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CURRENT LITERATURE ON HACKATHONS: OUTCOME SUSTAINABILITY AND REMOTE PARTICIPATION

Examiners: Associate Professor Ari Happonen
Professor Jari Porras

ABSTRACT

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CURRENT LITERATURE ON HACKATHONS:
OUTCOME SUSTAINABILITY AND REMOTE PARTICIPATION
Master's Thesis 2020

46 pages, 4 figures, 12 tables
Examiners: Associate Professor Ari Happonen
Professor Jari Porras
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This thesis work is based on Systematic Literature Review on hackathon like events. Thesis research focuses on outcome sustainability and remote participation during these events. A general overview of hackathon related research topics and coverage relevance have been conducted with potential future research suggestions in mind. Selected material has been classified during the in-depth reading process and focus-related observations recorded for further analysis. The most notable observations are the following: 1) Publications on post-event walkthrough are the most common ones, 2) There is a decent amount of research on motivation during the event, although it mainly focuses on participant motivators, 3) Hackathons are commonly viewed as part of the learning process that in many cases have similarities with Project-Based Learning and/or emphasise the importance of teamwork, 4) Event outcome sustainability is little researched and has contradictory findings as well as 5) Remote participation in hackathon like event is almost not studied and is mostly limited to subjective sidenotes in research focusing on other subjects.

TIIVISTELMÄ

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Diplomityö 2020

46 sivua, 4 kuvaa, 12 taulukkoa
Työn tarkastajat: Associate Professor Ari Happonen
Professor Jari Porras
Hakusanat: Hackathon, tulosten jatkuvuus, etäosallistuminen, online, digitalisaatio

Tämä työ pohjautuu kirjallisuuskatsaukseen (Systematic Literature Review) hackathon-tapahtumista. Työn fokuksena on tapahtumatulosten kestävyys sekä etäosallistuminen mahdollisuus kyseessä oleviin tapahtumiin. Myös hackathon-tapahtumien olemassa olevaa tutkimuksen kattavuutta ja suosiota tarkastellaan potentiaalisen lisätutkimuksen kartoittamisen näkökulmasta. Kerätty kirjallisuus on luokiteltu perinpohjaisen läpikäynnin yhteydessä ja työn fokukseen liittyvät havainnot kirjattu ylös. Tärkeimpiä havaintoja ovat: 1) Menneiden tapahtumien läpikäyntiin liittyvää tutkimusta on reilusti eniten, 2) Osallistumismotivaatiota on tutkittu runsaasti, vaikkakin se kohdistuu pääsääntöisesti osallistujien motivaattoreihin, 3) Hackathoneja tutkitaan myös kohtuullisesti osana oppimisprosessia ja niillä on havaittu olevan yhtenäisyyksiä projektioppimisen kanssa, 4) Tapahtumatulosten kestävyyttä on tutkittu vähän ja olemassa olevat johtopäätökset ovat jokseenkin ristiriitaisia, sekä 5) Etäosallistumiseen liittyvä tutkimus hackathonien kontekstissa puuttuu lähes kokonaan ja nojautuu tällä hetkellä lähinnä subjektiivisiin sivukommentteihin ja yksittäisiin julkaisuihin.

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LIST OF SYMBOLS AND ABBREVIATIONS

CBL	Challenge-Based Learning
COVID-19	Corona Virus Pandemic 2019
IEEE	the Institute of Electrical and Electronics Engineers
LC	Learning Cycle
MVP	Minimum Viable Product
PBL	Project-Based Learning
Q	Question
R	Respondent
RC	Radical Collocation
Resp.	Respondents
RQ	Research Question
SLR	Systematic Literature Review
WoS	Web of Science

1 INTRODUCTION

Hackathons were originated in the late 1990s with a close tie to Silicon Valley, where this format was used for prototyping and problem-solving activities [1]. The term was coined by OpenBSD that organized a seven-day event in 1999 around the open-source operating system with the same name [2], [3]. Hackathons are time-bounded events where participants gather together, form teams and work together on the project of interest [4]–[6]. These events are often associated with software development [4], [4], [7] but in practice cover also other areas such as civic engagement [8], [9], hardware [10], [11], healthcare [12], [13] and society development and sustainability aspects [14].

The length of these events varies usually between 24 and 36 hours [15] but could be extended up to a week [3], [16]. Team sizes might differ quite a bit but usually consist of three to five people [17], [18]. The term hackathon was first used in the year 1999 [2] and derives from a combination of words "hacking" and "marathon" [19]. Since the term is relatively new there is no single definition for it nor the event structure [20]. Hackathon like events have different names that go with suffixes such as "-fest", "-jam" and "-camp" [2], [19]. Generally speaking, hackathons are usually software-focused [11] and competitive events [21] that drives innovations [2], [22] and social interactions [21], [23]. They encourage learning in innovative ways [2], especially when organised in an educational context [24] as well as delivering quick and effective results with a hint of Agile methodology [25]. In an educational context, hackathons are usually highly motivating for both the educator and the students [26], events include some form of competitive gamification like elements [27] such as developing games to inspire students to learn coding skills for themselves [28]. Often, these events are collaborative by nature, between e.g., the educational unit which facilitates the event and different partner organizations, who offer the intriguing challenges for the students [14], [29].

Hackathons usually start with a case owner(s) presenting their subjects and/or concepts followed by participants deciding on the topic to continue with [30]. Trainer et al. [5] have formalised the following development phases: 1) group forming, 2) role negotiations, 3) process refining and deciding on working style and 4) the actual project performing. Flores et al. [31] go a bit more in detail by distinguishing phase 4 into the following stages: idealizing, designing, prototyping, testing and launching the solution for a given challenge. This final solution usually culminates in some form of MVP (Minimum Viable Product) by the end of the event [32]. Events are sometimes organized competitively with monetary prices [2], [33] or even funding for further development of the project outcomes [19]. Multiple studies have identified that often projects are not being finalized [5], [34] possibly due to limited time-based stress affecting negatively to the idea and/or concept innovation process [35]. Studies have also identified [9], [10] that there is a relationship between the duration of the event and quality of proposed solutions, suggesting to extend the duration to at least 24 hours. It is common for organizers to cater food and drinks during the event [19] while the necessary hardware, like laptops, are usually encouraged to be provided by participants themselves [11].

1.1 Stakeholders in hackathons

When it comes to hackathon like events, stakeholders could be divided into three main groups: organizers, case owners and participants. For student participants, hackathons are a good opportunity to work closely with professionals and tackle together relevant social issues [23]. There are a wide range of profit [2], [36] and non-profit [16] parties who might be interested in involvement in these events. Some of the main examples of such domains are corporations [19], educational institutions [2], government agencies [37], open-source [38] and other non-profit communities [39]. Hackathons have become increasingly more common during the 2000s which accordingly sparked more interest from corporate setting and start-up companies [2], [22]. This increase in interest has popularised sponsoring by companies which in itself have transitioned hackathons from philanthropic baseline to more competitive and innovation-driven style [16]. Hackathons are also noted to have potential on influencing corporate culture or even used as a tool for position company as “savvy digital workplace” [39]. As of writing, hackathons continue to be organized by different stakeholders [18] with some companies event publicly stating plans on continuing such efforts [19]. F-Secure, one of the active companies utilizing hackathons, has stated that although both organizers and participants have been satisfied with the events, the actual outcomes have rarely been exploited commercially [19].

