New Tracking Methods to Research the Business Creation Activities Among Entrepreneurs


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New Tracking Methods to Research the Business Creation Activities Among Entrepreneurs

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New Tracking Methods to Research the Business Creation Activities Among Entrepreneurs

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Executive Summary

People who start a new venture are important for many aspects of the economy. In literature, these people are referred to as entrepreneurs.

The activities part of starting a new venture is a topic that is only covered by a limited amount of research papers. Several reasons complicate researching this process. The most important reasons is the fact that the research domain is in need of a research method that is able to track the activities as they occur. Current research work around this dilemma by asking entrepreneurs what activities and decisions they made in hindsight. In several studies, this technique is proven to be inaccurate. The fact that the entrepreneurs know what happened, affects their ability to recall the activities and risks correctly. This research defines research methods that allow researchers to track these activities without this limitation.

Through a literature research, the important aspects to take into account when developing a new method are evaluated. Previous research that tracked the activities of entrepreneurs showed the limitations. It also strengthened the need to define a method that is not affected by these limitations. Analysing how activities are tracked in other research domains did not result in a suitable solution. However, two methods that have been applied to study experiences as they occur, did show up. The first method is the diary method (DM), where the participant is required to keep track of their experience using a diary of some kind. The second method is the experience-sampling method (ESM), which requires the participant to record events and experiences through a short survey as they occur. Through modification of these methods, both were considered suitable to track the activities of entrepreneurs.

The activities and phases of the entrepreneurs were classified based on the literature. These classifications are required to track the entrepreneurs while keeping the data organised. Both definitions were also required for the definition of the activity-tracking model. The model defined how each of the methods is able to track and form meaningful results from the data.

The proposed methods were evaluated in two trial runs. For both trial runs, two classes of students that enrolled in new venture creation courses participated. In the first trial run, the methods were tested over a period of eight weeks. Defining what data the methods are able to gather when running over a long period of time, was the goal of this first trial run. The second trial run focused on the ability to discover team-level patterns with both methods. This time, the students were tracked more intensively over a period of one week.

Through the use of these trial runs, it was shown that both methods are capable of determining the activities of the entrepreneurs. As the ESM interrupts the entrepreneurs throughout
the day, it was limited to track the activity only. With the DM, the phases of the entrepre-
eurs could be mapped on the model of Elizondo-Noriega et al. (2014). The resulting path shows what cycles the entrepreneur has been through to create their new venture.

Commitment of the entrepreneurs is required in order to achieve a high level of partic-
cipation. When this is achieved, both methods are able to show the diversity of the team members and whether collaboration took place in the team.

In both trial runs, the data were gathered through the use of a survey application called Paco. This application enabled notifications to be sent to the participants on their smart-
phones. The data gathered by Paco were aggregated and analysed by a newly developed analysis software. This software is able to generate reports with graphs to give participants insights in their activities during the research. These reports were found to be motivating by the participants. With the use of this framework, analysis of the data was performed to discover what insights can be discovered in the data of these methods.

After the trial runs, the students were questioned how they experienced the research. The experiences showed that the methods were not found to be intrusive in their workflow. The survey application Paco would require some polishing. Currently it prevented some of the participants to participate due to technical issues.

To conclude, both methods are suitable to track the business creation activities of entre-
preneurs. The ESM showed more diverse activities as minor and major tasks were spotted by this method. The DM could give more insights into the major activities of the entrepreneurs per day. However, the DM requires a higher commitment of the participants as it was shown that participation levels dropped quickly over time with this method.
Preface

This report is the final result of my master thesis. Written as the conclusion to my study Management of Technology at the Delft University of Technology. Research has been conducted at the university. In which, the students of two new venture creation courses participated to test the methods proposed by this thesis. With the support of the lecturers and students of the Technology-Based Entrepreneurship and Med-tech Entrepreneurship courses, I was able to analyse the capabilities of the methods in the field. I would like to thank Ákos Wetters, Johan Spaans, Dap Hartmann, Victor Scholten, and the students of their courses for providing the opportunity to research the business creation activities. I would like to thank Carlos Toro-Bermudez, Bart Kaas, Sander Geursen, Amber van Hauwermeieren, and Daan Eigenraam for their extensive support, discussions, insights, and advice on getting it done. Furthermore, I would like to thank my supervisors at the Delft University of Technology for their support and advice on this matter. Especially I would like to thank Victor Scholten for his support, interest, and advice. Last but not least, I would like to thank my girlfriend Charlotte Verouden and my family for their endless support throughout my study, without you I would not have been able to achieve this.

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# Table of Contents

List of Figures vii

List of Tables ix

1. Introduction 1
   1.1. Problem statement and motivation 1
   1.2. Research relevance 2
   1.3. Research objectives 2
   1.4. Research scope 5
   1.5. Research strategy 7
   1.6. Research deliverables 9
   1.7. Thesis overview 10

2. Literature review 13
   2.1. Task and activity tracking in general 13
   2.2. Entrepreneurs 16
   2.3. Team work 22
   2.4. Tracking of entrepreneurs 25
   2.5. Conclusion 28

3. Methods for task and activity tracking 33
   3.1. Requirements 33
   3.2. Archived data 39
   3.3. Observation 39
   3.4. Interviews 40
   3.5. Diary method 40
   3.6. Experience-sampling method 41
   3.7. Calendar method 42
   3.8. Time-tracker method 42
   3.9. Conclusion 43

4. Data collection 45
   4.1. Classification 45
   4.2. Activity-tracking model 47
4.3. Analysis software and reports ................................................. 49
4.4. Validity and mitigations ......................................................... 50
4.5. Research A ........................................................................... 55
4.6. Research B ........................................................................... 59
4.7. Experience ............................................................................ 61
4.8. Conclusion ............................................................................ 63

5. Data analysis and discussion .......................... 65
5.1. Research A ........................................................................... 65
5.2. Research B ........................................................................... 81
5.3. Experience and verification .................................................... 88
5.4. Discussion ........................................................................... 91
5.5. Conclusion ............................................................................ 95

6. Conclusion and future work ......................... 99
6.1. Limitations and future work ................................................... 100

Bibliography .............................................................. 103
Glossary ........................................................................ 114
Acronyms ................................................................. 117
Appendices

A. Manual screenshot ......................................................... 119
B. Website screenshot .......................................................... 121
C. Report screenshot ................................................................ 123
D. Questionnaire ................................................................. 129
## List of Figures

1.1. Research strategy in phases ........................................ 7  
1.2. Research trial run overview ...................................... 8  
1.3. Thesis overview, relating chapters to the research questions. The chapters are depicted in blue boxes. The green boxes depict the research questions they relate to. ....... 11  
2.1. Entrepreneurship and innovation process model, adapted from Elizondo-Noriega et al. (2014). .................................................. 18  
2.2. Venture creation framework as defined by Gartner (1985). ........ 19  
2.3. The conceptual model .............................................. 30  
3.1. Analysis requirements from literature ................................ 36  
4.1. Aggregating individual data to team data ......................... 47  
4.2. Diary method: Activity-tracking model ............................ 48  
4.3. Experience-sampling method: Activity-tracking model ........... 49  
4.4. Research A analysis goals ......................................... 56  
4.5. Research A timeline .................................................. 58  
4.6. Research B analysis goals ......................................... 59  
4.7. Research B timeline .................................................. 60  
5.1. Research A: Overall participation per method per week .......... 69  
5.2. Research A phase analysis goal .................................... 72  
5.3. Research A: Diary method: Reported phases by participant, mapped on adapted model from Elizondo-Noriega et al. (2014). ................. 73  
5.4. Research A: Diary method: Reported phases by team, mapped on adapted model from Elizondo-Noriega et al. (2014) ......................... 75  
5.5. Research A task and activity analysis goals ....................... 76  
5.6. Research A: Diary method: Reported hours per category by example participant 77  
5.7. Research A: Reported tasks and activities worked on per category by team ................................................. 78  
5.8. Research A: Experience-sampling method: Reported samples per category per team member ......................... 79  
5.9. Research A time spent analysis goal ................................ 79  
5.10. Research A analysis goals ......................................... 81
5.11. Research B: Overall participation per method per week. ........................ 83
5.12. Research B: Diary method: Reported hours per category by team members of the example team .......................................................... 84
5.13. Research B: Experience-sampling method: Reported samples per category by team members of the example team ............................... 85
5.14. Research B team analysis goals ............................................................. 88
5.15. Participation experience questionnaire insights, part 1 ....................... 89
5.16. Participation experience questionnaire insights, part 2 ....................... 90
5.17. Verification of collaboration results ....................................................... 91
5.18. Results of analyses linked to literature ................................................ 96
List of Tables

2.1. Entrepreneur definition per phase of the new venture .......................... 20

3.1. Requirement overview of the methods ................................................. 44

5.1. Research A: Participation per user with diary method. ......................... 70
5.2. Research A: Participation per user with experience-sampling method. .... 70
5.3. Research A: Participation per team with the diary method. .................... 71
5.4. Research A: Participation per team with the experience-sampling method. 71
5.5. Research A: Comparison of hours per sample between the methods. ....... 77
5.6. Research A: Time spent analysis. ..................................................... 79
5.7. Research B: Participation per team with the diary method. .................... 83
5.8. Research B: Participation per team with the experience-sampling method. 83
5.9. Research B: Collaboration of team members detected with diary method. .. 86
5.10. Research B: Collaboration of team members detected with experience-sampling method. ................................................................. 87
5.11. Analysis requirement overview of the methods ................................... 97
1. Introduction

This thesis focuses on a new method, to track the activities of people while they start their own business. The problem with the current research on the activities of these people, is limited in quantity and design. The exact problem and motivation to dive into this research area, and to come up with a new method to tackle it is described in section 1.1. The relevance to business people and the research community will be discussed in section 1.2. Whereas, section 1.3 describes the research objectives of this thesis. The scope of these objectives is written in section 1.4. Followed by the strategy in section 1.5 to achieve these objectives. Finally, section 1.7 will provide an outline of this thesis.

1.1. Problem statement and motivation

The activities of people who start running their own businesses is an under-researched topic. In the first phase of their business, they are confronted with many challenges. Each of these need to be dealt with and might be equal in terms of urgency. The motivation and energy of starting their own business, helps to get through this dynamic period. For others, however, it is this period that forms the bottleneck to get their business in operation (Aldrich and Yang, 2014). As Gartner (2008, p. 360) argued the importance of researching these actions:

“Unless we, as scholars, look to see how individuals, through their daily choices, which are often small discrete actions (Weick, 1984), move in ways that enable other, larger (or smaller) circumstances around them to form, it will be difficult to understand how the mechanisms of entrepreneurship actually lead to transformation.”

The challenges and activities of this period are mostly researched in hindsight. Seldomly, the researchers were able to observe this period while it was on-going. This lack of research and the reasons thereof is discussed in more detail in section 2.4.

In hindsight, the success of their business is reflected on the challenges and activities that they remember of this period. However, as Fischhoff (1975); Huber and Power (1985); Wasserman et al. (1991); Golden (1992) showed, in hindsight people are unable to correctly state what judgements and events occurred. In 2003, Carter et al. questioned the validity of most research on entrepreneurship due to this problem of retrospection. When entrepreneurs are asked to describe their prior actions and intentions, their self-justification bias seriously
undermines the findings (Carter et al., 2003). The results of these research articles are biased to a certain degree. One possible solution to this problem would be to observe or track these business creators during that period. Such that, data would be obtained that are as accurately as possible. By limiting the amount of time between events and the registration of them, the value of the data increases.

As will be discussed in section 2.1, several methods exist to track activities. Each of these have their benefits and disadvantages. There is a need for a method that is able to analyse exactly what the entrepreneurs did while they were in the business creation process. Therefore, the goal of this thesis is to define and test a method to provide these insights accurately.

1.2. Research relevance

People who start their own business are also referred to as entrepreneurs. Many definitions of an entrepreneur exist (Gartner, 1990). Schumpeter (1934) defined them as the innovators and creators. Baumol (1968) described them as the leadership implementers and locators of ideas. As described in section 1.1, the start-up phase of these fresh entrepreneurs is under-researched. Insights in the activities of new entrepreneurs, in this period, but also in later phases of their start-up would enable researchers to understand what entrepreneurs are going through. Additionally, these insights enable to accurately research the team dynamics, collaboration process, and describe success patterns.

As discussed earlier, the missing keystone to achieve this is the method to enable this. The definition and test insights of a method that could provide these insights will be valuable to the entrepreneurship research community. Additionally, the results might also be relevant in other research areas, such as social studies that are interested in the activities of people in general.

To entrepreneurs, the ability to research their activities might allow them to use their limited time more efficiently. It could help future entrepreneurs, or themselves in their next start-up, to become more efficient in starting their business. To start-up incubators, the method and results might allow them to coach the start-ups and provide guidance while events occur.

1.3. Research objectives

The research objective is to define and test a method that enables tracking activities of entrepreneurs during their business creation process. These entrepreneurs could operate alone or in a team to create their new business. Each of the entrepreneurs will be tracked individually. When they operate in a team, the individual data of each of the team members is aggregated in order to track the team as a whole. Ideally, when the new venture is created by
a team of entrepreneurs, the new method should also provide insights in the team diversity and collaboration process. Tracking the activities of a group of students with the newly defined method is used to answer the main research question:

MQ. How to track the business creation activities of entrepreneurs?

Before determining how these activities need to be tracked, the phases the entrepreneurs go through in this process, are important to know upfront. The first sub question is to determine these phases:

SQ 1. What phases do entrepreneurs go through in their process to create their new venture according to the literature?

The kind of activities that entrepreneurs are dealing with, while developing their business need to be researched. To define what activities need to be tracked, the second sub question is:

SQ 2. What activities do entrepreneurs spent their time on according to the literature?

The list of activity types resulting from question SQ 2, defines what kind of methodologies would be feasible. Tracking activities of subjects has been researched in various research domains. However, whether they fit to research entrepreneurs should first be determined. Therefore, the third sub question is to determine which fit:

SQ 3. What are the requirements for tracking activities of entrepreneurs?

A new method will be defined that best suits the entrepreneur domain. This method takes into account the requirements and insights gained from available research methods and their weaknesses.

Bergmann et al. (2016) showed the importance of student entrepreneurs in the knowledge transfer process. They concluded that it has long been a neglected group of entrepreneurs in previous research. Mueller et al. (2012), researched what kind of activities entrepreneurs are busy with in the process of creating their business. The entrepreneurs that are busy with this process, are also referred to as nascent entrepreneurs.

To test the method, a group of student entrepreneurs will be researched for a period of time. More explicitly, tracking their activities during a business creation course. The tasks and goals for the student groups during that period matches with the nascent activity list of Mueller et al.. Based on these findings, it is assumed that these student entrepreneurs would show behaviour that is similar to entrepreneurs in the same phase. Since these students
are creating their business in a controlled environment at an equal starting point, they are a suitable group to test the research methods on. Before the method is tested with the students, the fourth sub question will need to be answered:

**SQ 4.** How to track the time spent by student entrepreneurs, during a business creation course?

The activities nascent entrepreneurs spent their time on, when and for how long are interesting aspects to research. According to the literature, the time spent by nascent entrepreneurs follows a specific trajectory. One of those trajectories is defined by Elizondo-Noriega et al. (2014). Based on their research, whether the students follow a similar trajectory or not is analysed. What the method is able to reveal about the individuals and teams is investigated with the fifth sub question:

**SQ 5.** What insights can be found in tracking data of the new method using data analysis?

These insights are based upon the individual data of the entrepreneur. Frequently, new ventures are created by more than one entrepreneur. The dynamics of the entrepreneurial team are interesting and often researched, as will be shown in section 2.4. Insights in formation and processes of the team could be deduced by combining the individual data of the team members. In case the new venture is created by a team, the activities of all team members are relevant to form a picture of this process.

Based on research discussed in section 2.3.2, the diversity of the team could be an important indicator for its performance. Whether the new method is able to discover this diversity is checked with the sixth sub question:

**SQ 6.** What could the method reveal about the team diversity?

In section 2.3.3, research is discussed that showed how collaboration processes affect the new-venture-creation team and even the venture performance in the long run. How they work together and how they divide the tasks among the team members would, therefore, be interesting to analyse. This part of the research is covered by the seventh sub question:

**SQ 7.** Can the new method show when collaboration took place?

The ability to analyse the team aspects based on the individual reports of the team members is analysed with these students. Students teams are formed by the lecturers upfront. To diversify the teams, the students are assigned to teams based on their different backgrounds.
During the course, the students endure a high workload to participate in the course and create their businesses. Participating in the research is a task that they are asked to do next to all this. With the eighth sub question, their experience using the research method as a participant is evaluated:

SQ 8. How is participating in the activity tracking research experienced with the new method?

