their goals related to entrepreneurship by taking their own initiative and using aspects of the hackathon setting in accordance with their own needs. However, not all the hackathon goals of the startup founders were achieved, e.g., SF3 took part in a hackathon to create a startup, but despite winning an award and obtaining funding, the team abandoned the project. In this case, despite benefiting from various aspects of the setting, the startup did not take off, as opposed to SF4, who continued developing a startup after the hackathon ended. In this case, to support a startup after the hackathon has ended, market validation appeared to be more valuable than awards.

Some of the perceived hackathon benefits were unexpected. SF1 did not attend a hackathon to support her/his startup, as it had not been founded yet, but at the hackathon s/he met a designer who would become a temporary startup team member. Similarly, SF5 attended a hackathon as a mentor to give teams feedback, but unexpectedly met with her/his future employer. On another occasion, SF5 attended a hackathon to develop the initial startup product, but focused on learning about business management instead. This points towards hackathons supporting networking by the presence of diverse participants

Table 3. Perceived benefits of startup founders.

SF1-6	Related to existing startup	Unrelated to existing startup
SF1	Meeting a temporary startup member	Networking, Creation of company
SF2	Learning, Networking, Getting feedback about an idea related to the startup	No
SF3	No	Developing a prototype
SF4	No	Startup prototype/ Learning about a topic of personal interest
SF5	No	Learning about product development/Career development
SF6	Developing the skills of the startup team	No

and team formation, as well as learning, that is supported by working on a project and mentoring.

5.3 Beneficial Aspects of the Hackathon Setting (RQ3)

Various aspects of the hackathon setting were perceived as beneficial to the achievement of the aforementioned goals of startup founders at hackathons (**RQ3**):

- **Participant presentations.** Pitching an idea related to the startup field allowed SF2 to meet new people who were knowledgeable in that field and that gave her/him expert advice.
- **Developing a project (Hacking).** SF2 also learned about a field related to the startup by working with the hackathon team on a prototype. Similarly, SF4 and her/his team practiced their prototyping skills by developing a prototype.
- **Information material.** SF5 received feedback from the mentors about the pitch for the final presentation. The organizers also gave participants a document that explained the format of the pitch and the topics that needed to be addressed. This document allowed SF5 to learn and explore various aspects of the startup that s/he had not thought of before, such as potential ways to monetize the prototype, which were helpful when discussing funding possibilities with potential investors.
- **Mentors.** Mentors helped startup founders to learn about topics related to the startup (SF2, SF5) and a personal topic of interest (SF4).
- **Changes of roles during the event.** SF1 and SF5 changed from their roles as mentors to hackathon participants. Switching roles allowed them to work with other participants in a team and win a prize (SF1) and obtain employment (SF5).
- **Team formation.** For SF1 and SF5, team formation allowed them to meet people they would work with after the hackathon ended. For SF2, working with a team was helpful for learning. Finally, for SF3, SF4, and SF6, team formation allowed them to create a prototype with the help of their teammates.
- **Awards.** For SF1, winning an award at the hackathon was considered useful as s/he networked with new people s/he met during the mentoring process after the hackathon

ended. However, SF3 mentioned that the type of award the hackathon team received did not offer the necessary support for the team to continue working on their project after the hackathon ended, and the other hackathon award that SF3 won has not been claimed yet. Similarly, SF4 won a hackathon award that s/he claimed was not useful for developing the hackathon project further.

6 Discussion

Some of our findings of the hackathon goals of startup founders (**RQ1**) match the findings from previous research (see Sect. 2). **Learning** as a hackathon motivation [5] was mentioned in our study by SF2 and SF4, who attended hackathons to learn about topics related (SF2) and unrelated to their startups (SF4). This points towards hackathons allowing for a multitude of learning opportunities, such as learning from working on a project [46] and learning from mentors [30]. Learning is also an essential factor for startups [1] to improve their business and product development. **Networking** was also a motivation to attend hackathons that was mentioned in our study by SF2, SF4, and SF5. It has also been addressed [5] as one of the most popular motivations to attend hackathons, and as a helpful aspect for startups [8] as founders can learn from experts and peers about how to solve startup problems. **Building a prototype** [26] was mentioned by almost all startup founders as a motivation to attend hackathons. It is evident why these findings match, as hackathons are events that focus essentially on the development of projects. However, in community settings or collegiate settings, the main focus of the participants and the organizers might differ [13]. Receiving feedback about an idea was mentioned by SF2 (both as a hackathon goal and a perceived benefit) and has also been addressed by previous research [31]. However, other motivations, such as promoting an idea to the public, finding suitable employees, achieving status and reputation, attracting investors, and winning prizes [21, 31], were not mentioned by startup founders in our study. One of the reasons this occurred was explained by SF4, who mentioned that there were issues concerning IP rights at hackathons that restrained her/him from sharing new startup ideas, which has also been addressed by previous research work [23].