1.2 Types of hackathon like events

There are multiple ways to distinguish different type of hackathon like events, some of which could be applied simultaneously. One of the most general separation criteria is if the event is closed or open for public. Closed events are more common for inter-organizational target audience [19] where the focus is more on innovating and learning aspects [40]. Internal hackathons are practised in companies [7], higher education institutions [41] and even civic organizations [42], [43]. Hackathons have especially gained traction in tech companies, where these events have been integrated to support software development [4]. Briscoe et al. [2] have proposed a classification method based on describing the purpose of event with a question, making them either tech- or focus-oriented. Tech-oriented ones are tackling specific challenges with oftentimes predefined characteristic and requirements. On the other hand, focus-oriented are more open-ended and focusing for example on the social or business-related issues [2]. Douthard et al. [44] proposes another kind of method that classifies hackathons into 1) community nurturing, 2) issue-oriented and 3) innovation encouraging.

Despite being originated from software development related needs [7], hackathons are after all just a utility for driving different solutions and these events have been later integrated into more interdisciplinary and civically focused settings [2]. The literature identifies [45] hackathons with different goals in mind, such as industrial [20], educational [15], culturally [46] and civically [8] oriented ones. In some instances, hackathons are covering specific themes [47] such as targeting social [42], [43], [48] and environmental issues [49], enhancing learning [15], [50], [51] or dealing with existing online [52], [53] and offline communities [54], [55].

1.3 Focus, goal and delimitations

Hackathon like events probably wouldn’t be so popular without any significant advantages involved. Literature suggests that one of the main factors seems to be learning new skills during the event [50], [56]. These skills can be generally divided into soft skills like teamwork, adaptability and critical thinking, as well as hard skills such as coding and practical knowledge [45]. Another significant factor seems to be a process of innovating something new and interesting [2], [12], [22], [51], [57], [58]. Short timeframe of the event creates a sense of rush and forces participants to act fast without so-called “stovepiping” [54]. Creativity seems to be the driving factor for innovation and hackathons are no exception from that [59]. Also, hackathons seem to provide “new and exciting opportunities for education and research” [60].

Naturally, there are also some disadvantages to hackathon like events in existence. Although the short time frame is considered to be a driving force for creativity and innovation [59], some studies point out that it might also discourage the actual learning process [16], [18], [61] and affect quality of the end-results [62]. The reason is that in a competitive and corporate-sponsored event, solutions seem to be rewarded more than the actual learning process. In other words, the focus is on solution and competition rather than learning and collaboration [16]. This is simply a result of time optimization, where participants tend to utilize skills they already possess [16]. Some go as far as to criticize hackathons for technical solutionism where a deep understanding of the issue or subject might be deficient [61]. Sometimes hackathons are thought to appreciate a specific set of skills more than others, affecting negatively learning process of some participants [47], [63]. Also, the lack of formal event structure and feedback from instructors were mentioned as reasons for hindrance in learning [64].

In either way, hackathon events are used for educational and innovative purposes where learning and other benefits act as motivators to participate. While the motivation, commitment and engagement during the events are relatively studied aspects, the long-term effect and sustainability are not. The question arises, what happens after the event? Are these newly obtained skills, knowledge and experience being forgotten or do they hold up in the future? Remote participation is another characteristic that hasn’t received a lot of attention from researchers. Digitalization by itself is moving event organization from traditional and physical to more digital format. In addition to that, events like COVID-19 (Coronavirus Pandemic 2019) will probably only accelerate that process and highlight the importance of measures such as remote participation.

The goal of this study is to have a look at what topics have been studied regarding hackathon like events while specifically focusing on the following Research Questions (RQ):

RQ1) Status of post-hackathon outcomes sustainability

RQ2) Remote approach as an option for participation in hackathons

1.4 Structure of the thesis

Section 2 describes the methodology used for studying the research questions of this thesis. The research process is explained in section 3 on a step-by-step basis including all necessary data collection requirements and inclusions criteria's as well as data processing and classification results. The interview process is also briefly described in section 3.5. Section 4 includes literature observations derived from the research process finalised with literature analysis in section 4.5. Interviews were conducted in section 5 for validating observations from literature as well as narrowing the gaps that didn't receive sufficient attention in previous research. General discussion on the topic of this thesis is in section 6 followed by conclusions in section 7.

2 METHODOLOGY

For this study, primary method for gathering the information was a Systematic Literature Review (SLR). Additionally, expert interviews were used for validating literature observations as well as getting a better understanding of under-researched topics.

2.1 Systematic literature review

The study on literature in this work is based on SLR, a method suggested by Kitchenhand et al. [65]. It is a systematic practice of collecting secondary data, evaluating research studies as well as concluding findings based on that [66]. The main goal of SLR is to find academic publications that are as closely related to specific research question as possible.

The main stages of SLR are [65]:

1. Defining a research question
2. Defining exclusion and inclusion criteria's
3. Quality assessment
4. Data collection
5. Data analysis

Defining the research question is an obvious thing to do, but not always easy and clear in practice. It has to be properly balanced to be not too broad nor too narrow to correctly fit the scope of the work. The first version of the keywords is usually derived straight from the research questions. Later keywords are often modified or/and altered for example based on the expert interviews or screening of other related publications.

Before collecting the data, proper boundaries have to be defined such as exclusion and inclusion criteria's as well as quality standards of publications. Some examples:

- Publications in a specific language
- Limited timeframe
- No too short publications
- Publications have to peer-reviewed

When these matters are taken care of the actual data collection can begin. There are several different academic databases available, therefore the ones that match research topic in question are recommended to be chosen. Some variability in databases might be also beneficial in form of acquiring information from more diverse sources. This lowers the risk of being stuck in a disciplinary bubble. The last step of SLR is contacting actual qualitative and quantitative analysis based on gathered data.

2.2 Interviewing experts in the field

Interviews with experts in the field might offer some invaluable insight when it comes to the research topic. While SLR is preferred and will remain as the primary method in the study, some of the topics in this work simply haven't been researched enough to gather adequate information for making any valid conclusions. RQ2, in particular, seems to fit that criteria and will therefore be approached mainly via interviews.

Interviews are also helpful in cases where topics are well researched. They can be used as a complementary source for verifying and validating conclusions derived from SLR as well as bringing light on topics that didn't receive a lot of attention in the literature. While hackathon like events are growing in popularity [2], [22], there seem to be some gaps in the research literature. Therefore, interviews with organizers that have a lot of undocumented first-hand experience in the field are a promising source of insightful information for this work.

For the interviews to be academically reliable and credible they are recommended to be conducted systematically with a standardized basis. The simplest way to achieve this is to stick to the unifying question palette that will be presented to all interviewees. This will make the interview results more comparable. Standardised open-ended interview is the formal definition for this method. [67]

3 RESEARCH PROCESS

The research process consists of two separate parts: SLR and interviewing experts in the field. SLR is the primary one and starts with refining search keywords for discovering literature (section 3.1). Then comes the process of collecting the literature (section 3.2) followed by data processing and classification (3.3). SLR is finalised with Literature overview and analysis. The interview research process is described in section 3.5.

3.1 Defining search keywords for literature

The research questions have been already identified in section 1.3. By looking at them the main keyword is derived to be a *hackathon*. Based on RQ1 additional keywords are deducted to be as follows: *outcome, sustainability* and *support*. RQ2 on the other hand is a bit more unclear but eventually *remote* and *crisis* have been selected. For the initial search experimentation, Scopus has been chosen, since its collection is the largest one. Search has been conducted with just the main keyword alone, as well as in combination with the additional keywords using AND-operator. Search results show in Table 1.