With these eight sub questions, the new method will be defined and analysed. This includes analysing its abilities, what the data it generates reveals, and how the participants experience it.

1.4. Research scope

As will be further discussed in section 2.2, entrepreneurs are very valuable to our society. Therefore, a lot of research has been focused on these entrepreneurs and their operations. In terms of the start-up activities of entrepreneurs, research has only documented the tip of the iceberg so far. As discussed in section 1.1, the main reason for this is the lack of qualified research methodologies that are able to track the activities and phases of entrepreneurs as they occur.

The scope of this research is to define new methods to track the early activities of nascent entrepreneurs in their business creation process. These new venture creators could operate individually or in a team, both should be supported by the new methods. By reviewing the literature on entrepreneur tracking research, discussed in section 2.4, the methods are designed to be helpful for most of these research studies. Current limitations of the research methods used in these papers are taken into account. This literature review forms the basis for the requirements of the new methods, these will be discussed in section 3.1.

New methods will be defined after careful consideration of the available methods and how these can be adapted or renewed. For this early business creation process, the phases and activities will be classified according to the research of Elizondo-Noriega et al. (2014) and Mueller et al. (2012) respectively. This classification is required to compare the methods and to define at what level the methods are able to track the entrepreneurs. Further discussion on the classification can be found in sections 2.2.1 and 4.1. A analysis software will be developed to analyse the data returned by the new methods. With this application, patterns in the data are analysed to verify whether the methods are able to provide the required insights.

To perform this verification step, the abilities of the suitable methods are tested qualitatively using a trial research. The methods are designed to track entrepreneurs. Determining how these entrepreneurs do their job is eventually the goal that these new methods should achieve. The tasks and activities should be tracked while minimising the impact of the
method on this process. No independent variable (IV) will be modified to determine the causal effect. Additionally, putting the participants in a lab environment is not an option either. Therefore, the methods will be tested using two quasi-natural experiments (Meyer, 1994, 1995; DiNardo, 2008). In which the participants will work on their business creation process in their own natural environment.

Before these tests will occur, the validity of the tests and methods will be ensured where possible. The validity and mitigations taken to limit the impact of several error types are discussed in section 4.4. Based on the results of the tests, further limitations and validity issues will be discussed in section 6.1.

There are all kinds of entrepreneurs, as further discussed in section 2.2. Finding entrepreneurs that are in the process of creating their new venture could be a time consuming process. As the goal of this research is not to determine what activities entrepreneurs work on or what results in ideal new venture performance. Any type of entrepreneur or proxy of entrepreneurs would be an ideal candidate to test the methods. As long as they are able to reflect a similar behaviour as entrepreneurs would.

Students will be used as a proxy for entrepreneurs. These students all participate in courses to create their new venture with a team of three to five team members. As they work on their own business ideas, by definition that makes them student entrepreneurs and can also be seen as nascent entrepreneurs. At the start of the course, they begin with the earliest step of creating a new venture, the idea generation. A total of 21 teams will be participating in the experiment, each starting in the same period with this process. The teams proceed to create their business, while following the structure of the course. This allows further comparison between the teams, which would otherwise be very hard to achieve. These students form a good candidate to test the capabilities of the new methods.

By recognising patterns in the collected data, the goal is to see what insights these methods provide. The methods will track the tasks and activities of the individual entrepreneurs. Whether the methods can be used to track tasks and activities of individual entrepreneurs is tested in the first experiment, research A.

By aggregating the individual tracking data of the entrepreneurs in a team, the tasks and activities of the complete team could be deducted. Ideally, the team diversity and collaboration efforts would be recognisable in the data too. Whether this is the case is tested as in the second experiment, research B. If a method would be able to find these patterns, it would be a suitable candidate for tracking the tasks and activities of teams. Thereby, allowing researchers to track entrepreneurs over a long period of time in future research. How participants experience using the research methods will be researched as well.
1.5. Research strategy

As fig. 1.1 depicts, the research starts with a literature review. The literature review looks into the value of entrepreneurs and what activities they undertake to create it as efficiently as possible. Researching what phases entrepreneurs go through and what activities they spent their time on answers questions SQ 1 and 2. The literature review into how teams operate, is conducted in order to get more insights on the team diversity and collaboration processes in their business creation phase. By analysing current research on activities of entrepreneurs, it is shown that a new method is desired.

The requirements of a new method are formulated by combining these findings, answering question SQ 3. The problem is analysed with these requirements and further research on tracking activities in other domains. Based on this analysis, the activity-tracking model is defined. The activity-tracking model, problem analysis, and further analysis of other activity-tracking solutions, define the requirements to develop the new methods.

For each of the methods, the unit of observation is the entrepreneur or team of entrepreneurs that create the new venture. The methods track the tasks and activities of each individual
entrepreneur. When the new venture is created by a team of entrepreneurs, the data of the individual entrepreneurs is aggregated. Additional insights on the diversity of the team and collaboration processes will be gathered with these teams as well. How the data is aggregated and the additional insights gathered for teams are further discussed in section 4.2.

Before the methods can be put to the test, the analysis software is developed. The application will parse all collected data reports, combining the data per person and per team, such that analysis can be conducted for both of these. It will be able to report about the data patterns in near real-time. Allowing the researchers to analyse how the tests are proceeding. While giving the participants the opportunity to track their own progress on the website, where each will be granted access to.

To help the users to participate in the research, a manual is written. This will allow them to setup their mobile at a later time. The manual will be hosted on a website that is publicly available. When the users participate, they can also retrieve their own individual analysis reports. These reports are generated as an incentive for the users to contribute.

The methods will be tested in the data collection phase. At the Delft University of Technology, several courses and minors focus on creating new ventures. Two of these courses have opted in to the research to track the activities of student entrepreneurs from the start. In order to know how to track their time specifically, research answering question SQ 4 is performed. Throughout the data collection research, the participation and data gathered will be monitored. The effort of the participants is rewarded by providing them insight reports at the end of the research period.

<table>
<thead>
<tr>
<th>Research A</th>
<th>Research B</th>
</tr>
</thead>
<tbody>
<tr>
<td>Individual entrepreneur data, long-term trial run</td>
<td>Team data, intense, brief period</td>
</tr>
<tr>
<td>DM</td>
<td>Class 2</td>
</tr>
<tr>
<td>ESM</td>
<td>Class 1</td>
</tr>
<tr>
<td>14 Sep</td>
<td>21 Sep</td>
</tr>
</tbody>
</table>

Figure 1.2.: Research trial run overview.

DM stands for Diary Method, this is one of the methods that will be tested during the trial run. What DM is and how the method works is further discussed in section 3.5. ESM stand for Experience Sampling Method, this is the other method that will be tested. What ESM entails and how it works is further discussed in section 3.6.
The collected data will be analysed according to the activity-tracking model. Additionally, the data are analysed for patterns that are described as useful in literature on the new venture creation process. Figure 1.2 shows how the methods will be tested and which classes participate during these tests. Both methods will be tested in the two research trial runs. During the first trial, research A, the methods will be tested on their abilities to detect patterns based on individual data over a period of eight weeks. Both classes will participate in this trial run. Question SQ 5 is answered by analysing the data of research A, combined with the literature review data tracking activities.

In the second trial run, research B, the same methods are tested for one week. The run focuses on their capabilities to show patterns on a team level. With this trial run, only class 2 will participate. Questions SQ 6 to 7 are answered using this analysis.

How participants experienced the methods is questioned in a survey once the methods have been tested. The survey results are gathered and analysed to answer question SQ 8. This survey also provides an opportunity to verify certain patterns found in the data analysis phase. Based on the results of the survey, the usability and experience for participants is evaluated of these methods. Together with the insights gathered in the data analysis phase, the methods are evaluated as the last step in this research. The answers gathered for questions SQ 1 to 8, answer the main research question (MQ).

Where these phases and research questions are discussed in the thesis is described in section 1.7.

1.6. Research deliverables

The primary goal of the research is to deliver new research methods that are able to track the activities of entrepreneurs while they take place. To achieve this goal, several other deliverables will be produced. These are outlined in the following list.

**Research methods** The goal of the research is to deliver the research methods that enable tracking of entrepreneurs, specifically of their activities in the new venture creation process.

**Survey application setup** The survey application (Paco) will be configured to collect data from the participants with specific intervals. The logic and questions of the questionnaire is configured too. All data collected by the application will be reported back as individual reports. These reports contain the answers to the specific questions asked. The analysis software is developed to organise and analyse the reported data.

**Analysis software** All reported data during the research needs to be structured and analysed. The analysis software is developed to perform this task automatically. The reported data that is returned by the survey application is a simple set of data reports, each time a user reports a task or activity, it is put into this set. The analysis software
parses the data, checks whether the questions have been answered correctly, and links the data to the specific user and team they belong to. With these relations set, it is able to analyse it. Several analyses are performed on the data. Once the data is processed and analysed, it uploads the reports to the website such that each participant is able to access their own reports. When requested, it will send an email to the participants to inform them about their participation levels and show a summarised version of the report while linking to the full report. Additionally, the software creates analysis reports for the researchers as well. Allowing the researchers to track how the research progresses and analyse the data immediately.

**Participant instructions** These instructions have been written to help the participants setting up their mobile devices to participate in the research. It explains all necessary steps and instructs them how to fix problems if these occur. Furthermore, the purpose and idea behind the research is also explained in these documents.

**Reports** Through the use of the analysis software, reports on individuals, teams, classes, and all participants were generated. The individual reports were sent in summarised form to the participants, allowing them to access their full report through the research website.

**Research website** The research website explained the research in more detail, while providing the instructions to participate. When someone participated in the research, the website granted them access to their individual report after they logged in. To verify the user, the same credentials are required as specified with the survey application during the setup on their mobile device.

These deliverables are further discussed in chapter 4.

### 1.7. Thesis overview

The definition of the method to track activities of entrepreneurs in their new venture creation process, is covered by following the chapters of this thesis. An overview of these chapters and how they relate to the questions is depicted in fig. 1.3.

In chapter 2, the literature will be reviewed. This review entails activity tracking in general and for entrepreneurs specifically, what entrepreneurs do and which phases they go through. It also covers the importance to measure team diversity and collaboration processes. Through analysis of the literature, questions SQ 1 and 2 are answered. It also forms the basis to answer questions SQ 3 and 4.

The requirements for tracking the activities are covered in chapter 3. Several methods are considered as further discussed in this chapter. By comparing whether these methods
Figure 1.3.: Thesis overview, relating chapters to the research questions.

The chapters are depicted in blue boxes. The green boxes depict the research questions they relate to.

meet the requirements, two methods are selected. Thereby, the answer for question SQ 3 is finalised and the basis of the answer for question SQ 4 is extended.

Chapter 4 describes how the methods will classify data. It will also describe the activity-tracking model for each of the methods, showing what they track and how the reported data are aggregated. The methods will be tested in two research trial runs. Who participated, for how long, and how is further described in this chapter. Goal of the tests is to discover what the gathered data of these methods are able to show. By defining the research specifications, it answers question SQ 4.

The data gathered by these tests are analysed and discussed in chapter 5. The analysis will determine what the methods are able to tell about the participation, phases, activities, duration of the participants individually, thereby answering question SQ 5. On a team level it will analyse whether the diversity of the team can be determined to answer question SQ 6. It will also analyse how the team collaborated and how participating in the research is experienced, answering questions SQ 7 and 8 respectively.

The last chapter, concludes the thesis by describing how the methods can be used to track the activities of entrepreneurs. The abilities of the methods are compared and brought forward for use in future studies on entrepreneurial activities. With this conclusion, the main research question (MQ) is answered.
2. Literature review

In the last couple of decades, a lot of research has been conducted into the pre-start-up behaviour of nascent entrepreneurs. However, as discussed in section 1.1, most of the research focused on the behaviour and activities of these entrepreneurs do not track them accurately. To define a new method, this chapter will go through the current state of research and the limitations thereof.

Section 2.1 describes how activities can be tracked in general. It will go into detail about the current methods used in other domains. These findings define some requirements that the new method should meet, thereby partially answering questions SQ 3 and 4.

The value of entrepreneurs, what types of entrepreneurs exist, and what aspects are important to track are discussed in section 2.2. In this analysis, the activities and phases of entrepreneurs are brought forward, thereby answering questions SQ 1 and 2. As entrepreneurs often work together in a team, tracking how teams collaborate is covered in section 2.3. It also shows why it is important to be able to show whether and how they collaborate. As well as showing the importance of measuring the team diversity.

The answers for questions SQ 3 and 4 are further extended by section 2.4. Discussing the current state of tracking entrepreneurs. The findings of the literature review and answers to the questions SQ 1 to 4 are concluded in section 2.5. Bridging the literature findings to the definition of possible methods to track the tasks and activities of entrepreneurs.

2.1. Task and activity tracking in general

The research domain on entrepreneurship is in need of a new method to track the activities of entrepreneurs, as discussed in section 1.1. Before narrowing down to the scope of entrepreneur research and their tracking methods so far. This section will conduct a broad review on the methods used to track activities in other research domains. Through this review, it tracks what is required by other methods, forming a partial answer on what requirements need to be met to track entrepreneurs (question SQ 3).

In the domain of academics, Libaers (2012) researched how these scientists allocated their time and whether that allocation correlated to being involved in technological commercialisation. In this research, a survey among 1543 scientists was used to determine their time spent on several categories. Surveys are frequently used as a research method. When researching time allocation in hindsight, as introduced and further discussed in sections 1.1 and 2.4 re-
spectively, one needs to carefully address the possible effects of incorrectly recalling events by the respondents.

A survey based method that tackles some of these issues is the American Time Use Survey (ATUS). The population-based cross-sectional research of ATUS, asks adolescents to fill in a survey to track their time use over a period of 24 hours. In the survey, they are told upfront to keep track of their time-use and record it with the questionnaire the day after. Since the time to reflect upon their time use is limited to one day, the study tries to limit the effects of incorrectly recalling events. Through the use of the ATUS, several time-use oriented research papers have been written. Based on this survey data, Basner et al. (2007) showed the relation between sleep and work/travel time. They conducted the analysis by aggregating data from ATUS to determine the type of activities.

Observing events and time use as the day passes by the respondents themselves is also used by Hekkers (2003). In the United States of America, case managers are hired to deal with insurance and health issues for employees. These case managers are paid by the employer to decrease the impact of health issues on its workforce. Hekkers discusses how time tracking activities using a simple spreadsheet already provide accurate insights in time spent. The case managers actively need to track their time use as the day passes. The disadvantage of having to fill in the data regularly is reported as an issue. There is no feedback in terms of reminders, thereby the commitment of the participants is very important for this type of research to succeed. By linking a bonus structure or other incentives to filling in data, the motivation and accuracy of the data can be improved.

In terms of tracking while progress is made, Vanhoucke (2009) explains the benefits of tracking time spent on projects. The project tracking software and algorithms discussed, accurately predict costs and remaining duration of the project. Vanhoucke showed how accurate tracking of the project allows taking corrective actions to reduce total project duration. The start-up creation process can be seen as a project. Unfortunately, as will be further discussed in section 2.2.1, only a few steps are documented as part of this process. Therefore, one could not setup the project upfront. But would rather be able to track the steps the project required and the relations between the steps while they occur. This would be a time consuming process.

The research of Dugan et al. (2012) used calendar data to record events and activities as they were planned or executed, therefore, it is less susceptible for incorrect recalls compared to surveys. This calendar method enabled analysis on how much time was spent on certain activities, whether the calendar was overbooked, and report it back to the users. Logically, for calendar meetings the users did not have to do anything. However, in case the user was interrupted or was asked to work on a project intermediately, the user would have to put it in their calendar first, otherwise it would not show up. Dugan et al. stated that the participating users appreciated the time-based visualisations. These visualisations made them more likely to capture details about the activities as they occurred. The motivation of
the participants is important to consider, offering a visualisation as a reward for their effort should be considered.