Regarding how the motivations of founders matched the current challenges of their startups, we found that some of them attended hackathons in relation to those challenges. The startup of SF5 was at the inception stage, and SF5 went with the startup team to develop the first initial version of their product at a hackathon, which matches the main challenges of a startup at an initial stage [22]. Moreover, SF6, whose startup was at the growth stage, used the hackathon as a chance to improve the skills of the startup team. However, most startup founders did not attend hackathons to solve startup challenges in relation to their current stage (SF1, SF2, SF3, SF4).

We also found that the perceived benefits of entrepreneurial hackathons addressed in literature matched those addressed by the startup founders in our study (**RQ2**). **Learning** as a hackathon benefit [17] was mentioned in our study by SF2, SF4, SF5, although the latter had no learning expectations for the hackathon. **Networking** [28] was mentioned by most startup founders (SF1, SF2, SF4, SF5). However, **developing the skills of the startup team** was mentioned by SF4 in our study, but it has not been addressed by previous research. Startup founders mentioned other perceived benefits, such as the

recruitment of a temporary startup team member and finding employment. These were unexpected hackathon benefits that might have been related to the startup founders (SF1, SF5) switching roles during the hackathon from mentors to participants. Changing roles during a hackathon and achieving unexpected benefits implies that organizers should, to a certain extent, allow participants to change their initial goals and develop their own strategies to achieve new goals. This unexpected behavior led to beneficial results for the startup founders.

Regarding the aspects of the setting that supported or hindered the achievement of the goals of participants (**RQ3**), we found that mentors, participant presentations, information material, energizing activities, and allowing for role changes were beneficial for startup founders. However, not all of these findings overlap with the connections found in previous research [27]. It has been found that the presence of mentors at hackathons is beneficial to the participants [30], but it is still unknown how allowing role changes could affect participants under other circumstances. Moreover, even when some of the hackathon teams won awards (SF1, SF3, SF4), the startup founders mentioned that it was not enough to continue working on their projects. This matches with the findings of previous research that points towards the lack of funding [39] being one of the major reasons hackathon teams stop working on their projects after the hackathon, and that awarding teams with more substantial prizes to ensure that they continue working on their projects [40] could be a way to solve this issue. Some research gaps remain about the experience of participants (including startup founders) at entrepreneurial hackathons. The connection between the goals of participants and their intention of continuing working on their projects after the hackathon ends is still unknown, but we took a first step towards covering this gap.

7 Implications

Based on our findings, we suggest that organizers of entrepreneurial hackathons consider the different motivations of participants for attending hackathons and apply the aspects of the setting the startup founders mentioned to be beneficial for their hackathon experience. Moreover, we suggest entrepreneurs who are thinking about attending a hackathon take into account all the benefits of hackathons beyond team formation and developing a prototype. One of those benefits is networking. Our findings indicated that networking at hackathons allowed startup founders to meet new people who became valuable to the development of their careers, and their startups.

8 Limitations

We involved a small sample of startup founders as only a few had been to a hackathon and addressed their individual experiences as opposed to the experiences of the various hackathon teams, which limits the generalizability of our findings regarding the connection between the hackathon setting and the perceived benefits. Future research work regarding the hackathon goals of startup founders featuring a larger sample size may also obtain different findings. Moreover, our findings were based on the perceptions of startup founders about hackathons that took place years ago in collocated spaces, thus,

important nuances that could have changed the direction of our conclusions might have been omitted.

9 Conclusion

This paper contributes to our understanding of how entrepreneurial hackathons can support startups by presenting an overview of the motivations of startup founders for taking part in entrepreneurial hackathons, as well as their perceived benefits and how the setting helped them achieve their goals. We found that startup founders take part in hackathons motivated by reasons related to their startup. Those reasons can also change during the hackathon and lead to unexpected outcomes. These benefits are supported by certain aspects of the setting, such as team formation, participant presentations, and unrestrictive participation guidelines. These aspects can be applied to future hackathons that aim to encourage entrepreneurial behavior, create startups, and support the development of startups at various stages. We are currently in the progress of running a larger scale survey study with the aim to support the creation of guidelines about how startups at various stages can benefit from hackathons.

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