Table 1: Preliminary search term results from the Scopus database

Search Term	**Results**	**Appearance**
hackathon	573	Include hackathon related results
hackathon AND remote*	13	Search results are related to robotics
hackathon AND crisis	5	Hoped for COVID-19 related publications but resulted in research with crisis-related topics
hackathon AND sustain*	41	Good results
hackathon AND outcome	54	Include hackathon related results
hackathon and support*	122	Include hackathon related results

As seen in Table 1 just using the main keyword produces a reasonable and sustainable number of results. RQ1 related additional keywords produce also decent results where some of the publications are more or less related to the specific research question. On the other hand, RQ2 related additional keywords don’t produce satisfying results. The number of results is really low, and they barely related to the topic of this work. Exact search result numbers by different sources are available in Table 2.

Table 2: Source comparison for different search terms

Search Term	Database source		
	Scopus	Web of Science	IEEE
Hackathon	573	228	88
Hackathon AND remote*	13	2	1
Hackathon AND crisis	5	3	-
Hackathon AND sustain*	41	20	3
Hackathon AND outcome	54	32	10
Hackathon and support*	122	50	10

Since the main keyword by itself leads to a reasonable number of results, the decision has been made not to use the additional keywords. Additional keywords are necessary when the number of publications is sky high, which is not the case in this situation. Additionally, all the publications resulting from using the additional keywords are included in the main keyword search results anyway.

3.2 Collecting literature

Databases used for gathering publications for this thesis are the following:

- Scopus by Elsevier
- Web of Science (WoS), Core Collection
- the Institute of Electrical and Electronics Engineers (IEEE)

Above mentioned databases have been suggested by the associate professor and work supervisor as the most suitable ones when it comes to the topic of this thesis. WoS has the broadest topic coverage and contains publications from the beginning of the 20th century. Scopus on the other hand is the largest one, containing around 30 000 titles at the time of writing [68]. Lastly IEEE has been chosen because its publications are the most related to our research question and computer science in general. All three database show similar search results as shown in Table 1. They all differ in the number of publications but share a similar ratio in regard to the actual search terms. Comparison is shown in Table 3 where only the main keyword has been used.

Table 3: Number of publications by database with search keyword "hackathon"

Database	Number of results	Included
Scopus	573	52
Web of Science	228	46
IEEE	84	10

Search results have been exported from databases with the following information about publications:

- Authors
- Title
- Abstract
- Year
- Source link

3.3 Literature data processing and classification

Exported data have then been imported to Microsoft Excel for further processing resulting in a total of 885 publications. First, all duplicates were removed resulting in a decrease of publications from original dataset down to 625. Then the first round of iteration has been conducted where filtering happened based on the publication title analysis. The main purpose of that was to get rid of publications that don't focus primarily on hackathon like events. In many instances' hackathon is mentioned more as a sidenote while the actual work is mostly about something else. The number of publications decreased to 211 after the first round of iteration. See the visualisation of data processing and classification in Figure 1.

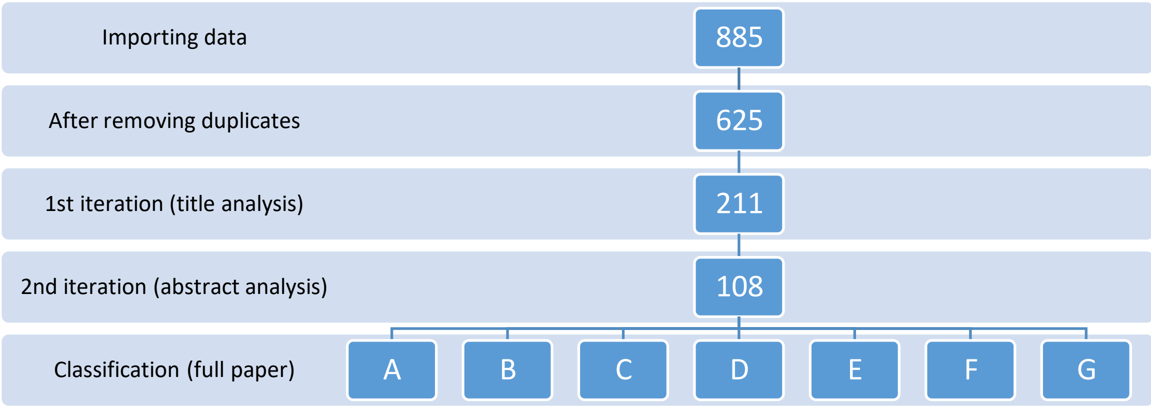

Figure 1: Process of data processing and classification

The second round of iteration was based on publication abstracts analysis. This resulted in a further decrease of dataset down to 108 publications. All remaining publications were downloaded for proper in-depth reading. During the full reading of publications, topic classification has been conducted for further analysis according to Table 4. There is no limit for assigning classes to publication. Topics that are specifically related to the research question of this thesis are shaded in green colour.

Table 4: Classes and their inclusion criteria's. Green indicates RQ related classes.

Class	Inclusion and classification criteria
A	The publication is about event walkthrough with lessons learned.
B	Research focuses on motivation, engagement and commitment during the events
C	The research focus is on the post-hackathon impact on outcomes. Things like future interest in the subject, the continuation of an event project, sustainability of learned skills etc.
D	Publication at least partly discusses remote participation at hackathons
E	The publication contains information about hackathons in general E.g., event types and formats, history, stakeholders etc.
F	Hackathons are studied as part of the learning process
G	The publication contains a discussion on how to organize hackathon like events

Classes C and D are based on research questions and the rest were derived from reading the collected publications. The basis for identifying classes was recognition of some common themes in literature. The actual classification has been conducted simultaneously while reading through the material. While preparing for starting the actual writing process and rereading material notes, some minor changes to classifications have been made.

3.4 Literature overview and analysis

The qualitative analysis demonstrated that hackathons as a topic in academia is relatively new with first publications dating back to 2007 as shown in Figure 2. Nevertheless, this topic seems to be in an uptrend and on average gaining popularity on a year-to-year basis.

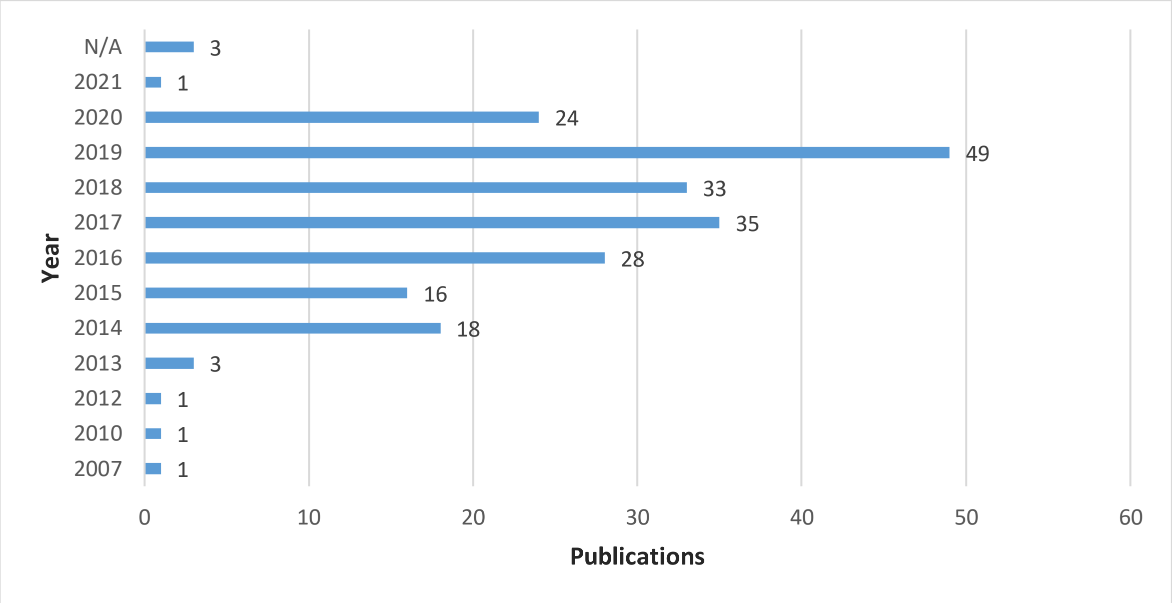

Figure 2: Publication yearly distribution after 1st round of iteration

Figure 3 visualises the occurrence of publications selected for SLR after 2nd round of iteration. While differing in numbers, both Figure 2 and Figure 3, resemble each other in relative yearly distribution indicating that the screening process has been conducted properly and with expected results.