Since these methods do not provide feedback to the participants that they need to register events, the methods require motivated participants to succeed. Through observations the actions of an entrepreneur might be determined, without requiring the participants to be motivated. An observation study allows the researcher to measure things as they occur. Additionally, the measurements are less subjective than self reflection in hindsight, as each of the measurements follow a preset observation model. In a sociological research, González (1996) tracked how the child copied behaviour through an observational study of a parent-child relationship. In order to research the parents and child, they recorded the interactions on video for later analysis. Another observation study was conducted by Doyle and Carter. Doyle and Carter (1984) observed the tasks in the classroom of the same teacher across multiple different classes. By tracking events and sequences using a time log, they were able to analyse what students were working on during these lectures. Both of these observation studies show the importance of defining classifications strictly upfront. It also shows how the observations are not able to cover all events since the researchers cannot be observing the whole time.

Vannest and Parker (2010) used a combination of self-registration and observation, allowing them to track all time spent without requiring the researchers to be present all the time, while keeping the reports as objective as possible. In their research to track time use of teachers in the domain of special education, the participating teachers were educated how to track their time correctly. By initially observing the time use and comparing it with the recorded time use of the teacher, their ability to record their time correctly was validated. The teachers were asked to sample their time use every hour, logging it through a website. There they were able to register how many percent of the last hour was spent per category. By tracking the time use of the teachers across ten different categories, the research was continued until results showed stable measurements across these categories. Vannest and Parker concluded that a ten-day measurement of time tracking by the teacher provides a stable measurement of time use for this domain.

Fullagar and Kelloway (2009) used a different approach to tackle the reflection and time consumption issues. In their research, they tracked the flow of a group of Architectural students while the students were working long hours on creative projects. Throughout their project work, a few times a day they were interrupted to fill in a short survey on a digital handheld device that was given to them. The software used in this research was the Experience Sampling Program (Barrett and Barrett, 2000). The survey questioned how they were feeling and what level of flow they were currently experiencing. Through this research, they showed that the level of flow experienced was correlated to the well being of the participants.

By using wearable and mobile devices, the time use and active participation requirements can be lowered even further. Rawassizadeh et al. (2015) analysed several research studies
that utilised these techniques. Two of the research studies were running on the UbiqLog platform (Rawassizadeh et al., 2013). With this life logging platform, they were able to track calls, text messages, location data, and other sensor data available on the devices carried by their participants. Based on their experience, Rawassizadeh et al. concluded that one should minimise the need for the participant to annotate data. Research should also take into account that there is a level of uncertainty and data loss with wearable systems. Rawassizadeh et al. showed that a need exists for multivariate reflection methods to visualise data. For example, to show incoming calls based on location and time of day. This data visualisation would help participants and researchers with discovering patterns.

From surveys to fully automated wearable and mobile research methods, each method has its own advantages and disadvantages. The entrepreneur and the several aspects of the process to create their new venture, determines how methods could be applied to research the process. In section 2.2 these aspects will be covered first. After which, section 2.4 will continue comparing frequently used methods to track the activities, this time focusing on entrepreneurs specifically.

2.2. Entrepreneurs

Before the different activities, phases, and other characteristics of entrepreneurs are discussed. This section will first show why it is so important to understand more about the entrepreneurs and their new venture creation process.

As briefly touched upon in section 1.2, the entrepreneur is known for its innovation and creativeness (Schumpeter, 1934). Through the creation of new entrepreneurial companies, old firms and products are replaced. Therefore, the process of entrepreneurs is also defined as creative destruction (Schumpeter, 1942). Berthold and Neumann (2008) drew the conclusion that self-employed entrepreneurs have the ability to create better products that meet customer demands than employees of companies could. They continued stating that, for this reason self-employment is important to achieve higher growth rates and more innovation.

This relation between entrepreneurship and growth is further continued upon by Romer (1986, 1990) and Lucas (1988). According to their endogenous growth theory research, a geographical area benefits from any kind of new knowledge investments. Audretsch and Keilbach (2008) stated that entrepreneurship is one of the neglected new knowledge creators. With their research they showed that entrepreneurship has positive long-term effects on the region.

Entrepreneurs add a lot of value to the economy. How they add value is researched frequently. In this research domain, the research would benefit from a new research method that is able to register these activities and phases as they take place. To determine what such a method should be able to register, the following sections will cover the important aspects that should be considered.
Section 2.2.1 dives into the research on activities and phases of entrepreneurs. It shows what different frameworks exist and how these have determined the list of activities so far. The type of entrepreneurs that exist is covered in section 2.2.2. In this research the methods are tested on a group of student entrepreneurs. What and how these differ from other type of entrepreneurs is covered in that section.

### 2.2.1. Activities and Phases

What activities need to be tracked and what phases are relevant to record are important to know upfront. In this section, the literature that researched these two areas is covered to answer questions SQ 1 and 2.

Earlier, a lot of research focused on the entrepreneur as a person. The qualities entrepreneurs possess was the main question of these papers. In 1988, Gartner argued, with the like-named article, that “Who is the entrepreneur? Is the wrong question.” Instead of the so-called “trait approach”, research should use the “behavioural approach”. Analysing on the process of creating new ventures and what entrepreneurs do (behavioural approach), instead of who they are and what traits they possess (trait approach).

To identify a venture in the process of creation, Gartner and Katz (1988) identified a theoretical and empirically based framework through literature review. Their framework states that four properties are required in new ventures; these properties are described as 1) intentionally, 2) resources, 3) boundary, and 4) exchange. Through the use of the Gartner and Katz (1988) framework, empirical explorations discovered no common pattern among the researched emerging organisations (Reynolds and Miller, 1992; Reynolds and White, 1993). Using the framework of Gartner and Katz (1988), Brush et al. (2008) verified that all four properties of the framework are required for survival of the new venture in short-term. Additionally, Brush et al. propose to extend the model to include explicit identification of activities that lead to “increased organisational legitimacy or enhanced organisational knowledge”.

Through analysis of the available research, Gartner (2008) concluded that the entrepreneurship entails a fundamentally heterogeneous process. Gartner and Shaver (2012) argued that this is the main reason why there have been few generalisable findings that fit all entrepreneurs in all kinds of environments. Continued upon this basis, Aldrich and Yang (2014) showed that entrepreneurs develop their skill set through learn-by-doing. They discussed why most entrepreneurs fail and only few succeed. According to Aldrich and Yang, the difference lies in the ability to adapt to new environments. Mosey and Wright (2007) specifically focused on the start of new ventures, determining why only few succeed. They argued that matching the market need for their invention or new technology, is something that is found difficult at the start. At the start they have many uncertainties, while trying to benefit most of the window of opportunity that appeared. As argued by Ensley et al. (2003), in order to take advantage of opportunity windows, entrepreneurs have to take action quickly (Hambrick and Crozier, 1985; Reynolds and Miller, 1992). Since time and resources of entrepreneurs are lim-
ited, determining the risks carefully is a luxury they cannot afford (Gilmore and Kazanjian, 1989; Shapira, 1995).

As proper risk management is not possible, Ries (2011) argued that entrepreneurs should try to fail as fast as possible. His theory is that through this approach, the entrepreneur is able to learn what the market wants fast and stop efforts that would fail anyway as early as possible. According to Elizondo-Noriega et al. (2014), the concepts of Design Thinking and Lean Manufacturing influenced Ries. With Design Thinking, designer methods are used to define a feasible product based on customer needs. Whereas Lean Manufacturing focuses on everything that adds value, leaving out things that do not. Through the use of these concepts, the entrepreneur proceeds through an interactive trial-error process. With each iteration, the knowledge gained could reduce the risk of failure next time (Schlesinger et al., 2012; Elizondo-Noriega et al., 2014). Elizondo-Noriega et al. (2014) integrated this iterative process in their entrepreneur thinking model, shown in fig. 2.1. Entrepreneurs will move around the circle many times. Due to mistakes and new knowledge gained, the entrepreneurs might jump back to earlier steps in the circle. If correct information is gathered and perfect timing mastered, the entrepreneur would step through the circle through the ideal path, sequentially.

Through a grounded theorising approach, Liao et al. (2005) analysed data of more than 600 nascent entrepreneurs to discover patterns in their venture creation process. They concluded that the venture gestation “is a complex, non-linear process, in which the developmental
stages are hardly identifiable.” In the process several activities and paths are explored by the entrepreneurs, this is in correspondence with findings of Elizondo-Noriega et al. (2014). In a study on high-technology ventures, Van de Ven et al. (1989) discovered that it takes entrepreneurs almost four years to complete gestation. Across all types of ventures, one fifth of the ventures completed the process in less than a month (Carter et al., 1996). After three years, 90% of the average ventures completed the gestation.

Based on literature, Gartner (1985) defined a framework in which four dimensions describe the new venture creation process. Figure 2.2 depicts the framework in which each dimension influences another. The process described is the most interesting part for this research, it entails the following six activities: 1) locating business opportunity, 2) accumulating resources, 3) market products and services, 4) producing the product, 5) building an organisation, and 6) responding to government and society.

Carter et al. (1996) classified the activities entrepreneurs undertake to establish their business in fourteen classes. The classification includes the following list of activities:

- Organising a team,
- Prepare plan,
- Buying facilities and/or equipment,
- Renting facilities and/or equipment,
- Looking for facilities,
- Investing own money,
- Asking for funding,
- Receiving financial support,
- Developing models,
- Devoted to work full time,
- Applying for licenses and/or patents,
- Forming a legal entity,
- Hiring employees, and
- Saving money to invest.

By tracking twelve entrepreneurs, Mueller et al. (2012) classified the activities in six different subsets. These included 1) type of operation, 2) its function, 3) whether they explored or exploited, 4) whether communication was required, 5) with whom they communicated, and
6) how they communicated. The functions listed by Mueller et al., show the diverse set of functions entrepreneurial activities entail. It includes 1) human resource management, 2) product development, 3) administration, 4) controlling and finance, 5) environmental monitoring, 6) production, 7) business and organisational development, 8) purchasing, and 9) travelling. This classification of activity functions forms the basis for this research. The activity classification will be further discussed in section 4.1.

There are several types of entrepreneurs that perform these activities. The type of entrepreneur that performs the activities is important in order to know how they should be tracked. These entrepreneurial types will be discussed in section 2.2.2.

### 2.2.2. Types of entrepreneurs

The new venture creation process can be defined in several phases, starting with the idea to start a business to the exchange with the market (Gelderen et al., 2005). The scientific definition of the entrepreneur differs for per phase. An overview of these phases, the main concerns per phase, and the scientific definition of the entrepreneur is shown in table 2.1.

<table>
<thead>
<tr>
<th>Phases</th>
<th>First phase</th>
<th>Second phase</th>
<th>Third phase</th>
<th>Fourth phase</th>
</tr>
</thead>
<tbody>
<tr>
<td>Main concern</td>
<td>Develop intention to start a new venture</td>
<td>Recognising opportunity and developing concept</td>
<td>Assembling resources and creating organisation</td>
<td>Exchanging with the market</td>
</tr>
<tr>
<td>Entrepreneur</td>
<td>Potential</td>
<td>Nascent</td>
<td>Starting</td>
<td></td>
</tr>
</tbody>
</table>

Table 2.1.: Definition of the entrepreneur per new venture phase, defined based on phase descriptions of Gelderen et al. (2005)

Aside of these entrepreneur types, each of them can be classified according to the three definitions of entrepreneurs by Ravesteijn and Sjoer (2010). Through empirical analysis it was shown that there exist three types of entrepreneurs, who focus on different aspects and activities throughout their entrepreneurial process. The first type is the classical Schumpet-erian entrepreneur, exploits competition logic to innovate while managing risks (Schumpeter, 1934). The second type is the idealistic entrepreneur defined by Ravesteijn and Sjoer (2010) as the “sustainable techno-innovator”. This entrepreneur focuses on sustainability of the planet, people and its profit. For these entrepreneurs, sustainability is part of the commercial strategy. Right in between these two entrepreneurs the third type of entrepreneur exists. Defined as “the techno-entrepreneur of the future”. This entrepreneur establishes growth and transformation within the existing socio-economic framework.
Students are used as proxy for entrepreneurs in this research to test the methods. As student entrepreneurs might behave differently, where student entrepreneurs originate from are discussed first, followed by discussing the properties of student entrepreneurs and differences compared to academic entrepreneurs. The influences of entrepreneurial courses at universities are discussed, as the participating students are enrolled in courses on creating new ventures. It is important to understand the context the tests operate it in order to justify whether it might have influenced the tests or not.

Students are generally interested in a career as entrepreneur (Sieger et al., 2011). For young people and students, the supportive context is initially created by the background of their family (Aldrich and Cliff, 2003; Laspita et al., 2012). Regional and university contexts play another important role in the decision to start an entrepreneurial career (Geissler et al., 2010). Bergmann et al. (2016) recently published an article about the effects of context on student entrepreneurs, and what exactly influences them to become entrepreneurs. One of the issues they raise is whether the effect of motivating students to become entrepreneurs might have side effects. What if a lot of students get motivated to start, but only those that originally would, will also succeed? In other words, Bergmann et al. question whether the group of student entrepreneurs might be mixed with a group that would fail anyway. Whether this is the case and what different behaviour these groups might show, emphasises the importance of behavioural research on these entrepreneurs.

The field of Entrepreneurship Education and Training (EET) is growing throughout the world at a fast pace (Kuratko, 2005). Von Graevenitz et al. (2010) argued that EET is ranked high on policy agendas in the United Stated of America and Europe. In the last twenty years, the number of courses related to entrepreneurship increased heavily in the European Union (European Commission, 2012). Universities aim to create a supportive context for entrepreneurship by offering these courses, as concluded by Kuratko (2005); Walter et al. (2013); Siegel and Wright (2015); Hoppe (2016). In their research, they showed that the availability of these offerings affect the entrepreneurial intentions of male students. By offering these courses and supporting start-ups through the incubator facilities they offer, universities are more entrepreneurial (Rasmussen and Sorheim, 2006; Soetanto, 2009). Ensley and Hmieleski (2005) argued that how Top Management Teams (TMT) are assessed, monitored, and developed by universities, is a key topic to support the technology transfer process in the long run. Stimulating this transfer process is one of the goals why universities offer EET. Martin et al. (2013) concluded that the value of EET is supported in the context of human capital theory.

Students who use facilities provided by the university to develop products, services, and processes that are marketable can be defined as student entrepreneurs (Mars et al., 2008). Sometimes, students are also referred to as academic entrepreneurs. The most generally accepted definition of academic entrepreneurs entails faculty members who become entre-
preneurs, not students (Bercovitz and Feldman, 2008). Åstebro et al. (2012) stated that a lot of research has been conducted on these academic entrepreneurs, while students create new ventures more often with substantial economic impact.

In other words, student entrepreneurs are a subset of entrepreneurs. They create new ventures just like other entrepreneurs would. Their are limited in their industry experience, but this could just as easily be an advantage to think outside the box. When they just started creating their new venture, like any other entrepreneurs, they are also referred to as nascent entrepreneurs.

**Nascent entrepreneurs**

Carter et al. (1996) defined the nascent entrepreneur as someone who took initial steps to setup their business that is not operational yet. By this definition, the process of students performing their business development steps in a course could be seen as nascent entrepreneurial activities. Gelderen et al. (2005) states that it should be more than just an idea to become an entrepreneur. As shown in table 2.1, they should be busy with, or have completed, the opportunity recognition and business concept development. When nascent entrepreneurs exchange with the market, they become starting entrepreneurs.

Gartner and Shaver (2012) defined nascent entrepreneurs as those who, are “actively in the process of organising a business (alone or with others) and who expected to be an owner of the business being organised”. In these terms, it is the nascent entrepreneur that is most interesting to research. Their activities to create new venture can help others achieve valuable businesses too.

### 2.3. Team work

When a team of entrepreneurs decides to start a new venture, many team work related aspects become relevant to research their activities in the new venture creation process. All activities of the team members are relevant to the process. As are the related processes to coordinate the team to create the venture.

Whether and how entrepreneurs work in teams is researched in this section. The literature is reviewed to show what it focuses on when considering entrepreneurs in teams. This is important to determine what the method should be able to discover, to strengthen this research domain in the future.

How a team operates is related to the leadership style the group adopts. These leadership styles are discussed in section 2.3.1. The leadership styles define a certain aspect of the behaviour of the entrepreneurs and how they work together.

Section 2.3.2 shows how the team diversity can be important aspect for many new ventures. In section 2.3.3, the collaboration processes of entrepreneurial teams are discussed. The latter two sections show current findings that relate it to the performance of the new ventures. This
shows what aspects are important to that research and might be worth tracking with the new method.

2.3.1. Leadership styles

In terms of organisation performance, Ensley and Pearce (2001) showed that the process of thinking at group level in New Venture Top Management Teams (NVTMT) is more important than the outcome of the process. In terms of team performance, Ensley et al. (2003) showed the performance related issues that NVTMT face. They showed that factors such as the limited amount of resources and related time pressure greatly affect team performance.