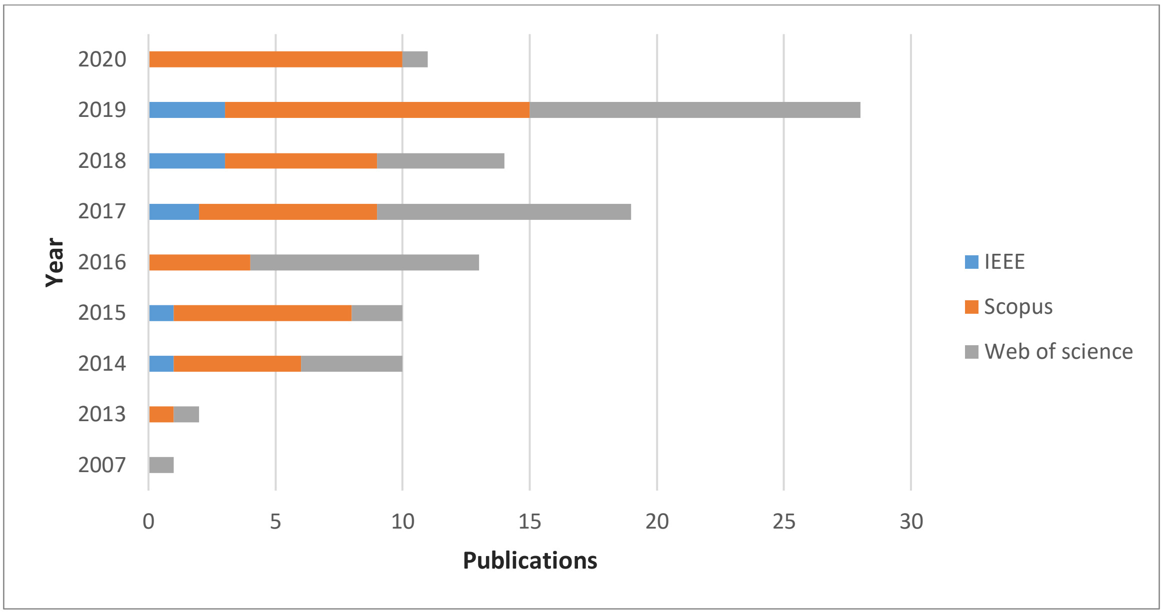

Figure 3: Number of publications by year and source that were selected for SLR

When it comes to topic classification there are some interesting findings. See the classification results visualised in Figure 4. There is a big difference in the occurrence of classes previously defined in Table 4. Class A is the most common one having 71 occurrences. Classes G, B, E and F are moderate having between 15 and 34 occurrences. The lowest in prevalence are classes C and D, both having less than ten occurrences. Prevalence of class A speaks for the fact that most publications on hackathons are focusing on event walkthrough, in many cases in pair with lessons learned (class G). Therefore, it could be concluded that while hackathons are receiving a decent amount of research interest in general, the focus is primarily on specific events and their post-analysis rather than more general and epistemic approach. Classes B, E, G and G on the other hand have received a decent amount of attention while at the same time not being overly studied. There seem to be potential for further research on these topics especially with proper focus on understudied sub-segments.

The most understudied topics can be derived from classes C and D. Both classes have received the least amount of attention and are therefore recommended for further research based on this analysis. As already suggested by preliminary search results in Table 1 the long-term effect from hackathons have not received a lot of attention (class C). This is quite unfortunate since one of the main goals of these events is to learn new things. The lack of extensive research on systematic methods might also cause some uncertainty for event organizers which in itself affects participants as well.

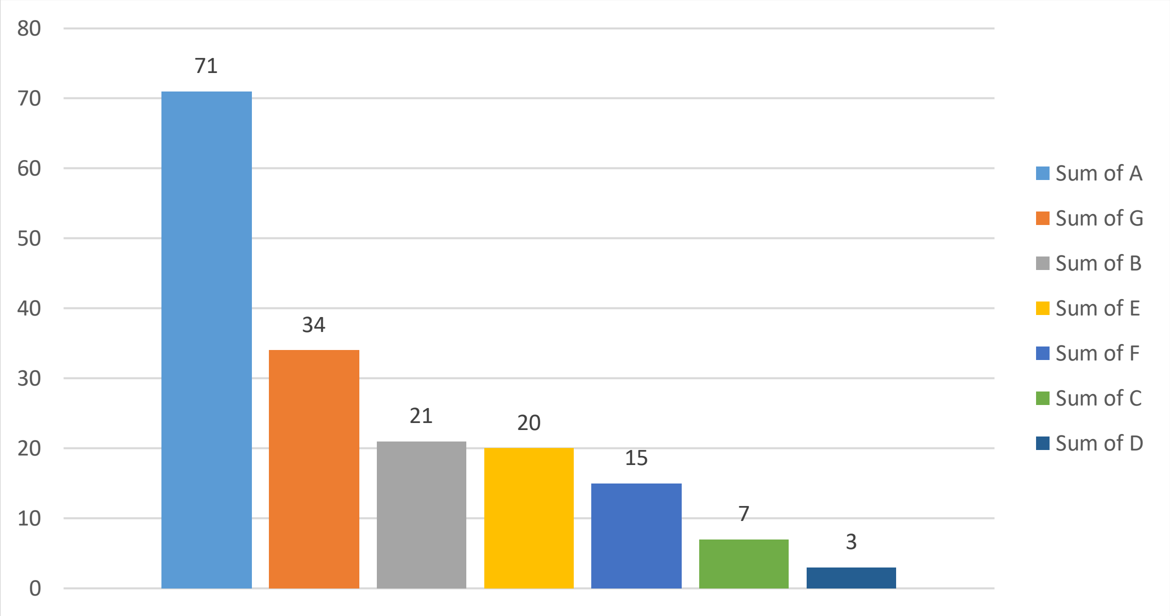

Figure 4: Topic classification distribution

Remote participation in hackathon like events has been almost non-existent, at least based on the published publications. Remote participation (class D) has not received almost any attention. Most publications only briefly touch this topic, without focusing too much on it. However, COVID-19 and similar global events in the future might drive more interest in this topic around remote participation.

3.5 Case material and interviews

Interviewing is a secondary research method in this work aimed at narrowing the gaps left from the primary method – SLR. Therefore, this part of the work is not supposed to be overly structured nor complicated. Interview questions are refined based on the findings in literature analysis (section 4.5). Interviewee candidate selection and interviewing process is described in detail in the 5th paragraph.