In 2006, Ensley et al. compared the performances of traditional top-down and shared leadership in NVTMT across a large sample of start-ups through the use of questionnaires. Compared to top-down leadership, robust evidence was found that shared leadership among the NVTMT results in higher start-up performance.

The effects of the leadership style are influenced by the team diversity. Section 2.3.2 will discuss how the diversity affects the team performance and can even affect new venture performance in the long run.

2.3.2. Team diversity

The diversity of the team could be an important factor to succeed. Multiple research studies have been conducted to analyse the relation between the diversity of the team and its performance. Various attributes to define the diversity have been studied.

By analysing Panel Study of Entrepreneurial Dynamics (PSED) data of 816 entrepreneurs, Ruef et al. (2003) showed that teams form with a preference towards the same gender, ethnicity, and occupation. Based on venture capitalist data on ventures seeking capital, Sandberg and Hofer (1987) defined a model in which the new venture performance could be determined as a function of the entrepreneurs attributes, venture strategy, and the industry structure. Roure and Keeley (1990) focused on high potential ventures that are likely to be funded by venture capitalist. In their analysis, they confirmed the existence of the three attributes to describe new-venture performance. However, Chrisman et al. (1998) showed that the three-attribute model should be extended to include the resources and organisational structure to predict new-venture performance more accurately.

In the domain of high-technology ventures, Cooper and Bruno (1977) showed that entrepreneurial teams that had previous experience with the technology and market were more likely to become high-growth firms, than those who did not have this previous experience. These findings were confirmed through the analysis of Roure and Maidique in 1986. By analysing venture capitalist data, Roure and Maidique showed that successful founders had previously worked together and created larger, more complete teams. This matches with the findings of Harrison et al. (2003), they concluded that knowing the team members facilitates
team performance. Chrisman et al. (1998) argued that compared to their previous experience in established firms, the type of problems and decisions while operating a new venture are completely unique. To deal with these problems and decisions, the team cohesion is very important. This was confirmed by Ensley et al. (2002), who argued that the team cohesion of TMT positively relates to new-venture growth.

Davidsson et al. explored whether teams have a higher change to succeed when they have similar (homogeneous) or different (heterogeneous) previous start-up experience, gender, and age. Teams that were heterogeneous in previous start-up experience and age showed a higher likeliness to become profitable (Davidsson et al., 2006; Steffens et al., 2007, 2012).

Earlier research by Davidsson and Honig (2003) showed that entrepreneurs, who are member of a business network, show higher early stage firm performance. Mayer-Haug et al. (2013) concluded that network of the entrepreneurs shows a strong relationship with the profitability of the new venture. Through PSED analysis, Liao and Welsch (2003a) confirmed this as well. They stated that assets embedded in relationships (i.e. social capital) play a significant role in entrepreneurial growth aspirations of nascent entrepreneurs.

While a diverse team might enjoy from these benefits to overcome some issues, it also introduces new ones. According to Ancona and Caldwell (1992), team diversity for product developing teams is not a recipe for success. In order for a team to perform well, it was shown that the variety also poses risks for lower team performance. Divers teams require greater conflict and negotiation skills. Additionally, these teams need to be protected from external politics and should be rewarded for team outcomes. Ancona and Caldwell (2007) continues on this theory by defining the roles that a team requires to function better as a whole. One of the most important roles mentioned by Ancona and Caldwell is the ambassador role. This role protects the team from the external politics involved. During the creation process of the new venture, entrepreneurs are required to focus on many aspects. Entrepreneurs should make sure that the product development team is protected, by taking the ambassador role. The TMT of a new venture need to work closely together to minimise the overhead involved. This strengthens the need for team cohesion.

The need for team diversity is further underlined by Rasmussen et al. (2011). In their research, they discussed the broad set of skills that are required in order to transform an idea into an operational business. Some of these skills can be taught, others need to be acquired by searching for talent. This shows the importance of the team diversity.

2.3.3. Collaboration

Hoegl (2005) analysed the effects of team size on the performance of the team in terms of collaboration, overhead, and cohesion. By analysing 58 software development teams, it was shown that the top teams in terms of teamwork quality were between three and six team members. Through this analysis, Hoegl concluded that small teams are more effective in terms of teamwork quality. In terms of creative processes, when teams need to discuss and elaborate
ideas, collaborative elements are required Drazin et al. (1999); Hoegl and Parboteeah (2007). Whereas teams that develop ideas require less collaborative elements.

When teams are more socially integrated, it showed a positive relation with the performance of the team (Harrison et al., 2002). Harrison et al. (2002); DeMatteo et al. (1998) confirmed that when individual outcomes depend on team performance, the team collaborates more frequently. Related to this, Hackman (2004) stated that when team performance is desired, one should not reward the individual performance of the team members. This is confirmed by Kramer et al., in 2014. They showed that when a team is rewarded for the sum of its effort, the group performance is influenced positively.

Hackman (2004) argued that five enabling conditions are required for teams to work efficiently. First of all, the members of the team should perceive it as a “real team”. The team should have a task with clear boundaries and specified authority to manage their own work. Where team membership is stable over reasonable time. Second, “compelling direction” is required to make sure that the team is heading into the right direction. Teams in creative and innovative domains work best when the goal is set, but the means are not stated. Third, “enabling team structure”, such that the team’s work is experienced as meaningful, they are responsible, and have knowledge of the results to stimulate motivation. Fourth, the team should be in “supportive organisational context” to operate well. Finally, “team composition” in terms of size, backgrounds, and capabilities should be guided to maximise effectiveness. In 2011, Hackman added a sixth condition, being “well-timed team coaching” should be provided.

Through quantitative analysis of Chief Executive Officer (CEO) survey data, Westphal (1999) argues that trust in the boardroom positively relates to the amount of collaboration between the board members. More collaboration inside the team and more control, both independently improved the venture performance.

2.4. Tracking of entrepreneurs

In section 2.1, the activity tracking methods in other domains have been discussed. In this section, the current state of tracking entrepreneurs is discussed. This shows the methods used to research entrepreneurs. It also underlines the need for new methods to research entrepreneurs as events occur. It further researches what requirements need to be met to track the activities of entrepreneurs, forming an answer for question SQ 3.

To better understand the business over time, the PSED was created and conducted frequently by the Entrepreneurial Research Consortium (ERC) since 1995 (Gartner et al., 2004). A lot of research has been conducted through the use of PSED. As discussed by Gartner and Shaver (2012), before the existence of panel studies like PSED, the only way of conducting research on entrepreneurship with a proxy for time was to reflect back on the past. Asking participants to reflect back on a period of time results is a biased view of what happened
for at least four reasons. The first reason being survival bias, as about 50% of the aspiring entrepreneurs fail to create their organisation (Aldrich, 1999). Therefore, research would completely miss half of the entrepreneurs, as they are not present in public records. The second reason is hindsight bias, as discussed in section 1.1. Participants fail to accurately describe the events and judgements made. The knowledge of the final outcome biases their view (Fischhoff, 1975; Wasserman et al., 1991; Cassar and Craig, 2009). As Gartner and Shaver described it, the entrepreneurs who succeeded overestimate the success probability compared to when asked while they are still uncertain about the outcome. Social desirability is the third bias. In retrospective research, the participants might change their view to match what is socially desirable. This is especially the case when the expectations of the research are known to the participants (Edwards, 1957; Jackson and Messick, 1961; Crowne and Marlowe, 1964; Rosenthal, 1966). The fourth bias is that participants might describe their activities in terms that fit to the stereotype definition of the entrepreneurs. Even if that definition is far from accurate. Participants might, therefore, describe their activities in terms of motivated by money and their requirement to be independent (Gartner and Shaver, 2012).

Although PSED tracks entrepreneurs over time, closer to the moment events occurred, it can still be biased for the period it reflects upon. Even the survival bias is still present with PSED, according to Brush et al. (2008). Weick (1995) stated that this is a result of organisational sense-making, in which the interpretation of events that have occurred is re-evaluated to explain certain events and actions, also referred to as “retrospective sense-making”.

One of the topics covered by most entrepreneurial courses is writing the business plan as one of the initial activities to start a new business. Through the use of panel studies, the efficacy of business planning has been researched many times. Although there is no single definition of success for businesses papers, it is interesting to note that the success ratio of business with or without a business plan have shown mixed results (Delmar and Shane, 2003; Shane and Delmar, 2004; Honig and Karlsson, 2004; Liao and Gartner, 2006). Bygrave et al. (2008) concluded that there is not enough evidence to state that writing a business plan results in a better performing business. However, where Gumpert (2003) states that entrepreneurs should stop writing business plans, Bygrave et al. do not want to conclude tossing the business plan right away. Further continuing upon these findings, Honig and Samuelsson (2012) discovered that formal planning and changing the business plan did not correlate with the venture-level performance. They conducted their research by studying 623 nascent entrepreneurs over a period of six years.

The relation between activities and the success of the new venture has been studied several times. Carter et al. (1996) researched the activities of a group of nascent entrepreneurs. The authors conclude that the day-to-day activities of nascent entrepreneurs are important indicators whether their business will succeed or not. Especially those that were more aggressively focused on establishing the company seemed to succeed more frequently. LeBrasseur et al.
(2003) empirically studied 145 start-ups, to determine whether a relation exists between the activities and the amount of sales it generates after two years of being in business. They concluded that the diversity of the pre-start-up activities and the focus on expanding while being operational, resulted in a better revenue model. Liao and Welsch (2003b, 2008) compared technology-based entrepreneurs with those that are not technology-based, focusing on the venture creation process of both. Through analysis of a PSED, they concluded that technology-based entrepreneurs focus more on planning, acquiring resources, and establishing legitimacy. Whereas, non-technology-based entrepreneurs focused more on marketing.

By analysing a similar PSED, Lichtenstein et al. (2007) used complexity theory to show that a few patterns, like the frequency of start-up activities, have a direct positive effect in the emergence of new firms. What kind of activities these nascent entrepreneurs performed was not considered specifically. Newbert (2005) used PSED as its data source as well, to show that there is a specific set of activities that successful entrepreneurs have in common.

Other research that used a form of panel study to determine the productivity of entrepreneurs was conducted by Verheul et al. (2007). They researched the differences between male and female entrepreneurs in the amount of time they spent and how productive they were. The research is limited to the total number of hours they worked, not on the type of activities or whether those activities would be the most productive for their business. The productivity of the entrepreneurs is analysed through the use of utility maximisation on the work effort and outcome (Douglas and Shepherd, 2000, 2002). The data were collected through a detailed panel study on business and policy research.

Gelderen et al. (2005) used data collected by a general public survey of the ERC in 1998. With this data, Gelderen et al. determined whether the entrepreneurs were successful or not in the phase of being a nascent entrepreneur. Nascent entrepreneurs were classified in two categories: high and limited ambition. Those who showed low ambition were found to be more successful when writing a business plan. Whereas when high ambition was discovered, writing the business plan showed a negative relation with the firm performance. At a later stage, writing a business plan was shown to be related to higher probability to success.

On some tasks, entrepreneurs can be seen as the managers of the new venture. In 1973, Mintzberg wrote a book about the time use of executive managers. Through structured observation, Mintzberg showed that there is no pattern in the tasks executed by managers. This contrasts the relation between activities and success discussed before.

In terms of university spin offs, Druilhe (2002) analysed academic spin offs at the Cambridge University at the end of the 20th century. In this research, focus was on academics going entrepreneurial and how proactive mentors helped former researchers transition to entrepreneurs. This allowed Druilhe toanalyse the new venture creation process and track their progress.

Through a longitudinal research, Rasmussen and Borch (2010) discovered that the university context influences the entrepreneurial process differently for specific phases of the
venturing process. Universities can stimulate the venture-creation process by balancing academic and commercial interest, together with the integration of new resources for the new ventures. Based on the results of another longitudinal qualitative research, Rasmussen et al. (2011) showed that it is important to identify who provides the competencies in a team and how these evolve. Rasmussen et al. concluded that universities aim to increase the number of new ventures created, but lack important competencies to achieve that goal. A university spin-off venture requires three competencies to be successful. First competency is referred to as opportunity refinement, being able to discover opportunities in the research domain and refine those into a viable business. Second competency is leveraging, being able to integrate resources required to develop the business. Third competency is championing, being the driving force behind the business.

Through longitudinal research, the activities and phases of entrepreneurs has been researched before. To categorise the main activities of entrepreneurs, Elizondo-Noriega et al. (2014) defined a cyclical model. The model depicts the main activities of entrepreneurship and how entrepreneurs iterate among those. Mueller et al. (2012) tracked a total of twelve entrepreneurs, of which half were in the start-up stage with their business and the other half were in the growth phase. With their research, they showed that some activities are similar in both groups, while other activities differed.

Tracking entrepreneurs has been conducted with different methods. Some of these methods reflect on activities and events after a long period of time. The longer the period takes, the more likely the results could be affected by biases, as argued by Gartner and Shaver (2012). The research discussed in this section, can be used to determine the aspects research considered before. It is shown that the research domain is in need of a new method that is less affected by these biases, while still being able to track the entrepreneurs as they did before.

2.5. Conclusion

Through the literature review, the goal was to determine how activity is tracked in general and what the current research on tracking entrepreneurs shows. It was shown that only limited research is available on the kind of activities that a nascent entrepreneur has to perform throughout its business development. Even less research is available when the scope is limited to technology-based entrepreneurship.

Related to task and activity tracking for both entrepreneurs and in general, different research methods have been found. It was shown that research analysed several aspects of the new venture creation process. These aspects included the type, frequency, order, and amount of activities executed over time. As well as the phases they go through, how much time they spent on their new venture, and how activities differ based on the industry they are in. When the new venture is created by a team, the diversity of the team in terms of
skills, background, and experience has been researched too. The importance of cohesion in
the team and its collaboration processes were also discovered as important indicators for new
venture performance. The conceptual model, depicted in fig. 2.3, shows how these type of
analyses can be executed with the new tracking methods. The model will be used in the
design of new methods in this research, as further discussed in section 3.1.

In these previous research studies, the methods used to track entrepreneurs suffer from
four types of biases, as discussed in section 2.4. The research often used methods to reflect
on the past, making it susceptible to 1) survival, 2) hindsight, 3) social desirability, and 4)
stereotype biases. The need for a method that is able to track entrepreneurs, while minimising
the influences of these biases, clearly exists.

It was shown that the effect of EET is positive towards the sharing of knowledge through
entrepreneurs. Among other experiences and resources, this educational material is also
influenced by the research on entrepreneurs. Next to entrepreneurial coaching offered by
incubators and universities, entrepreneurs learn many of their skills by doing. It would,
therefore, also help universities and future entrepreneurs if their process is mapped while it
progresses. By discussing the type of entrepreneurs and what influences them, it was shown
that student entrepreneurs can be used as a proxy to study the business creation process of
nascent entrepreneurs.

The process of creating new ventures is executed by nascent entrepreneurs. In order to
define a method that tracks these entrepreneurs, the activities and phases they go through
have been analysed. For the nascent entrepreneurs, the model of Elizondo-Noriega et al.
(2014), shown in fig. 2.1 and further discussed in section 2.2.1, plays an important role in the
new methods to determine the phases they go through. This answers question SQ 1.

Several classifications of the activities of entrepreneurs coexist. To track the activities of
the nascent entrepreneurs consistently, the activities classified by Mueller et al. (2012) will
be used. Answering question SQ 2, this classification includes the following nine functions of
activities:

- human resource management,
- product development,
- administration,
- controlling and finance,
- environmental monitoring,
- production,
- business and organisational development,
- purchasing, and
- travelling.

These phases and activities form the basis for the classification of the methods, these will be
further discussed in section 4.1.
Research papers

Ancona and Caldwell (1992)
Rasmussen et al. (2011),
and thirteen other papers

Ensley et al. (2002, 2006),
Westpal (1999),
and six other papers

Mintzberg (1979),
Liao and Welsch (2003b, 2008),
Mueller et al. (2012),
Elizondo-Noriega et al. (2014),
Carter et al. (1996),
LeBrasseur et al. (2003),
Newbert (2005),
Gelderen et al. (2005),
and twelve other papers

Carter et al. (1996) and
Lichtenstein et al. (2007)

Mueller et al. (2012),
Elizondo-Noriega et al. (2014),
and twelve other papers

Verheul et al. (2007)

Team diversity
Collaboration
Activity analysis
Frequency of activities
Phase analysis
Time spent

Person
Activity
When
Phase
Duration

Figure 2.3.: The conceptual model, based on the literature review.

Shows the research linked to specific type of analyses and what attributes should be tracked in order to support that type of research with the new methods.
When new ventures are created by a team of entrepreneurs, different aspects were discussed as interesting and some were shown related to venture performance. To take these team aspects into account while tracking their process, research on the team diversity, leadership styles, and collaboration effects has been included in the review too. The team aspects describe how to analyse questions SQ 5 to 7 later on. The individual and team aspects form the basis of the activity-tracking model, as is described in section 4.2.

The limited amount of research on the activities of entrepreneurs, and the possibly biased data the conclusions are built upon, emphasises the need for a method to track entrepreneur activities. In chapter 3, an outline is given of the different approaches to track the activity of entrepreneurs.
3. Methods for task and activity tracking

Multiple research methods exist, each with its own advantages and disadvantages. In this chapter, several methods will be considered by analysing to what extent they are suitable to track the tasks and activities of entrepreneurs. First, section 3.1 will discuss what is required of these methods and why. These requirements answer question SQ 3. Followed by the methods that have been considered, in sections 3.2 to 3.8. In section 3.9, a comparison is given of these methods, summarising which requirements they match and which not. Concluded will be which methods fit best and whether those need further modifications. The findings and conclusions in this chapter lay the basis to answer question SQ 4.

3.1. Requirements

Based on the literature review covered in chapter 2, this section specifies what the method should be able to do in order to track tasks and activities of entrepreneurs. The requirements are listed using the MoSCoW prioritisation technique (Clegg and Barker, 1994). Each priority level has its own section and reference numbers, such that the distinction between the priorities is clear. Sections 3.1.1 to 3.1.4 outline the requirements.

3.1.1. Must have requirements (MRs)

To repeat the objective defined in section 1.3, the goal is to define a method that will enable tracking what tasks and activities nascent entrepreneurs work on in their business creation process. Therefore, at the bare minimum the method must meet these requirements:

MR 1. The method **must** be able to identify what tasks and activities a team of entrepreneurs worked on over a period of time.

As discussed in section 2.4, current research is limited to multiple forms of biases (Aldrich, 1999). The social desirability and stereotype biases are important to keep in mind when the method is tested. Current research methods are limited by survival, hindsight, social desirability, and stereotype biases. Therefore, to add value this results in the must have requirements (MRs) 2 to 5:

MR 2. The method **must not** suffer from survival bias.
MR 3. The method must not suffer from hindsight bias.

MR 4. The method must not suffer from social desirability bias.

MR 5. The method must not suffer from stereotype bias.

When researching the tasks and activities of entrepreneurs, the method must be location independent. Otherwise, it would be biased by measuring only tasks and activities in a certain environment, while the entrepreneurs can work on other tasks and activities outside of it too. This forms the sixth MR:

MR 6. The method must be location independent.

While the entrepreneurs are observed, they should be able to continue as if they were not. The method should be as noninvasive as possible. If it affects their behaviour, it would not be suitable to track the tasks and activities of entrepreneurs. This is the seventh MR:

MR 7. The method must not limit the work of the entrepreneurs.

In case the method is limiting who could participate, for example due to language or technical reasons, it should be able to work for the majority of the group. Leading to the eighth MR:

MR 8. The method must work for the majority of the entrepreneurs.

When the participants are asked to contribute for a longer period of time, the method should take the initiative to keep the participants on board. For example, when they had weekend and completely forgot about the research, it should invite the participants to contribute if that is required. This results in the ninth MR:

MR 9. If the method requires participants to contribute, it must be able to invite them to do so.

3.1.2. Should have requirements (SRs)

In total, there are thirteen should-have requirements. How tasks and activities are related to each other adds more detail about the process. In order to determine how they are related, required for the first should have requirement (SR) is that:
SR 1. The method should be able to identify what tasks and activities were worked on per day.

Section 2.2.1 showed that only few definitions of the tasks and activities of nascent entrepreneurs have been found. Therefore, it is important that the method is as resilient as possible, in other words this leads to SR 2:

SR 2. The method should be able to track tasks and activities that were not known to occur upfront.

The effect of social desirability bias could affect the behaviour of participants when monitored. Although the participants might become aware of their behaviour over time. The fact that they are researched should not affect their decisions, the third SR is:

SR 3. The method should not influence the decision making of the participants.

Some new ventures are created by entrepreneurs who operate in a team. To research the dynamics inside the team, the fourth SR is that:

SR 4. The method should be able to identify who worked on the activity.

Previous research has found no pattern in the new venture creation process Reynolds and Miller (1992); Reynolds and White (1993); Gartner and Shaver (2012). In order to track for patterns, it is best to track multiple new venture teams at the same time. So that the phase and environment the new ventures operate in is as equal as possible. In order to facilitate this, the fifth SR is that:

SR 5. The method should be able to track multiple teams concurrently.

Whether someone will participate in a research study, and for how long, depends on many aspects. One of them is the amount of time it takes to participate. A few minutes per day should be the maximum amount of time it should take. This results in the sixth SR:

SR 6. The time required by participants of the method should be limited to a few minutes per day.

While creating their new venture, the entrepreneur will go through several phases. Using a classification that is based upon Elizondo-Noriega et al. (2014), it should be able to identify which phases. This results in the seventh SR:
SR 7. The method should be able to track what phases the entrepreneur has been through.

Based on the literature review, a total of six different analysis categories were identified, as concluded in section 2.5. Whether these analyses can be performed based on the reported data of a method, is to be defined in trial runs with the selected methods. Translating the ability to perform these analyses in requirements, the requirements SR 8 to 13, and CR 4 are formed. These analysis can only be performed if the required attribute data is available. The relation between the requirements that state what data should be present and how it relates to the analyses is shown in fig. 3.1. When multiple requirements are listed, such as with the activity and when attributes, the could have requirements (CRs) increase the accuracy or resolution only. They are not absolutely necessary to perform the requirements that are dependent upon that attribute.

![Figure 3.1.: Analyses requirements from literature.](image)

Through the literature review, six analysis categories were identified in section 2.5. Based on fig. 2.3, this depicts how these are translated to requirements and what other requirements they depend on. In the case of the activity and when attributes, the list of requirements include CRs. These are not necessarily required, but do increase the accuracy or resolution of the attribute.

When a team is creating a new venture, literature showed that the diversity of the team can be an indicator to its performance. This results in the eighth SR:
SR 8. The method should be able to analyse the diversity of the team in terms of who spent time on certain tasks and activities mostly.

To create their new venture, some activities require the team to collaborate. Literature showed that collaboration processes are related to the team cohesion. When team cohesion is high, the performance of the team is also shown to be higher. Written as a requirement, it results in the ninth SR:

SR 9. The method should be able to analyse whether team members worked on the same task or activity at a given moment.

A lot of literature researched the tasks and activities of entrepreneurs during the creation of a new venture. There are different types of analyses that are interested in the activities of the entrepreneurs: Written into three requirements, it leads to the tenth, eleventh, and twelfth SR:

SR 10. The method should be able to analyse what activities were worked on during the period researched.

SR 11. The method should be able to analyse in broad terms what order the activities were performed.

SR 12. The method should be able to analyse the frequency an entrepreneur worked on different activities.

Throughout the new venture creation process, the entrepreneurs will work on different phases. Literature showed that these phases each have their own characteristics, even showing different patterns in tasks and activities. Written as a requirement, it results in the thirteenth and last SR:

SR 13. The method should be able to analyse what phases the entrepreneur has been through.

3.1.3. Could have requirements (CRs)

There are four could-have requirements. Being able to research what main tasks and activities were worked on first per day increases the resolution to research task and activity dependencies. Therefore, the first CR is that:

CR 1. The method could be able to identify order in the main tasks and activities
worked on per day.

Comparing how much time someone spends on a specific task with someone else is hardly insightful. If their skills are different, one might spend significantly less time, but achieve a better result. However, the amount of time spent on a task or activity does say something about the priority related to other tasks he or she could have worked on. If the second SR could be met that would give additional insights:

CR 2. The method could be able to identify how long the entrepreneur spent on the main tasks and activities per day.

Researching patterns and behaviour at a larger skill would eliminate the influence of outliers. Therefore, the method should handle large scale research studies well. In other words, when studying twice as many participants, the amount of researcher time or researchers required to study them should be less than double. This leads to the third CR:

CR 3. The method could scale well.

Continued upon the analysis requirements depicted in fig. 3.1, the last type of analysis depends on CR 2. The productivity or efficiency of the entrepreneurs has been researched by other researchers too. The literature review showed how the time spent by entrepreneurs was required to research this. Written as a requirement, it results in the fourth and final CR:

CR 4. The method could be able to analyse how much time the entrepreneurs spent on their new venture.

3.1.4. Would be nice to have requirements (WRs)

Originally the MoSCoW prioritisation method named the last category “won’t”. Clegg and Barker defined it to indicate would not have these requirements in the first release. To avoid confusion, it was chosen to name these requirements would like to have. Clearly, they are not the priority in the definition of the new method, but it would be nice if these requirements could be met. There are two would be nice to have requirements (WRs) in this research.

Tracking at what time an entrepreneur worked on a certain task or activity might give insights in their typical working day. If data reports are available from multiple entrepreneurs that form a team together, it might also show who worked together at the same time. Therefore, the first WR is:

WR 1. The method would be able to identify at what time the entrepreneur worked on a task or activity.
As discussed in section 2.2, nascent entrepreneurs are mainly focused on creating their business. While researching their process is interesting, it should not become a burden to be part of the research. Otherwise, the entrepreneurs might decide to drop out before any conclusive results have been found. This results in the second WR:

WR 2. The method would not require any time or effort from the participants to participate.

3.2. Archived data

Using archived data is a common way to research a very broad range of domains. There are three ways to perform data collection using this method (van der Velde et al., 2004). Analysis using 1) statistical or written records, 2) archived documents, or 3) through meta-analysis.

If a resource of archived entrepreneur diaries would be available, the analysis of these would be an option to consider. Unfortunately, no such archive exists.

Through meta-analysis, other research data can be aggregated to conclude how entrepreneurs spent their time. However, as is discussed in sections 2.2 and 2.4, the current research is subject to four forms of biases (Gartner and Shaver, 2012). Therefore, this option cannot be considered, as it does not meet the requirements MR 2 to 5.

3.3. Observation

Observing the entrepreneurs while they create their new venture provides several benefits. As van der Velde et al. (2004, p. 99) argued that this method is suitable when “investigat[ing] the complex interactions between people and the actual behaviour of people in organisations in situations where the respondents do not know exactly what they do or how they do something.”

Through observation, tasks can be identified carefully. It allows to adapt the definitions of what these tasks and activities could be (MR 1) and since recording happens while events occur, it does not suffer from the four biases (MR 2 to 5).

However, it does fail to meet one major requirement. It is location dependent (MR 6), as the observers will need to travel with the team. Therefore, either the team will need to work together on predetermined work places, or there need to be as many observers as entrepreneurs in the team, to observe everyone of them. The first option would seriously affect their decision making and their way of working (SR 3 and MR 7). Whereas, the last option would not scale well (CR 3).
3.4. Interviews

By interviewing the new venture teams, the researchers could ask what the main tasks and activities have been that they worked on in a certain period of time. Best would be to do this at a very regular schedule, where the period between two interviews would be so small that the hindsight bias (MR 3) has no effect. Since interviewing involves someone asking questions, the person might be more inclined to answer socially desirable or to according to their idea of what the stereotype entrepreneur would do, making it hard to meet MR 4 and 5.

However, this would require a lot of time of the participants (SR 6) and the researchers (CR 3). When the interval requirement is relaxed, the entrepreneurs should remember what they did for a longer period of time. As discussed in section 2.4, the longer the period is that they need to recall, the less accurate it will be.

3.5. Diary method

The main purpose of the diary method is to investigate patterns of certain phenomena as they occur, while participants can continue with their daily lives (Ludwig et al., 2016).

In their analysis on diary studies, Wheeler and Reis (1991) classified the studies in three categories. The first category is the interval-contingent protocol, in which participants need to report at predetermined, regular intervals. These interval reports can be from once per day (Kahneman et al., 2004) to multiple throughout the day (Rieman, 1993). The second category is the signal-contingent protocol, in these studies participants need to report when signalled. The signalling could be on a fixed schedule, random, or based on the occurrence of certain conditions. The last category is the event-contingent protocol, with this protocol participants need to report when a certain event occurred. These last two categories can also be described as experience-sampling method (ESM). Since it requires a different approach and results in different data these will be covered in section 3.6.

A disadvantage of the diary method (DM) is the fact that it can be a time-consuming method to both participants and researchers (Wheeler and Reis, 1991). This could lead to missed samples, in which the participants failed to record a sample while they should. Bolger et al. (2003) stated that since participants are responsible for reporting data, they should be more motivated and involved. A risk they mentioned of this method, is that of habituation. The participants report the same data, even when changes worthwhile to report have occurred. Related to this risk, it is important that participants completely understand the protocol (Reis and Gable, 2000). Their inputs are not valid when they do not understand what they are supposed to do or how they should answer these questions. Wheeler and Reis (1991) argued that self-report studies have the risk in which participants become aware of their behaviour. Their behaviour could therefore be interpreted from different perspectives and might even affect their behaviour over time. However, in a study by Litt et al. (1998) it
was shown that although participants became more aware, it did not change their behaviour. For the purpose of tracking tasks and activities of entrepreneurs using this method. The DM will be set to report once at the end of the day. The questionnaire will ask the participants what major tasks and activities they have worked on that day and how long. The time frame is limited to one day in order to diminish the impact of the hindsight bias.

With these goals set, the method is not able to identify the time when they worked on a task or activity (CR 1 and WR 1).

Whether this method would be able to track the majority of the entrepreneurs (MR 8), depends on the software. Using the mobile phones of the entrepreneurs, the research could remind them to fill in their diary. For the majority to have access to it, it should run on the majority of mobile phone operating systems. At the moment of writing, 99% of consumer mobile phones run Android or iOS (Forni and van der Meulen, 2016). In order to reach the majority of consumers, a mobile application should therefore be able to operate on these two operating systems.

Through careful analysis of more than twenty available software packages, it is concluded that only one application is able to run on both platforms at the moment. This application is called Paco.

3.6. Experience-sampling method

As discussed in section 3.5, this method is actually a subset of the DM. Regarding the purpose, its data and design require a different approach, it is covered in this section separately.

The experience-sampling method (ESM) allows the research to capture experiences as it occurs in the context of the participant’s everyday life (Christensen et al., 2003). ESM asks the participant to fill in a small questionnaire at a certain interval. The interval can be fixed, at random moments throughout the day or in response to certain events (Barrett and Barrett, 2000).

The main benefit of the ESM is its ability to capture events as close to the occurrence as possible. Developed in the psychology research domain, its goals are to capture thoughts, feelings, and events as they occur. The ESM can be configured so that participants can submit self reports too. With these self reports, changes would be registered that otherwise would go unnoticed. The idea of setting up a certain schedule in the ESM is to retrieve enough data over a longer period of time without bothering the participants too much.

At first introduction, the method was described as a self-report method, sampling the participants using a paper form (Reis and Wheeler, 1991). In 2000, Barrett and Barrett made an enormous contribution to the research field by developing the first mobile application that followed the principals of ESM. Their application, named Experience Sampling Program (ESP), was written for handheld devices pinging the user at specified or random intervals asking them to fill in a brief survey.
According to Kahneman et al. (2004), since ESM samples throughout the day, it puts an extra burden on the participants in which it interrupts their workflow. Since this influences their workflow a bit, it has an impact on requirement MR 7. However, it is assumed that by reducing the amount of time required, the interruptions will not affect their workflow much.

The risks and disadvantages mentioned on the DM (see section 3.5), apply to the ESM too.

In order to compare the methods, the ESM will sample the entrepreneurs a few times a day. When the participant is sampled, they will be presented a question form of one question. Asking them what they are working on at that moment. The form is limited to one question to make sure that the research takes only a few seconds to complete.

With these goals set, the method would not be able to identify how long the participant worked on a task or activity (CR 2). Like the DM, the ESM can also be conducted with the use of Paco. Therefore, meeting requirement MR 8.

3.7. Calendar method

Shown by Dugan et al. (2012), the calendar is a rich resource that holds a lot of information about the tasks and activities scheduled. By instructing the participants to enter tasks and activities as they work on those, the data sets could give a realistic view of what he or she worked on (MR 1, SR 1, 2 and 4, CR 1 and 2, and WR 1).