4 HACKATHONS IN LITERATURE

This section will describe literature findings on topics related to classes B, C, D and F, that were previously described in Table 4. In other words, these topics are the following: “Hackathons as part of the learning ”, “Motivation, engagement and commitment in hackathons”, “Sustainability of hackathon outcomes” and “Remote/online participation”

4.1 Hackathons as part of the learning process

There seems to be a decent amount of interest when it comes to learning part of hackathon like events. Parallels have been drawn between hackathons and both, Project-Based Learning and Challenge-Based Learning. However, collaboration and teamwork during hackathons have received the most attention as a contributing factor towards participant learning.

4.1.1 Project- and Challenge-Based Learning

In parallel with the traditional curriculum, Project-Based Learning (PBL) has been used as an alternative for students to apply theories from lectures into practice with a focus on collaboration and multi-disciplinary integration [69]. The popularity of PBL within the engineering education made it possible for students to apply technical knowledge to actual engineering projects [18]. These projects are often related to real-world problems or challenges provided by industry representatives [45]. There are similarities between the PBL approach and the way hackathons are conducted [70]. In both cases project is being tackled in teams and similarly, mentors are often along with the process. Research indicates that mentors are necessary for achieving the desired goals and outcomes of the project [71], [72]. Properly supporting teams working on complex projects is perceived as one of the major challenges [73]. Additionally, studies show that mentoring can contribute to an increase in interest towards project topic in question [47], [73].

Another common approach to learning is to utilize the Challenge-Based Learning (CBL) framework [74]. In general, it is quite similar to PBL [75], but with a focus on solving a challenge. It emerged as “an approach to foster learning while solving real-world problems” [34] and was originally targeted to hight schools but later evolved to better fit higher education [74]. The short timeframe for CBL and PBL frameworks force teams to "narrow down ideas and quickly find solutions to be developed" [69] leading to a development of skills such as problem-solving, project management and task prioritizing [34].

4.1.2 Collaboration and teamwork

Collaboration has become a subject of interest in education [45] and crucial skill to master at 21st century [76], [77]. Teamwork seems to be playing one of the major roles in both PBL as well as CBL frameworks [20]. It is a complex process [78] that is believed to trigger or at least enhance a successful team model [79]. Well-functioning and effective teams could lead to members trying the fullest of their abilities [80]. According to the study [80] there is a positive relationship between teamwork and effective learning as well as teamwork and engagement behaviour. Other research [79], [81] show that collaborative learning leads to a deep understanding of the topic in question and individual change. It is common at hackathon like events that members of just formed teams are not familiar with each other and for these situations, icebreaking techniques are recommended to bring individuals closer together [59], [82]. Team building practices are common for organizational development [83] and is considered essential for establishing successful teams [84], [85]. Leadership is an essential foundation for effective teamwork [86]–[88], both vertical and shared [89]. There is clear evidence of difficulties for teams to work efficiently and distribute tasks in an optimal way [90], which hints at the importance of proper leadership. Besides, suitable membership, commitment, argumentation and working methods are considered conditional for forming interdependency within team members, which boosts learning [80], [81], [91]. Setting a clear goal and objectives seem to increase performance [92] and make the context more meaningful to a learner [93].

4.2 Motivation, engagement and commitment in hackathons

Factors affecting participants motivation, engagement and commitment towards hackathon like event have received relatively a lot of attention. A common approach to tackle this topic is via identifying the participation motivators as well as the mentor's role in creating and supporting engagement during the event.

4.2.1 Motivators to participate and perform in hackathons

There is a huge amount of interest in making the education process more interesting and engaging for students [15]. While research on hackathon like events is relatively scarce, multiple studies have been conducted to better understand the willingness of participants to engage in such events [2], [37], [94], [95]. The challenging part of these studies is that motivating factors are presented indefinitely and non-informatively [96]. Motivating factors to participate in hackathon like events could be roughly divided into intrinsic and extrinsic one [95], where some of the motivators can apply to both categories. See Table 5. There are some geographical differences in the prevalence of different motivators [30], [95]. For example "hackathon participants in Europe and Asia agreed (88%) that they registered in hackathons because they are fun events, while those from the United States disagree in a proportion of 33%" [30]. Hackathons participants have shown an increase in motivation regarding programming and general computing as well as practical improvements in practising above mentioned tasks [97].

Table 5: Intrinsic and extrinsic motivators to participate in hackathon like events

Intrinsic motivators	**Extrinsic motivators**
Fun and enjoyment [19], [30], [94]–[96], [98], [99]	Job performance and career concerns [30], [94], [95], [98], [100], [101]
Experimenting with new technologies [19], [22]	Social influence [30], [96], [98], [102], [103]
Intellectual challenge [94], [96], [98], [99]	Financial gain [19], [30], [94]
Personal development [9], [19]	Status and reputation [94]
Interest in subject [95], [99]	Fair judgement system [22]
Innovating [9], [30]	
Contributing to a social problem [9], [37]	
Learning and developing skills [2], [22], [56], [94], [96], [104]–[106]	
Networking [2], [19], [37], [56], [94]	
Applying personal skills [95], [103]	
Professional and personal identity [9], [94], [103]	
Collaboration [9], [22]	

4.2.2 Benefits of mentoring for participants

Mentoring, or in other words coaching, is considered to be a crucial factor for participants to create their solutions [40]. Mentors role is to support participants with the creation of solution [40] and in general to guide into the right direction. There is an indication of bonding between mentor and participants, which might positively affect project progression [107]. Well established communication leads to frequent and effective feedback which on itself result in getting more work done [107], [108]. There is evidence [107] that inter-community feedback boosts commitment and self-esteem on an individual level. According to research [107] longer and more intensive mentoring leads to the creation of stronger ties between participant and mentor. Whereas people who develop these strong connections in groups, seem to work harder, get more done, and tend to stick with the group for longer periods [109]. Other research supports that idea by pointing out that members who work on common tasks tend to be more united and committed [110], [111]. While working on these interdependent tasks during the event, the participant may feel more important and therefore commit more actively to the goal [109], whereas independent tasks are speculated to lower the levels of commitment [107].

Mentoring is a complex process that can be both, successful and non-successful. Studies show that in the context of hackathon like events, guiding and supporting participants in seeking their solutions leads to more positive and engaging outcomes [47], [112], [113]. On the other hand, fixating to predefined goals without adjusting participants abilities might lead to misunderstanding between mentor and participants and worse atmosphere [47]. The way hackathons are constructed might leads simultaneously to cooperation, competition or both [49]. These competitive setups with prizes, peer pressure and tight schedules encourage and motivates participants to go with easy and effective solutions rather than focus on actual individual learning [16].

4.3 Sustainability of hackathon outcomes

Hackathon outcomes are considered to be for example prototypes, networking, learning and other direct results [114]. While hackathons themselves are relatively studied, the long-term effect of these activities very little, if at all [115]. The little research that exists has a contradictory interpretation of the matter. Some even suggest that hackathon outcomes are not sustained at all [5], [10], [116], hinting at the uselessness of doing so. According to one survey, [94] 80% of hackathon participants expressed plans on continuing further development while only one third actually achieving in this. Partly explained by the lack of support by organizers [40], it still looks like more research is needed to gain a better understanding. At the same time, other studies suggest that there is reason to believe that hackathon like events may be “an effective way to put scientific software projects on sustainable trajectories” [38], [108].

Continuation of a project beyond hackathon like event mostly depends on a market need as well as the project’s fit to the already existing product, if that is the case [64]. Proper community is mentioned [107] to be one of the crucial ingredients for the success of scientific software sustainability. The need for proper follow-up process is recognized with a potential benefit of building new collaborations and in learning more about project development processes [117]. To support these follow-up processes, such as developing, marketing and launching, it has been suggested to find the right people interested to sponsor activities of such kind [118], [119]. The importance of corporate representative in hackathons is highlighted in several studies suggesting that they should be more active at helping winners at finalizing their solutions and launching them to the market after the actual event [40], [120]. As an example, to sustain the continuation and development of artefacts created in hackathon like events the following have been offered by several organizers: Coaching and mentoring, showcasing the artefact during an event [121], prizes [13], [116], releasing a production version of artefact [121], recruiting new team members [13] and writing grants [13].

Learning Cycles (LC) [122] have been applied to post-hackathon activity, where the aim is to “connect hackathon teams with key stakeholders, reflect on prototypes and consider business models” [123]. LC is described as a “group of people who come together to engage in dialogue about a common interest” where the process is marked by “equality and empowerment of all participants” [124]. While hackathons role as part of the learning process is recognized [114], it seems like a complementary step, such as LC, might be useful for better outcome sustainability [123].

4.4 Remote/online participation at hackathons

Primarily hackathon like events are organized in physical venues [22], but there are also reports of virtual participation [23]. The topic of remote participation in these events hasn't received a lot of attention as previously already hinted in section 3.4. The little research that exists seems to showcase an attitude that is ranging from neutral to negative. According to quantitative analysis of one study [96], the offline setting is slightly preferred participation method over online platforms explained by interviewees "because it is not a real-life setting and it could foster extreme or non-constructive opinions". In another study [47], findings indicate "difficulties related to remote mentoring which did not only appear to hinder students to progress with their project but might also have affected their future interest in the community". This is a strong statement based on single-event experience, but none the less, a real-world observation, which "resulted on average in poor learning experience (…) for students" and "low-quality connection between the parties" [47]. In one case [125], a hybrid approach was used, where some of the participants were physically present while others connected via online meeting tools. The online meetings are considered by different practitioners to be inferior to physical ones [126].

Radical collocation (RC) means a situation where team members are located together in a room for a period of the project [127]. This methodology was developed in response to communication-related challenges in distributes software development and it is noted to increase coordination and communication among software team members, resulting in "increase in productivity and outcome quality" [128].

4.5 Literature analysis

Quantitative analysis revealed several prominent findings concerning hackathon like events. Both, Figure 2 and Figure 3 indicate that the general trend in publishing material related to these events is still uprising as of writing. A local peak is identifiable in the year 2019, with lower results in 2020. While impossible to know for certain, the reasons for that is likely relative longevity of the research process as well as lagging in the actual publication. E.g., research is conducted in the second part of 2018, but the publication date is likely to be in the following year 2019.

The publication classification conducted according to section 3.3 showcases some interesting insight on the status of research in the area of hackathon like events. There is quite a noticeable difference in research interest as seen in Figure 4. Class A, which is about walkthrough of specific hackathon event, have received over twice as much attention that any other class in Table 4. Classes B, E, F and G on the other hand have received a moderate amount of attention while classes C and D extremely little. Reading through collected publications from SLR, many of the above-mentioned points were supported. As already suggested by Figure 4 publications are predominantly about post-analysis of recently held events (class A), many of them in pair with lessons learner and suggestions for future similar events (class G).

The topic of hackathon like events as part of the learning process (class F) have received a decent amount of interest. Several pieces of research have brought up similarities between hackathons and Project- and Challenge-Based Learning methodologies. Another common dominator appears to be the importance of teamwork in learning with hackathons. Although relatively studied topic, there is room to go for future research with proper targeting and segmenting.

Although, specifically motivation focused publications (class B) received a decent amount of attention, settling in the middle of Figure 4, multiple other publications touched that topic as a sidenote. But despite the general interest, topics seemed to focus almost solely on participants motivation to engage in hackathon like events. The motivators behind corporate representation, organizers, problem owners and mentors received almost no attention, at least compared to participants. In other words, there seem to be some potential to investigate other stakeholders' motivation without clinging too much to participants viewpoint.

The literature about post-hackathon outcome sustainability (class C) is scarce even for hackathon standards, ranking second lowest in classification as seen in Figure 4. This topic is directly related to the RQ1. The identified literature that exists is heterogeneous and one could say even contradictory, ranging from extremely pessimistic attitude to belief in the good potential of succeeding in outcome sustainability. There is real-life evidence of attempts on sustaining hackathon outcomes via different methods, but very little has been studied on the effectiveness of above-mentioned. This leads to a conclusion that the topic of outcome sustainability has somewhat gained interest but haven't been studied extensively as of writing this work. Therefore, there seems to be a lot of potential for future research.

Remote participation, the topic of RQ2, is almost entirely avoided in hackathon related research. There are almost no publications specifically focusing on this topic, leaving a lot of room for uncertainty. The question arises if there is even any potential in this topic after all, based on the low general interest from academia. The little research that exists has for the most part negative attitude towards remote participation with some neutral ones amongst. The situation looks bleak, but on the other side, it is immature to make any definitive conclusions based on such little evidence and almost non-existent literature. One could even speculatively assume, that this topic might gain some traction in the future as technology progresses and people's attitudes change. Also, maybe remote participation could work out as a secondary or additional research topic by utilizing A/B testing methodology. E.g., A hackathon research where subjects are divided into two groups: A) Offline and B) online participant whose performance will be monitored and documented.

5 INTERVIEWS WITH HACKATHON ORGANIZERS

This section aims to compare findings from the literature review with the first-hand experience by hackathon organisers. Additionally, interviews might be a valuable source of information on topics that weren't satisfactorily discussed in the literature as of writing this thesis. Respondent selection and interview questions are discussed in section 5.1, interview content is available in section 5.2 and interview analysis is conducted in section 5.3.

5.1 Respondent selection and interview questions

Interview candidates were selected with the assistance of thesis instructors. The criteria for selection was at least a moderate amount of experience in organising hackathons, preferably with a remote approach as well. Eventually, four candidates were interviewed anonymously. See Table 6 for more information about respondents (R).

Table 6: Role and experience of interviewees

R	Role and experience in hackathons
R1	Associate Professor at the faculty of Software Engineering. Hackathon related academic research conducted. About 15 years of experience in organizing hackathons. 2018 onwards experience in remote hackathons as well.
R2	Professor at the faculty of Software Engineering. Hackathon related academic research conducted. About 20 years of experience in organizing hackathons, including remote ones past few years.
R3	Co-founder and managing director at the company that organises hackathon event. Several years of experience in organising both normal and remote hackathons, mainly focusing on the corporate setting.
R4	Associate Professor in Information Systems. Hackathon related academic research conducted. Almost a decade worth of experience in organizing both normal and remote hackathons.

The interview questions were generated based on the conducted literature analysis in section 4.5. These questions are either aimed at validating previously deducted observations or alternatively exploratorily searching for entirely new answers to RQs. Therefore, final questions are based on classes defined in Table 4 as well as RQs from section 1.3. See the questions in Table 7. Referring to question with abbreviation Q as of now.

Table 7: Interview questions with references to classification and RQs

Q	Reference	Question
Q1	Class F	Have you noticed elements of PBL in hackathons?
Q2	Class F	What is the role of teamwork in learning process in the context of hackathons?
Q3	Class B	Have stakeholder motivators been clarified (before the event)? Which stakeholders? How? How much?
Q4	Class C, RQ1	What factors can support and help to sustain event outcomes? How to do that in practice?
Q5	Class D, RQ2	General question on experience in remote hackathons. Differenced between remote and normal approach? Advantages and disadvantages in remote participation?