There are two issues with this method. First, it requires the participants to actively add tasks and activities to their calendar for it to work. Second, and more important issue, is that when they forget to do so. The method is not able to notify them (MR 9) and gives an incorrect overview of the tasks done.

3.8. Time-tracker method

Through the use of a time-tracker application, the amount of time spent on predefined tasks and activities could be tracked. Every participant would need to start the time tracker as soon as they work on something and stop it afterwards.

Through the use of existing software, both the entrepreneurs and researchers can get more insights on their time use at the same time. Unfortunately, most time-tracking software that allows to work in teams is either expensive or limited in its features. It requires tremendous effort of the participants, therefore it does not meet MR 7. The ability to notify participants to contribute (MR 9) is another requirement that is not met.
3.9. Conclusion

An overview of the requirements which the methods match is given in table 3.1. Only two methods meet the must-have requirements. These are the diary (DM) and experience-sampling methods (ESM). Both methods have been used to track thoughts, feelings, and events in the domain of psychology research. As discussed in each of the methods sections (see sections 3.5 and 3.6 respectively), the methods need to be adapted in order to work for task and activity tracking. Originally, the methods have been designed to register the experiences and events in psychology research. By tailoring the methods to raise questions about the tasks and activities, and configuring their logic according to workday schedules, they are made usable to track entrepreneurs.

Both methods have their advantages and disadvantages. The DM would only interrupt the entrepreneurs once a day. Whereas, the ESM would allow sampling throughout the day. As the ESM asks about what the participant is working on at that moment, it will not be influenced by any recall bias. It is impossible to deduce what method would work best with the entrepreneurs without measuring them. Seven of the requirements (SR 8 to 13, and CR 4), require the methods to be tested in the field to determine whether they are met or not. These requirements are marked with question marks in table 3.1. As discussed in section 1.4, the methods will be tested in quasi-natural experiments. Both methods will be compared with each other in the remainder of this research. Chapter 4 discusses how the methods collect data and how they are put to the test.
### Table 3.1.: Overview of methods and which requirements they meet.

The highlighted columns show the two methods that have been selected. These are the diary (DM) and experience-sampling methods (ESM). The question marks refer to requirements that require further tests to determine if they are met. These tests will be performed with the selected methods in research A and B, discussed in chapter 4.

<table>
<thead>
<tr>
<th>Req.</th>
<th>Archive</th>
<th>Observ.</th>
<th>Interv.</th>
<th>DM</th>
<th>ESM</th>
<th>Calendar</th>
<th>Time</th>
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<tr>
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<td>Yes</td>
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</tbody>
</table>
4. Data collection

In section 3.9, the diary (DM) and experience-sampling methods (ESM) were picked as most suitable methods. The methods will need to be adapted and set-up to track the tasks and activities of the entrepreneurs. To start, a classification will be defined in section 4.1 to get consistent measurements with the methods. What is going to be tracked, how, and why is discussed in the activity-tracking model in section 4.2. The data gathered by the methods will be structured and analysed with a new software application, this application and its capabilities are discussed in section 4.3. The validity of the methods and mitigations taken to reduce errors are explained in section 4.4. Followed upon this, to determine the value of the method and its abilities, it is tested in two research trials.

How the first trial (research A) is setup and going to be tested is discussed in section 4.5. The goal of research A is to discover what methods are able to analyse based on the phase and activity data gathered, answering question SQ 5. Specifically, it needs to test whether the SR 10 to 13 and CR 4 are met by the methods.

Based on the experiences gained in the first trial, a second trial (research B) is conducted. This latter research, tests whether the methods are able to analyse the team diversity (SR 8) and whether collaboration took place (SR 9), answering questions SQ 6 and 7 respectively. How this is research is going to be conducted is outlined in section 4.6. The actual results and analysis of both research trials will be discussed in chapter 5.

This chapter will answer question SQ 4 by defining how to test and setup the methods. Once both research trials finished, how the participants experienced the research will be validated, answering question SQ 8. Section 4.7 will discuss how this is going to be measured. Concluding, section 4.8 will discuss the data collection goals and how further analysis is performed.

4.1. Classification

With both methods it is possible to raise open and multiple-choice questions. One could conduct a research asking the entrepreneurs to fill in what they have been busy with in plain English. Through analysis of the answers, a classification scheme can be defined. This classification allows the researchers to aggregate the data afterwards. However, in order for this to work correctly, the entrepreneurs will need to be instructed how to describe their tasks and activities.
A solution would be to use a small group of entrepreneurs to verify or classify their actions. Enabling the use of the classification to conduct the research using multiple-choice questions. The entrepreneurs will need to be instructed how to classify their tasks and should understand the definitions correctly.

4.1.1. Tasks and activities

To aggregate and correlate the data, it needs to be classified as well. It is important that the classification matches the tasks and activities completely. Each task or activity should match to one, and only one, class.

To classify the tasks and activities, the literature review showed that such a classification exists. Based on the research of Mueller et al. (2012), the activities of the entrepreneurs are categorised into the following options:

- Product development
- Marketing or public relations (PR)
- Sales
- Business and organisational development
- Managing employees
- Administration, controlling and finance
- Travelling
- Other

Another category was added to indicate that the entrepreneur is not working on their business at the moment. With these categories, the tasks and activities of the entrepreneurs can be classified.

4.1.2. Phases

Elizondo-Noriega et al. (2014) determined the several phases in which activities of entrepreneurs can be categorised. The categories were outlined in their entrepreneurship and innovation process model. The model is depicted in fig. 2.1. Based on this model, the following list of phases was defined:

- Contextualising - identification of opportunities
- Contextualising - planification
- Exploring
- Reflecting
- Generating
- Validating - Prototyping and design
- Validating - Client interaction
- Validating - Business model first approach
- Validating - Minimum Viable Product
- Validating - Pilot test with metrics
- Validating - Analysis of pilot test
4.1.3. Observation unit

Each participant will report their activities and phases individually. In case a new venture is created by a single entrepreneur, this returns the required data to perform the analysis completely.

When the new venture is created by a team, the team is in the process of creating the new venture. All activities and phases of the team as a whole are of interest to analyse the process. The individual data need to be aggregated to analyse it on a team level. In research A and B, all new ventures are created by teams of three to five student entrepreneurs.

Figure 4.1 shows how the data of two entrepreneurs is aggregated. The figure shows the reported activities on a timeline. Where the colour of the circles depicts the class of the activity that was reported. Entrepreneur 1 is responsible for all yellow tasks. Whereas, entrepreneur 2 is responsible for all green tasks instead. One could say that these are the specialisations of the teams. Based on this concept, the specialisation and diversity of the team will be determined in research B (section 4.6). Both work on blue, red, and brown tasks. Sometimes, they work together on blue and brown tasks. This is depicted by the line between the two entrepreneurs. In research B, this will be determined based on the timing of the reports. If both entrepreneurs report the same activity class that day, it is assumed that they worked together. The process to create the new venture for this team, includes all activities and phases of entrepreneur 1 and 2.

![Timeline diagram]

Figure 4.1.: By aggregating the individual data reports of the team members, analysis can be conducted at team level.

4.2. Activity-tracking model

Since the two methods have different requirements and possible outcomes, they will both be discussed in their own section.
4.2.1. Diary method

The goal of the diary method is to ask the entrepreneurs at the end of the day what they have been busy with that day. The activity and phase options are multiple-choice questions, where the entrepreneur can select one of the options. The options that are listed follow the classification specification as described in section 4.1.

The assumption is made that an entrepreneur only works on two major tasks or activities on a single day. This assumption allows for a simple questionnaire where the entrepreneurs only need to state what their two major tasks and activities have been. For each of those, the questionnaire will ask them in what phase the task or activity and how long they worked on it. To verify whether the assumption was correct, it asks how much time was spent on other business related activities.

Figure 4.2 depicts the activity-tracking model. Since the model depends on the entrepreneur to report their tasks and activities, the participation is most important. When they participate, it enables analysis of who (person), did what (activity, phase), for how long (duration), and at what moment (when). Combining the data from multiple team members allows analysis of the collaboration processes in the team. It might give insight into the stages at which the new venture is operating.

Whether one task may or must start after another is deductible by combining the data of which activities were worked on and when. When combining the data of the team members, it could be shown who is specialised in certain tasks. The specialisations of the people in the team could show the diversity of the team.

![Activity-tracking model](image)

Figure 4.2.: Diary method: Activity-tracking model

4.2.2. Experience-sampling method

For the ESM, the goal is to ask the entrepreneurs at random intervals throughout the day what they are working on. Since entrepreneurs are able to work any time and when they want, no fixed schedule can be set. The best option would be to randomly schedule pings throughout the day. As it is random, the timing of the pings could be inconvenient, for
example during lunch. It is not possible to estimate these breaks and exclude them, as each might have their own schedule.

At each ping, the entrepreneur is offered a single question survey. In this survey, the entrepreneur can choose what type of task or activity he or she is working on. It was chosen to leave out other interesting questions such as the phase and duration of the task. The main reason for this decision is the argument of Kahneman et al. (2004), where they state that the workflow interruptions put extra burden upon the participants. By minimising the number of questions the questionnaire could be experienced less burdensome.

The activity-tracking model for ESM is shown in fig. 4.3. The model is dependent on the level of participation of the entrepreneurs. Therefore the participation is the first block drawn in the model. In the case that they participated, it allows analysis of who (person), did what (activity), at what time (when). Together with the data of the other team members, whether collaboration took place or not might be deductible.

Like with the DM, the task dependencies, different specialisations of team members, and team diversity can be determined.

![Activity-tracking model](image)

Figure 4.3.: Experience-sampling method: Activity-tracking model

### 4.3. Analysis software and reports

The data would be gathered by the survey application Paco. This application allows to survey participants randomly or at fixed time slots each day. Since the application runs on the smartphone of the participants, it can notify the participants directly when it is time to report what they are working on. Researchers are able to specify the questions and logic of the questionnaire upfront.

The data gathered by Paco, is made available in the form of a set of records. Where each record stores when it was submitted and what the participant answered on the questions asked.

Without further processing, the data collected by Paco would be of little use. Therefore, the analysis software was developed to parse and gather all data from these separate records. While parsing the data, it validates the answers. For example, making sure that no participant would report that they worked more than 24 hours that day. It ensured that the questions were present and that users would be able to correct their answers by reporting another time
shortly after their earlier (incorrect) report. The software makes near real-time analysis of
the data possible. It was able to generate reports on all participants, a specific team or
class, as well as individual participants. The analyses in chapter 5 are all based on the data
gathered with this software.

To stimulate the participants to contribute, their individual reports will be made available
to them. Each participant is able to see his or her own report when they login on the website.
To remind students that these reports were made available, a summary of the report with a
link to the full report were sent to the participants by email.

As argued by Bolger et al. (2003), the motivation and involvement of the participants is
important for both methods. The reports were generated based on the findings of Dugan et al.
(2012). Dugan et al. showed that providing insightful reports to the participants motivated
them to contribute more frequently. The data gathered, could help the entrepreneurs keep
track of what projects they worked on and for how long. It could be interesting for the
entrepreneurs to see what decisions they were overthinking or to keep a diary of the period.

On the same website, the participants would also be able to find the manual to participate.
This allows them to read the instructions at their own convenience and troubleshoot
when they encounter issues. Writing a manual for the participants is discussed to be an
important step in conducting a DM or ESM research (Christensen et al., 2003). The website
also provided the opportunity for the participants to get in contact for further questions or
assistance.

4.4. Validity and mitigations

Every research is as strong as the foundation it is based upon. To make sure the research
will be conducted with the least amount of errors, the mitigation plans for the errors that are
likely to happen have been written upfront. The validity of this research is divided into four
segments, being the 1) statistical conclusion validity (what can be concluded statistically, see
section 4.4.1), 2) internal validity (related to internal effects, see section 4.4.2), 3) external
validity (related to external effects, see section 4.4.3), and 4) construct validity (is the method
measuring what it intends to, see section 4.4.4).

4.4.1. Statistical conclusion validity

This applies when a causal relation is researched. Specifically, it tests whether there is a
relation between the IV and dependent variable (DV), and whether that relation is signifi-
cant (Meyer, 1995). In order to determine the causal relation between activities and for
example the new venture performance, a large sample is required to ensure that activity
patterns are significantly present. In other words, only some outliers might deviate from
the pattern, the majority, however, should follow the same pattern in order to be able to
state anything about its relation with the performance. The goal of this research is not to
determine whether these patterns are significant. It is to determine whether the methods are able to detect such patterns. If this is the case, follow-up research might use a larger sample size to detect the relationships between patterns and its outcomes.

4.4.2. Internal validity

The internal validity concerns effects of the research itself that might affect the results. Based upon the internal validity definitions of Campbell (1957); Cook and Campbell (1979); Meyer (1995), it is discussed per type of internal validity check in the following list.

**Omitted variables** Whether the methods missed any tasks or activities that are important depends on the type of research that is conducted. For example, to determine the different tasks and activities worked on by the entrepreneur for a given period of time, it needs to have the highest resolution that is still feasible to achieve. In its current design for research A, the research measures once a day using the DM, asking the participants about their two major activities that day. While the ESM polls twice a day to determine the activity that is ongoing at that specific moment. Whether the participants are able to remember what they worked on is important for the DM. While the frequency of ESM and its configured timing mainly defines whether the method will be able to measure all activities during that day.

**Trends in outcome** When the outcome of the methods are the recorded set of activities, they could be affected by trends including the passage of time. For example, the entrepreneurs might be busy with their administration and finance mostly a few times per year, when they are required to submit tax reports. This might affect the patterns detected. Since the new ventures tested in these research trials are not registered yet, the estimated effect of these two examples is probably non-existent. However, the fact that they attend to a course on creating new ventures would likely affect the activities across the groups. Whether this is the case will be discussed further in section 6.1.

**Misspecified variances** This would occur if incorrect variance selection would be applied. Whether this is the case depends on the type of patterns that are detected. For example, certain patterns might only show up for a specific industry. This is not a threat to this research, as no statements about causal relations are formed.

**Mismeasurement** This would occur if the definitions variate over time. In a sense, this is a dangerous threat to this research. The students are asked to define what activities they have been working on. As the strength of this research is as strong as their level of understanding of these activities, additional mitigations have been implemented to ensure consistent outcome over time. During the introduction presentation, students were presented the list of activity options. In class 1, the definition list was formalised after one week, in which the students were asked to reflect on the list whether the
tasks and activities have been clear. From the start, the list of activities included a formal definition and an explanation of the activities specifically. Whether the list was clear for these students has been tested in the survey after the research was over. Options that overlap are another risk to take into account. When these are present, the participants might choose a different value, making it harder to detect patterns and compare the activities and phases over time. The results showed that the students agreed the definition was clearly defined and non-overlapping. The results of the survey are further discussed in section 5.3..

**Political economy** When changes are applied in the legal foundation for ventures, it might affect their activities as well. This is a threat to take into account when specifically looking at the patterns across companies. None of the students that participated in the experiments have set-up their new venture. Since the goal of the experiments is to test the ability to detect patterns, not to compare the patterns between the new ventures, the effect of these changes are not considered a threat to this research.

**Simultaneity** When multiple variables are used to detect their patterns the simultaneity could become a threat. In this research, the phases and activities are tracked using the DM. Certain activities might only occur within specific phases. Therefore, the patterns detected for these two types could be similar. This is not a threat specifically, as both are individually interesting to analyse. The relation between activities and phases is a pattern researched by previous research and shown of interest (Elizondo-Noriega et al., 2014). See section 2.2.1 for further research on this relation.

**Selection** In research A and B, the groups have been selected as they enrolled to the new venture creation courses. The teams inside these classes, have been formed by the lecturers based on their background. The goal of this selection is to create diverse teams. The fact that these teams have been selected by the lecturer to be diverse in terms of their background could be a threat to this research. Maybe this diversity affects their activities and team processes. When looked at the selection of the classes, the fact that these are students and time was given during the lectures to address the research could have affected their motivation to participate. The courses could also have affected the activities and phases they register, as they are guided to create their new venture with these lectures. Further effects of this selection have been discussed in section 5.4.

**Attrition** The strength of the measurements depends on the level of participation. Over time, some might stop to report their activities for different reasons. The cause of these effects is important to analyse, this will be further discussed in section 5.4. To mitigate this, reports will be sent to the individual participants to show what patterns exist in their data. These reports are further discussed in section 4.3.
Mitigation steps applied for measurement, process, and non-response errors are further discussed in the following three sections.