5.2 The content of the interview

This section will focus on the content of the interview. Interview questions are as in Table 7 with respondent references according to Table 6.

Table 8: Answers to Q1 related to commonalities between hackathons and PBL

R	Q1: Have you noticed elements of PBL in hackathons?
R1	Hackathons can surely be organised utilising PBL, but it is not necessary and depends on the approach. Hackathons aren't always based on a problem or challenge to solve but can be instead focused on having fun (e.g., game jams).
R2	Except for the fact that PBL is supposed to be in pair with formal theory, it has otherwise similarities with the way hackathons are conducted. It has to be noted though, that limited timeframe of these events makes it almost impossible to satisfy

	formal PBL formulation. But in general, hackathons are specifically based on a problem or challenge to solve.
R3	Not certain about the formal definition of PBL, but I can say that we have implemented problem-solving in our hackathons. Not always though.
R4	Hackathons and PBL are kind of the same thing, but the former is not usually integrated with educational material. Also, there is rarely any control on what topic participants want to work on as opposed to the educational environment.

Table 9: Answers to Q2 related to the role of teamwork in the learning process

R	**Q2: What is the role of teamwork in learning process in the context of hackathons?**
R1	We are encouraging teamwork in hackathons because participants can achieve more that way. Teamwork increases social networks and lowers the barrier to engage with other participants. Usually, teams have a more diverse set of skills leading to a better chance of success. Solo approach, on the other hand, leads more likely to dropping out.
R2	Hackathons are based on both, inter- and intra-team collaboration. Teamwork is important for learning, but not as important in a corporate setting. Learning and collaboration seem to be correlated as opposed to the corporate and more competitive environment.
R3	Our hackathons are always based on teamwork. It forces people to connect with each other. Competitive environment seems to increase inter-team disagreements.
R4	Typically learning is a social context and hackathons are fundamentally based on teamwork.

Table 10: Answers to Q3 related stakeholder motivation in hackathons

R	**Q3: Have stakeholder motivators been clarified (before the event)? Which stakeholders? How? How much?**
R1	Motivation is mostly discussed in the context of participants since the whole existence of event depends on the fact that people are motivated to participate. It is a good practice to get feedback after the event (e.g., questionnaire). If the feedback

	is positive organization is probably interested in continuations as well. Hard to comment on corporate cooperation because motivation varies largely.
R2	In learning-oriented hackathons, you have to think on what there is for participants to be motivated. Technically oriented hackathons (e.g., code-camps) are pretty straight forward. Learning new skills is the main motivator there. Customer side is usually pretty clear as well (e.g., raising awareness on a specific topic). Corporate hackathons are usually motivated by finding new recruits or contacts.
R3	Focus is mostly on participants because problem owner motivation is usually pretty clear. Nailing motivation is especially important at short events. Problem owner (corporate context) motivation examples: increasing engagement, socialising and innovation.
R4	Underlying motivators are generally the same for different stakeholders. Unfortunately, companies are oftentimes unclear on motivation. E.g., companies are rarely honest on their motivations (hiring, generating money, free business ideas etc.) Organisers motivation is quite clear usually, but the mentors not so obvious.

Table 11: Answers to Q4 related to hackathon outcome sustainability

R	**Q4: What factors can support and help to sustain event outcomes? How to do that in practice?**
R1	It is important to think about outcome sustainability in advance. The event must be structured in a way that supports the continuation of outcomes. E.g., Financial support for winners, company assisting with continuation and hiring as an assistant in education. There is also a potential for getting funding from several parties like scholarships, grants, accelerator programs etc.
R2	The topic is very little studied. Contacting customers afterwards and asking how the outcomes have been supported. It might be helpful to ask for feedback from participants as well.
R3	Outcome sustainability is a bit problematic. If the problem statement is too broad, it is often challenging to fit the outcome into the market. Therefore, the missions statement has to be thought through beforehand and adjusted to goals. The best way

	to support outcome sustainability is to mentor sessions after events. Sometimes hackathon winners are promised assistance by clients with a continuation of the project.
R4	Mostly event outcomes depend on participants themselves. Are they interested to continue or not? Winning might work as a motivator to continue but doesn't necessarily lead to success and continuation of the project. The decision has to be made on what the preferred outcome is, and the event should be planned accordingly. E.g., If the desired outcome is to create a complicated app, focus on proper teambuilding so participants could realistically achieve the goal.

Table 12: Answers to Q5 related remote participation in hackathons

R	**Q5: What is your experience on remotely held hackathons? What is the difference compared to normally organised hackathons? What are the advantages and disadvantages?**
R1	Distribution of material in remotely held hackathons happens over video. Companies have been interested because it is more practical for them. No need to travel any more. Hybrid methods have been also used where both local and remote participation is possible. The interest towards topic is growing, especially with the coming of COVID-19. The remote approach is more challenging. The role of a mentor/facilitator is increased. Communication in general is also challenging. E.g., unexpected dropping out of the event with no explanation. It is also possible that inter-team collaboration is less common.
R2	Little experience. The situation might change in near future because of the COVID-19. Remote participation may decrease collaboration, which is problematic since it is so essential in the context of hackathons.
R3	The quality of the work is the same. Difference is mainly in the atmosphere – the feeling is not there. It is less fun remotely but possibly more effective (no chit chat etc.). The remote approach is better for one-to-one meetings if necessary. There are some advantages. E.g., Having speakers and participants all over the world.
R4	It is more difficult to control the event remotely. People might just disappear suddenly. Team forming is also harder. The difference in time zones might be a

	challenge as well. Mentoring takes more resources in remote events. The event relies more on mentors/facilitators.

5.3 Interview analysis

The topic of hackathons as part of the learning process consist of two questions. The first one (Table 8) asks if there are similarities between PBL and hackathon like events. Answers to this one are pretty homogenous with a consensus on the fact that hackathons can and often are organised around problem-solving. R2 and R4 recognize that hackathons are only partly filling the definition of PBL since these events are rarely integrated with purely educational material. The second question (Table 9) is about the role of teamwork in the learning process in hackathon like events. All respondents seem to agree on the importance of teamwork with benefits ranging from outcome efficiency (R1) to better learning (R2). There is also an interesting observation by R2 and R3 acknowledging the negative effect of corporate and competitive environment on collaboration.

Hackathon literature seemed to mainly focus on participants motivation to engage with the event and other stakeholders received less attention. The question arises where this difference is coming from. R1 justify it with an observation that the mere existence of these events depends on interest by participants. R2 and R3 also mention that the case owner's motivation is usually pretty clear to begin with, hence the focus specifically on the participant side. R4 on the other hand brings up a problem of unclear motivators of case owners. Companies rarely directly explain their motivation to engage in hackathons. E.g., The true reasons might be hiring new people, generating money and finding free business ideas.

Outcome sustainability is very little studied (R2) so getting first-hand expertise from hackathon event organisers might be very valuable. When it comes to answers on Q4 there seems to be one common feature amongst respondents: Post-outcome sustainability depends on properly adjusted mission statement (R3) and structuring event in a way that supports these outcomes (R1 and R4). R1 emphasise planning the event having outcome sustainability in mind, while R2 expressed the risk of too broad problem statement leading to a challenge on fitting the outcome to the practice. Some of the proposed solutions for supporting outcomes are the following: Money prizes (R1), assistance in outcome continuation (R1, R3) and post-event mentoring sessions (R3). R2 suggested that organisers could collect feedback from participants as well as problem/challenge owners, effectively leading to potentially better outcomes in future events.

Respondents had mixed feeling towards remote participation in hackathons (Table 12) having both positive and negative things to say. The remote approach seems to be more practical for company representatives as the need to travel diminishes with online attendance (R1). It also makes international events possible (R3) albeit difference in time zones might be a challenge (R4). However, there are also some downsides such as a huge negative change in the atmosphere (R3), decrease in collaboration (R1, R2) and increased risk of sudden dropouts during the event (R1, R4). Remotely held events also seem to demand more mentoring resources (R1, R4). Although little studies (R2) it has been speculated that COVID-19 might cause an increase in interest towards a remote approach in hackathons (R1, R2). It appears to be also possible to organise hybrid hackathons with optional and fully remote participation option (R1).

6 DISCUSSION

Systematic Literature Review (SLR) was used as a primary method for collecting material and conducting initial quantitative analysis. During the process total of 885 publications were collected from three different academic publication databases: Scopus, WoS and IEEE. After removing the duplicates and two rounds of preliminary screening based on both, title and abstract analysis, 108 publications were left for topic classification that was conducted during in-depth reading according to criteria shown in Table 4. Classification results, visible in Figure 4, indicated a tremendous difference in topic relevance ranging from only three to as high as 71 class-specific assignments.

Several observations were deducted from the in-depth walkthrough of selected literature. Publication centring around hackathon like event walkthrough (class A) were the most common ones. Following topics got a decent amount of traction from academia as well: motivation, engagement and commitment during the hackathon like events (class B), general hackathon related walkthrough (class E), hackathons as part of the learning process (class F) and exploration on how to organise hackathons (class G). Unfortunately, post-hackathon outcome sustainability (class C), as well as remote participation at hackathon like events (class D), received very little attention.

Despite being studied, classes B, E, F and G have the potential to be researched more with proper topic targeting and segmenting. E.g., Class B related studies concentrate on participant motivators to engage in hackathons leaving other stakeholders, like organizers and case owners, in a vacuum. Finally, classes C and D carry huge potential regarding future research. Both topics are extremely understudied with contradictory interpretations (class C) and seemingly anecdotal evidence (class D). E.g., Research has a varying attitude towards post-hackathon outcome sustainability ranging from extremely pessimistic to a somewhat promising one. Also, feedback on remote participation in such events is mostly limited to negative and subjective comments.

Literature findings from section 4 explained the current status of research on the topic of hackathon like events as of writing this thesis. Some of the topics received more attention than others partially leaving uncertainty in the air. It was decided to additionally conduct anonymised interviews with hackathon event organizers in an attempt to narrow that gap in uncertainty, compare literature with real-life experience and possibly discover entirely new findings. The four respondents that were interviewed are introduced in Table 6 and interview questions listed in Table 7.

Expert interviews brought some insight to the above-mentioned observations from literature analysis. E.g., The reason for mainly focusing on participants motivation to participate in hackathons simply appears to be a considerably better understanding of other stakeholders' motives. Compared to literature, interviews provided especially significant breakthroughs to the research questions of this thesis. There was a strong view amongst respondents that to sustain hackathon outcomes (RQ1), the mission statement should be adjusted properly, and event structured with the outcomes in mind in advance. Some practical suggestions were also provided, matching ones in the literature. Respondents shared similar attitudes towards remote participation in hackathons (RQ2) compared to literature findings, although they were a bit more optimistic about it. In spite of some clear advantages to the remote approach, like practicality of online attendance and opportunity for more international events, there are also some disadvantages, like requiring more mentoring recourses and lack of notorious hackathon affiliated atmosphere. As of writing this thesis, several respondents noted a potential increase in interest toward remote participation because of currently ongoing COVID-19 related events.

One thing that personally stood out was a notion of seemingly dualistic attitude towards motivations and characteristic around organizing hackathons. It seems like the focus on these events is either on A) collaboration, teamwork and learning, or B) competitive and commercially centric innovation. These two types don't appear to be inter-compatible with each other leading to a clear difference in motivation, desire and reason to participate. This observation is brought up in literature as well as by interview respondents as seen in section 5.2. The question arises if these two focuses could after all be combined and would it improve the hackathon event outcome sustainability?

As noted in section 4.4 remote participation is mainly viewed negatively based on the topic related publications. E.g., Some researchers suggest that outcome sustainability is not worth investing in while others cautiously believe in the possibility of doing so. Although very little studied, I will personally have to agree with this negative attitude based on my own first-hand experience. Participating in several events during studies as an attendee as well as working at DigiEduHack 2020 as a facilitator has been a valuable experience for understanding remote participation methodology with all of its pros and cons. It does feel less practical, intuitive and "real" for lack of a better word. One of the respondents (R3) mentioned in the interview (Table 12) something similar, stating that "the feeling is not there" in remotely held events. On the other hand, it opens up a lot of before-impossible possibilities such as international collaboration, a larger pool of potential participants and of course lower threshold to participate. I just can't help but wonder if the above motioned negative attitudes originate from unfamiliarity and relative newness to remote participation framework. It must be pretty challenging to get used to this approach after doing it physically and face-to-face for entire life. Technology is also progressing in an extraordinary phase leading to a belief that current drawback and cons will be eliminated. The technological solutions of virtual- and augmented reality might be a game-changer in the future when it comes to remote participating in hackathon like events.

Considering hackathon event outcome sustainability, organizers must think of how these events should be organized. E.g., Have educational units measured the effect of Problem- and Challenge Based Learning in education [129], and how this methodology affects students results. In case results are positive, it might be reasonable to try to integrate this methodology more into the hackathons as well. Understanding the underlying motivation to participate in hackathon like event is really important as well. Why do people participate, collaborate [130] and co-operate in these events [131]? Why are participants willing to give their own time and resources for greater good [132], [133]? Also, it seems like the literature doesn't provide an answer to what is combined result of different motivators? What are participants, organizers, challenge owners and other stakeholders' true motivations to engage in hackathon like events and how it correlates with event outcome sustainability?

7 CONCLUSION

This study has been focusing on literature review related to the subject of hackathon like events with a special focus on the following research question:

RQ1) Status of post-hackathon outcomes sustainability

RQ2) Remote approach as an option for participation in hackathons

Systematic Literature Review (SLR) was used as a primary method for collecting and selecting related publications for this thesis work. During the in-depth literature analysis, the following main observations were made:

1) Publications on post-event walkthrough are the most common ones amongst collected literature. These publications explain how the event was organised with lessons learned.
2) There is a decent amount of research on motivation during the event, although it mainly focuses on participant motivators
3) Hackathons are commonly viewed as part of the learning process that in many cases have similarities with PBL and/or emphasise the importance of teamwork
4) Event outcome sustainability (RQ1) is little researched and has contradictory interpretations, ranging from extremely pessimistic to somewhat promising ones
5) Remote participation in hackathon like events (RQ2) is almost not studied and mostly limited to subjective sidenotes in research focusing on other subjects

Expert interviews were conducted to compare literature findings with real-life experiences and possibly get more insight specifically on observations 4 and 5 from the list above. Respondents seemed not to be too worried about hackathon outcome sustainability (RQ1) but rather highlighted that it should be planned in the event in advance. As of remote participation in hackathons (RQ2), respondents identified clear advantages like practicality of online attendance and opportunity for more international events, as well as disadvantages such as requiring more mentoring recourses and lack of notorious hackathon affiliated atmosphere.

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