**Measurement errors**

Participants are asked to report the data using the DM and ESM methods. A measurement error would occur if participants do not fully understand the questions, or do not know how to answer them correctly.

To mitigate this problem, the activity classification has been discussed upfront with the lecturers of the course. Clarifications were made, to make sure that students who were not familiar with the terms would also know what was expected. During the introduction presentation of the research, the activities were discussed with the students. No issues were raised at the time of presenting and discussing the research.

After one week, the students were asked whether everything was clear and if they had further questions.

**Process errors**

These would occur when the data would be processed incorrectly. Since reports are handled digitally, this is mitigated by writing tests that verify every transition between different formats. In order to analyse the data from Paco, the data were converted to business logic. Using explicit requirement validations and input/output verification tests, all process errors have been mitigated.

**Non-response errors**

There are two types of non-response errors:

First being unit based, in which the participants stopped to report. If this results from a technical problem, it needs to be investigated. In order to do so, students were asked regularly why they stopped responding. In case they found the research too intrusive or had other issues why they could not contribute, they were asked to mention that in the review survey at the end of the research period.

Second type is item based, in which the participants did not submit a particular item. This was mitigated by making sure that all input was validated and certain questions were made obligatory.

**4.4.3. External validity**

The external validity is related to the selected group of participants and its contexts. These threats to the validity influence whether the findings can be generalised or not. Threats to the external validity can be split into three categories according to Cook and Campbell (1979). These include the 1) selection, 2) environment, and 3) history interaction.
**Selection interaction** This becomes a threat when the population selected is not a representative proxy for entrepreneurs. The students selected to participate in the research all participate in courses on creating new ventures. As discussed in section 1.4, the fact that these students work on their business ideas with the goal of creating a new venture, they are by definition student entrepreneurs. The process they are in makes them part of the nascent entrepreneurs group, as defined in section 2.2.2. It could be that these students show different behaviour than non-student entrepreneurs would. No causal relation is concluded by this research to generalise their activities with the outcome. If in further research findings would be generalised to all entrepreneurs, the sample population needs to include different type of entrepreneurs as well.

**Environment interaction** The environment the entrepreneurs operate in could affect their activities. For this research, it is not an issue as discussed in the previous discussion on the selection interaction. With further research, the environment of the entrepreneurs needs to be diverse to limit the impact of this threat.

**History interaction** Certain activities might only occur in a specific time frame. The other courses in which the students participate might influence their behaviour. For example, whether the students participate in the research could depend on the workload they experience from these other courses. When they are preparing for an exam, their participation levels might drop, limiting the ability to distinguish what they are working on specifically.

4.4.4. **Construct validity**

The validity of the construct is important to validate. The phases and activities measured by the methods should be valid according to the literature. To ensure this, the methods have been designed to use the research of Elizondo-Noriega et al. (2014) and Mueller et al. (2012) to classify the phases and activities respectively. The classification is further discussed in section 4.1.

The participants record their phases and activities. Therefore, it is important to ensure that they have a correct and unified view on the options which they can choose from. As mentioned earlier in the mismeasurement threat to internal validity, the phases and activities were clarified to ensure this. Furthermore, whether the participants understood the definitions correctly was validated through the questionnaire. Whether the definitions overlap is important to validate too. When they would overlap, it could be that one group answered the first option, while the other group answered the second option. Making it hard to determine that the pattern holds for both groups. As discussed in section 5.3, the results of the questionnaire show that the definitions were clear and non-overlapping.

The phase and activity analyses have shown to match with the expected behaviour according to the literature, as is shown in sections 5.1.2 and 5.1.3. Whether the participants agree
with the results has been measured as well. Through the use of the questionnaire on their experiences, one of the questions asked whether they thought the reported analyses reflected their behaviour correctly. The majority answered that this was the case.

Another issue that is important to validate is whether the method affected how the participants spent their time. With the same questionnaire, the majority of the participants reported that they did not think it affected them. These results are further discussed in section 5.3.

4.5. Research A

The intention of this research is to analyse whether the methods are capable of tracking the tasks and activities of students that are working on their business creation course. During the course, the students need to perform all steps, as if they were making their new venture investor ready. From customer recognition to writing their business plan, the steps simulate a business creation process.

The goal of research A is to test the analysis capabilities of the methods when tracking students for a period of eight weeks. Determining whether the methods are helpful to perform four type of analysis classes, as depicted in fig. 4.4. These analyses focus on the phases, activities, and total time spent by the individual entrepreneurs and the team as a whole. More specifically, these include analysing what tasks and activities were reported (SR 10) and in what order (SR 11). It also includes analysing the frequency of the activities (SR 12), what phases they passed through (SR 13), and how much time they spent (CR 4). What attributes are required, how they relate to the analyses, and what literature used these analyses is shown in fig. 4.4.

By testing the methods in the field, the requirements SR 10 to 12 are tested for both methods. Additionally, the DM method will be tested whether it meets the requirements SR 13 and CR 4. These last two requirements are not tested with ESM, as the phases and duration of activities are not tracked by this method. This field-test will discover what the methods are able to analyse, thereby it answers question SQ 5.

Through discussions with the lecturers of the course, the following assumption was made: During the business creation courses, the students work on at most two major tasks or activity categories per day. The number of pings was limited to two per day, so that it would not interrupt the students too much. Especially since the goal of this research was to track their tasks and activities over a period of eight weeks. Two reports per day could show these different activities when the random notifications pop-up at the right times. It could also show the minor activities which the DM method would otherwise miss. Furthermore, having two notifications per day would cover the event that the student missed the first notification.

The phases and activities are collected by the two methods independently. Using the DM, the students were asked to report what their major activities have been during that day.
These questions were sent to the students at the end of their working days, around half past seven in the evening. To minimise the interruption of possible dinner plans or other evening schedules, the students were able to change the time if necessary.

With the use of the ESM, the students were notified twice a day to report on their activities. These pings were randomly distributed throughout the day between 10 AM and 6 PM. The only requirement was that the second ping should be at least 2.5 hours later than the first ping.

Both methods would notify the students on weekdays only. The students were also able to report manually (self-report) using the application. The students were instructed to submit a self-report when they were working on tasks in the weekends or evenings. In the case of the DM, only the last report would be taken into account. In case they made an error they could submit it again to correct it. With the ESM, students were able to submit additional reports this way.

To keep the students more involved and motivated, they were told upfront that their data would be reported back to them in individual reports. All data were processed anonymously, no reports about the activities or lack thereof would be reported to the teachers. However, since the survey application (Paco) required users to register with a Google Account, there would always be some identifier that linked the data to an email address. To ensure anonymity, the students were instructed to create a temporary email address. The trial would run for a couple of months to analyse their progress.
4.5.1. Groups

The research trial was performed within two classes in the Delft University of Technology. Both classes were third year bachelor students working on their minor in the area of entrepreneurship. The students were instructed to answer all questions honestly.

The first group (class 1) were students who were enrolled in the Med-Tech Entrepreneurship (MTE) course. This class was divided into twelve teams of three to four students each. As their course started one week earlier than the second group, this group was used to test the process for one week. After this first week, the feedback on the research was gathered team-by-team. Feedback was gathered such as whether the students understood what was meant by the activities. Additionally, it gave the opportunity to discuss the motivation of the groups and solve technical difficulties if these were present. With the feedback, some minor changes were made to the research. For example, due to a configuration error, the students were asked what they did during the weekend. This was corrected to weekdays only.

The student who were enrolled in the Technology-Based Entrepreneurship (TBE) course formed the second group (class 2). This group was divided into eight teams of four students each, and one team of five students. This group started exactly one week later than the first group. All feedback from the first group was processed by the time the second group started.

4.5.2. Timeline

For the first class, the trial started on the 14th of September, 2016. The second class started one week later, on the 21st of September, 2016. For both classes it ended on the 5th of November, 2016. How both methods are tested and with which classes is depicted in fig. 4.5.

4.5.3. Activities and phases

The classification of the activities and phases is based upon the classification as presented in section 4.1. To make sure that the activities would fit the tasks related to the business creation courses, the activities and phases were agreed with the lecturers upfront. The courses on entrepreneurship and managing their business were new to most of the students. Therefore, the list of activities they could choose from was clarified before hand.

At the start of the research, the descriptions of the type of activities they could choose from was presented in class. The students of class 1 had the opportunity to try out the research for one week before the list would be finalised. Through a team-by-team discussion with the students, it was found that these descriptions were clearly defined and understood.

The clarified activity classifications given to the students:

- Not business related
- Product development (problem definition, opportunity framework, value proposition, etc)
Figure 4.5.: Timeline of research A.

Showing that both DM and ESM are tested and that class 1 and 2 both participate. The research period started on Wednesday, 14th of September 2016, and ended on Friday, 5th of November, 2016. Class 2 started on Wednesday, 21st of September, 2016. The weekends are depicted with a lighter colour, as notifications were sent on weekdays only. The participants were asked to report manually, if they worked in the evening or weekend.

- Marketing or public relations (generating publicity, customer discovery and segmentation)
- Sales (calling/visiting (potential) customers)
- Business and organisational development (who are my partners, competitor analysis, forming legal entity)
- Managing employees (who do we need, who does what)
- Administration, controlling and finance (cash-flow activities)
- Travelling
- Other (business related)

The phases of the activities were also clarified. The definition list agreed upon by the students:

- Contextualising - identification of opportunities (problem identification)
- Contextualising - planification (problem delimitation)
- Exploring (search into)
- Reflecting (retrospect)
- Generating (developing solution)
- Validating (design, implementation, confirmation)
  - Prototyping and design
  - Client interaction
  - Business model first approach
4.6. Research B

During meetings with participants, it became clear that the students were working on other tasks and activities than they were able to submit in the research. This resulted in a high dropout rate of the students in the research.

To make sure that the activity-tracking model would be tested to its full extent, this second research was scheduled. This research focuses on the team diversity (question SQ 6 and SR 8) and team collaboration data (question SQ 7 and SR 9). What attributes are required, how they relate to the analyses, and what literature used these analyses is shown in fig. 4.6. With this field-test, the requirements SR 8 and 9 are tested for both methods.

The teams were instructed to contribute for a brief period of five working days. Like in the first research, the DM was configured to collect the major two tasks each workday. Whereas the ESM was configured differently. Due to the briefness of this research, it was set to notify the students three times per day to get more insights on what they are doing. In the event that students work in the weekends or evenings too, they were instructed to report these manually too.

4.6.1. Groups

This trial was performed by the students of the Technology-Based Entrepreneurship minor of the Delft University of Technology. The group was part of research A too. Some of the students missed the presentation of research A, therefore the instructions were repeated and clarified where necessary. To make sure that more data would be available, the participation in the research was made obligatory. The students were instructed to answer honestly, only their participation rate would be made known to the teachers this time. This is important to ensure that the data are not influenced by the fact that participation is made obligatory.
4.6.2. Timeline

The research started on the 10th of November, 2016. It ended when the mid-term presentations were scheduled, on the 17th of November, 2016. All data reports were gathered between these dates. The timeline on which both methods are tested is depicted in fig. 4.5.

![Timeline of research B.](image)

Figure 4.7.: Timeline of research B.
Showing that both DM and ESM are tested and that only class 2 participates. The weekend is depicted with a lighter colour, as notifications were sent on weekdays only. The participants were asked to report manually, if they worked in the evening or weekend.

4.6.3. Activities

The activities in this research were closely matched to the tasks that the students needed to perform during a short period. The students had one week to finish all their tasks in order to present for the jury. What they were supposed to deliver was known upfront, the activities were clarified based on the deliverables of the mid-term presentations. The activity list was verified with the lecturer of the course upfront.

The activity classifications given to the students:

- I did not work on the mid-term at all
- Develop market segmentations
- Identify beachhead market
- Building end-user profile
- Calculate total addressable market
- Profile persona
- Develop life cycle use case
- Detailed product specification
- Quantify value proposition
• Compare to competition
• Edit or record video
• Develop presentation
• Other (mid-term related)

Due to the briefness of the research period, the phases were not considered relevant. Since they would not provide any relevant information in a period of one week.

4.7. Experience

As discussed in sections 3.5 and 3.6, both methods have their own advantages and disadvantages. One of the major issues raised with both methods is the time it consumes (Wheeler and Reis, 1991). If it would consume too much time, it will definitely have an impact on the participation rate.

To answer question SQ 8, the experience of the participating users needs to be researched. The research will be conducted in the form of a questionnaire. Van der Velde et al. (2004) defined the questionnaire method as ideal for personal questions, as its respondents feel more anonymous than with other methods. How the students of class 1 and 2 experienced the research will be surveyed using this questionnaire.

The questionnaire will be handed out on paper, such that the students that were not able to participate due to technical limitations are also included in this research. When the questionnaire is handed out, it is important to mention that the data is handled with great care. The reason why personal details are asked is to link the survey data back to the original research data of each participant. Once the link has been established, both the survey, as well as the data obtained through the methods, will be anonymized.

Automated recognition software was used to define the questionnaire. This reduces the time required to input all survey forms. The resulting questionnaire is shown in chapter D.

4.7.1. Questions

The questionnaire first asks about the personal details, previous work experience. It then continues with statement questions to determine their experience on the methods, the survey application (Paco), and the research in general. These questions are defined in the form of statements. Which participants can agree or disagree with on a seven-point likert scale. A value of one would indicate the participant fully agrees. Seven indicates they fully disagree. The questionnaire ends by asking about the level of collaboration per activity, as well as the dependencies between these activity classes.

Personal details

The personal details will be collected to link the survey data back to the other research data. This includes asking about the team they are in, to analyse the data on a team level as well.
Previous experience

Next, several questions about the experience of the students with entrepreneurship will be raised. In the literature it was found that teams with higher levels of entrepreneurial experience, have a higher probability to succeed. When the team members have a lot of experience working in teams, especially together in the same formation, the team is more efficient at the start. Whether this is the case is questioned in this part.

Samples throughout the day (ESM)

The first method questioned about is also the first method they got in touch with. Being the ESM, where random notifications asked the participants about their activity at that moment. The six aspects that are analysed include 1) how time consuming it was, 2) whether the pings interrupted their focus, 3) whether they noticed pings quickly, 4) whether pings arrived on convenient times, 5) whether they were able to find the activity in the list often, and 6) whether the activity classes were clearly defined. Statement 1 and 2 were added to check what the impact of the method would be for the participants.

End of the day survey (DM)

Separately, the DM questioned what two major activities the participants worked on each day. For this method, four statements analysed 1) how time consuming it was, 2) whether they knew at the end of the day what they did, 3) whether the major activities were listed as options, and 4) whether they worked on more tasks than they were able to report. Statement 2 in this list was added to determine the impact of the hindsight bias in their experience. While statement 4 checks whether the assumption that they would work on two activities per day was correct.

Reports

To motivate the students, reports with details about their individual phases, activities, and other insights gained based on their reports were sent to them. To check whether the reports were considered useful, three statements are added. These include 1) the reports motivate to contribute, 2) when data would be made available in real-time, it would motivate more, and 3) the reports showed a correct overview of the time spent. What could be changed to the reports was asked as an open question as well.

Survey application Paco

For both methods, the Paco survey application was used. Like with the methods, how using the application was experienced is important to research. A negative experience with the survey application would greatly affect the results of both methods. The five statements
about Paco are: 1) the app is easy to install, 2) I experienced no issues with the app, 3) pings arrived every workday, 4) the app was easy to use, and 5) issues with the app made me stop. What could be improved in the app was raised as an open question.

**Research in general**

About the research trials in general, five statements check how it was perceived in a general sense. The statements are: 1) the research instructions were clear, 2) tracking time made me aware of what I did, 3) by registering, I changed what I spent time on, 4) I felt watched, 5) my privacy was well protected. Statements 2 and 3 check what the experienced impact of tracking is on their real time use. What reason they quit eventually, how long it took per week, and what could be improved on the research were questioned as open questions.

**Collaboration**

Whether the team collaborated and how much should also be determined by the survey. On a seven-point likert scale, the participants were asked whether they collaborated on the task classifications and to what degree. Where 1 resembles no collaboration, worked on by this participant completely. At the other end, 7 states that someone else worked on the activity instead. All the values in between show the degree that this participant worked together with someone else.

**Task dependencies**

Whether the sequentialness of tasks can be determined from the data is verified by the last question. In a matrix, where the rows and columns list the activity classes, the participants are asked to mark the dependencies between the classes if present.

**4.7.2. Conclusion**

With a questionnaire, the experience of the participants is researched to answer question SQ 8. The questionnaire was handed out on paper to include all students in this research. If students would not be able to respond due to issues with the survey application (Paco), these reasons will also appear in this survey. The questionnaire will be handed-out to both classes after research period B is over.

**4.8. Conclusion**

The classification defined is required to get an overview of the tasks of the participating users and to compare the methods with each other. The classification defined eleven phases and eight activity classes of the business creation process.
The activity-tracking model specified the data that gets tracked and how they relate to each other. Participation of the entrepreneurs is required in order to get the reports in the first place. With the DM, the reports allow reasoning about what phases the major activities took place on a day, by whom and for how long exactly. The ESM takes a different approach by samples randomly throughout the day. Showing what activities were worked on, by whom, at what time. By aggregating the data, the task dependencies, specialisations of the team members, and whether collaboration took place can be determined with both methods.

Data will be gathered with the use of the questionnaire application Paco. The application will notify and collect reports from the participants directly on their smartphone. The data is aggregated and analysed by a newly developed framework. With the use of the framework, near real-time analysis can be performed on the data reports. The analyses performed with this framework will be used to generate reports. The participating users are motivated through reports about their behaviour. The goal of these reports is to achieve a high participation level to get more data throughout the research. This is one of the mitigations discussed to deal with problems and errors in the research.

To test the methods and to answer question SQ 4, how the research is going to be conducted is outlined. The research is split into two trial runs. Both of these runs are performed with students in new venture creation courses. Based on literature, it is assumed that the activities of the students is similar to that of entrepreneurs.

The first trial run, research A, tracks the student entrepreneurs over a longer period of time. Goal of this research is to determine what insights the methods found on the participation, phases, and activities. It describes how question SQ 5 is going to be answered. Whether the methods are able to perform analysis on the activities (SR 10 to 12), the phases (SR 13) and the amount of time entrepreneurs spend on their startup (CR 4) is field-tested in this research.

The second trial run, research B, requires a higher level of participation by the users. With consistent data reports of the team members, diversity in the team (SR 8) and whether collaboration took place (SR 9) can be determined. The definition of this research enables answering questions SQ 6 and 7.

To answer question SQ 8, a survey is defined to determine how the methods were experienced by the participants. The data collection methods allow further analysis of the methods with actual research data. The goal is to research what the methods are able to determine. Not to base any conclusion on the patterns it shows by itself. To be able to do that, a much larger research will need to be performed. The data analysis allows comparison of both methods. Determining whether the methods are suitable to track the activities of entrepreneurs. The data and analyses will be presented and discussed in chapter 5.
5. Data analysis and discussion

The focus of the research in general is to determine how to track the activities of entrepreneurs who are in the business creation process. Two methods have been proposed in chapter 3. The data that has been gathered with trial runs as outlined in chapter 4. In this chapter the data are analysed and discussed.

With the proposed new methods, it is important to determine what insights each method can discover. Throughout this chapter, the methods will be compared and reviewed. The results of these analyses answer question SQ 5.

It is important to note that the goal of this research is to determine the method and the analysis it enables. Since the sample size of the research is too small, no conclusions can be drawn on the behaviour of the entrepreneurs who are being researched. The results and insights are discussed to compare the methods with each other, not to analyse the entrepreneurs.

The first research (A) was conducted over a period of eight weeks. In this research, the focus is on the individual and team participation, phases, and activities. The results of this research will be discussed in section 5.1.

The second research (B) was more intense and took five days. By making the research obligatory, the higher level of participation would give more insights into teams. This was required to determine the diversity and collaboration processes in the team. With the analysis of research B, questions SQ 6 and 7 are answered. The insights and results of this research will be discussed in section 5.2.

The participants were asked to fill in a questionnaire at the end of the research. The focus of this survey was to determine how the participants experienced both research methods, hereby answering question SQ 8. The results of this survey are discussed in section 5.3.

Based on all of the results together, conclusions are drawn in section 5.5.

5.1. Research A

Research A is the first research trial run to test the two proposed methods over a period of eight weeks. The focus of this research is to determine what insights both methods can find on the individual participant data and when a group of team members is analysed.

As discussed in section 4.5, the participants of this research are students from two business creation courses. In this research, students were asked to join the research voluntarily. Each
participating student will be testing both methods (DM and ESM) simultaneously. Throughout the day, the ESM will notify the participant twice, surveying what they are working on at that moment. While the DM will notify the student at the end of the day, raising questions about the major two activities they worked on that day. The goal of research A is to determine what the methods are able to analyse based on the participation, phase, and activity data of the entrepreneurs, thereby forming an answer to question SQ 5. Whether both methods are able to analyse what activities the entrepreneurs worked on (SR 10), in what order (SR 11), and with what frequency (SR 12) is tested. The DM method is also configured to question the participants about the phases and duration of the tasks they performed. Whether the DM is able to analyse the phases the entrepreneurs go through (SR 13), and how much time they spend on their new venture (CR 4) is tested too.

The participation level of the users with both methods is discussed in section 5.1.1. Section 5.1.2 discusses the insights the DM showed on the phases of the new venture creation activities. The tasks and activities detected by both methods are compared with each other in section 5.1.3. Analysing how much time is spent is covered in section 5.1.4. The conclusion on the findings are written in section 5.1.5.

5.1.1. Participation

The level of participation is important in order to get a clear overview of the period researched. Therefore, the participation scores of both methods are compared to each other to see with which method participation was highest.

In terms of participation of the users, the participation levels per individual user are discussed first. From this data, a user is selected for further discussions in the next sections on the phases and activities of that user. Next, the participation per team is discussed. A team will be selected with which further team-level analyses can be conducted. The overall participation is compared between the two methods last.

Participation of individual users

The DM was set-up to collect a report about the two major activities the users worked on that day. The top-20 participating users with the DM is shown in table 5.1. The table shows the user that participated the most in the first row at the top. The first column (ID) references the identifier of each user. The second column (Class) states in which class the student participated. Class 1 is the MTE course, this started on the 14th of September (week 37). The other class is the TBE course, this started on the 21st of September (week 38). All columns that follow indicate the participation score in percentage of the user. To achieve 100%, the user must report once per weekday since the date joined. The first week they joined cannot be compared with other users completely for this reason. If one user joined on Friday, one report would equal 100% for that week. Any week after that is comparable.
What stands-out from the data, is the fact that most users originate from the class 1 (MTE). Only one user of class 2 ranks among the top 20 by contributing for five weeks. All his or her fellow class members contributed significantly less. Class 1 was involved in a test trial of one week. After the first week, the level of understanding and participation of the groups was verified through separate team discussions. Another insightful point to mention, is the fact that the participation scores are higher in week 38, compared to week 37. Some of the participants that were not able to join earlier were convinced to help out when talked to individually. A small group of users experienced issues with installing the application, all of these issues were resolved by troubleshooting during those meetings. This might have resulted in a higher participation score of class 1 compared to the class 2.

Table 5.2 shows a similar structured table, instead focusing on the top-20 participating users with the ESM. As explained in section 4.5, the ESM pinged users twice a day to ask what they were working on at that moment. A user was considered fully participating in ESM research when they reported at least once. The fact that they report once shows a lot of insights into their activities. Whether the added value of the second report is equal to the first report is up for discussion. A single report was therefore considered just as valuable as two reports in this overview.

The data shows the same differences between the two classes. The top two students of class 2 in the DM methods also show up in the ESM top-20. Fourteen out of seventeen class 1 students appear in both top-20 lists notified to participate at two random moments between 10 AM and 6 PM.

On average, the top-20 users participated 4.4 weeks per person with the ESM. The top-20 users participated 3.9 weeks per person with the DM.

An example user was selected for further discussions on the phases, tasks and activities on an individual level. The selected user is highlighted in tables 5.1 and 5.2. This user was selected since seven weeks of data are available with both methods. A user was selected that was not the top performing participant. This choice was made deliberately, as this would show what kind of data are available in a more realistic setting.

### Participation of teams

Which users were in a team was determined when the research was over. A list of the teams was retrieved from the course lecturers. Since all data collected through Paco was linked to anonymous Google Accounts, the data had to be linked back to teams separately. Through a survey, students were requested to state the Google Account they used and which team they are part of. For most of the participant data it was able to determine what team they belonged to. However, not all participants of the research were present at the time of the survey. Some participants participated in the survey, but left the team or Google Account questions blank. In some cases the student number allowed to trace back who belonged to which team. Unfortunately, not all data could be linked back to the correct teams.
Table 5.3 shows all the teams that participated in the DM research. The team names are shown in the first column. To anonymize the team names, random letters have been assigned as their unique identifiers. The first digit in the team name shows which class the team belonged to. For example, 2T was a team part of class 2 (TBE). The table is sorted on these anonymized team names.

The users who could not be placed in teams correctly were placed in a left-over group. These are indicated as LO* in the table. Based on the date they joined, the users were linked to the left-over group of their specific class. For those users who joined at a very late stage in the research, even the class could not be determined. Therefore, a third left-over group shows the participation scores separately.

The second column shows the original team size in number of persons, as reported by the overview of the lecturers. The number of users who joined and could be placed in their corresponding teams is shown in the third column. The columns that follow are the total average participation scores per week. The average participation score of a team is determined by taking the total participation score of all team members that joined, divided by the real size of the team. In other words, if a team originally has four team members, but only three joined the research, the maximum participation score for that team is 75%.

Since the participation of the users influences that of the groups, it is logical that the same class differences can be found here too. In the DM data, eight teams of class 1 participated for four or more weeks. Whereas, only one team in class 2 participated that long.

In the same structure, table 5.4 shows the participation data of the teams using the ESM. The participation score of the teams is an aggregated form of the individual user data. Showing similar patterns in the overview for teams.

Team 1D has been selected as the example team for the data analysis of the phases and activity data. There are several teams that have a higher participation rate than this team. However, in team 1D, all three participants have participated for several weeks. This team contributed enough data to show interesting patterns. More data would further strengthen the analysis, but would not made it easier to discuss the insights discovered with the methods. This team would more realistically depict the insights available among most of the teams, instead of only the top one.

**Participation overall**

The overall participation of the users is depicted in fig. 5.1. The graph on DM participation (fig. 5.1a) shows the total average participation of all users per week. The score per week is determined on the set of users that joined in that week or earlier. The participation score is deduced by taking the average participation score over these users per week.

By cross-referencing the graph with the data of table 5.3, it is visible that even though the participation of class 1 increased in week 38 and continued in week 39. The total average in the graph drops due to the fact that the participants of class 2 did not participate a lot.
The ESM averages shown in fig. 5.1b are split into three lines. The line labelled ‘twice’ is showing the percentage of users that participated twice a day. The ‘once’ line shows the percentage of users that participated just once a day. The total line takes these two percentages together, such that it is comparable with the DM graph.

By cross-referencing the graphs of both methods in fig. 5.1, the same pattern is visible with exception for week 42. The difference between the graphs is related to the fact that ESM participation’s scores are generally higher than those of the DM.

![Graphs showing participation (%) per method per week.](image-url)
Table 5.1.: Top 20 user participation (%) with diary method (DM) per week.
The table is sorted on average participation using the DM, in descending order. Users were notified to participate in the evening once a day. Participation of a user is 100% if the user reported once every workday, since the date they first participated in the research. The data of the example user are highlighted.

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Table 5.2.: Top 20 user participation (%) with experience-sampling method (ESM) per week.
The table is sorted on average participation using the ESM, in descending order. Users were notified to participate at two random moments between 10 AM and 6 PM. Participation of a user is 100% if the user reported at least once every workday, since the date they first participated in the research. The data of the example user are highlighted.

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<td>1</td>
<td>100.0</td>
</tr>
<tr>
<td>5</td>
<td>1</td>
<td>66.6</td>
</tr>
<tr>
<td>50</td>
<td>1</td>
<td>100.0</td>
</tr>
<tr>
<td>25</td>
<td>1</td>
<td>0.0</td>
</tr>
<tr>
<td>19</td>
<td>2</td>
<td>0.0</td>
</tr>
<tr>
<td>9</td>
<td>1</td>
<td>0.0</td>
</tr>
<tr>
<td>52</td>
<td>1</td>
<td>100.0</td>
</tr>
<tr>
<td>29</td>
<td>1</td>
<td>100.0</td>
</tr>
<tr>
<td>24</td>
<td>1</td>
<td>0.0</td>
</tr>
</tbody>
</table>
Table 5.3.: Participation (%) per team with the diary method (DM) per week.

The table is sorted on the anonymized name of teams, in ascending order. LO* is the left-over group of participants who's team could not be determined. The data of the example team are highlighted.

<table>
<thead>
<tr>
<th>Week</th>
<th>Weeks</th>
<th>Team</th>
<th>Size</th>
<th>Joined</th>
</tr>
</thead>
<tbody>
<tr>
<td>1A</td>
<td>33.3</td>
<td>77.7</td>
<td>66.7</td>
<td>0.0</td>
</tr>
<tr>
<td>1B</td>
<td>33.3</td>
<td>77.8</td>
<td>66.7</td>
<td>0.0</td>
</tr>
<tr>
<td>1C</td>
<td>33.3</td>
<td>77.8</td>
<td>66.7</td>
<td>0.0</td>
</tr>
<tr>
<td>1D</td>
<td>33.3</td>
<td>77.8</td>
<td>66.7</td>
<td>0.0</td>
</tr>
</tbody>
</table>

Table 5.4.: Participation (%) per team with the experience-sampling method (ESM) per week.

The table is sorted on the anonymized name of teams, in ascending order. LO* is the left-over group of participants who's team could not be determined. The data of the example team are highlighted.

<table>
<thead>
<tr>
<th>Week</th>
<th>Weeks</th>
<th>Team</th>
<th>Size</th>
<th>Joined</th>
</tr>
</thead>
<tbody>
<tr>
<td>1A</td>
<td>33.3</td>
<td>77.7</td>
<td>66.7</td>
<td>0.0</td>
</tr>
<tr>
<td>1B</td>
<td>33.3</td>
<td>77.8</td>
<td>66.7</td>
<td>0.0</td>
</tr>
<tr>
<td>1C</td>
<td>33.3</td>
<td>77.8</td>
<td>66.7</td>
<td>0.0</td>
</tr>
<tr>
<td>1D</td>
<td>33.3</td>
<td>77.8</td>
<td>66.7</td>
<td>0.0</td>
</tr>
</tbody>
</table>
5.1.2. Phases

In the list of end-of-the-day questions, the phase of each major task was surveyed. In order to keep the interruptions caused by the ESM as brief as possible, the question ESM would ask would be what activity they were working on at that moment. It was decided that the phases would only be reported using the DM.

Whether the DM is able to analyse what phases the entrepreneurs or the team of entrepreneurs have been through is determined, verifying whether DM meets SR 13. Figure 5.2 shows the attributes that are required to perform this analysis.

First the phases of one individual are shown. After this analysis, the available phase data of teams are analysed. For both of these analyses, the data and insights are discussed.

![Figure 5.2.: Phase analysis goal of research A.](image)

Phases of participants

The phases reported by the example user are depicted in fig. 5.3a. The graph shows the many different phases the user worked on over time. As discussed in section 4.1, the list of phases was defined in accordance with the article of Elizondo-Noriega et al. (2014). The order of the phases in the legend of fig. 5.3a is equal to the order described in the article. Interesting to see, is that the user almost exactly followed the path as described in the literature. Figure 5.3b shows the mapping of the phase data on the entrepreneurship and innovation process model of Elizondo-Noriega et al. (2014). As shown in the path, when the user reached the exploration phase, he or she most likely discovered an issue. The user jumped back to identify new opportunities (Contextualising / Identification) and continued his or her path exactly as predicted by Elizondo-Noriega et al.. Since the research was conducted over a period of two months, the path stops in the validation, prototyping and design phase.

With this analysis, the DM is shown capable of analysing the individual phase path, thereby meeting requirement SR 13.
Figure 5.3.: Diary method: Path based on reported phases of user 3 over time, on the model adapted from Elizondo-Noriega et al. (2014).

The user starts in the identification of opportunities phase, after which he or she goes through the following eight identified phases: 1) general planification, 2) knowing the customer, user, and industry, 3) back to identification of opportunities, 4) general planification, 5) knowing the customer, user, and industry, 6) empathy to find big problems, 7) formulating solutions, and 8) prototyping and design.

See section 2.2.1, p. 18, for a detailed explanation of the model of Elizondo-Noriega et al. (2014).
Phases of teams

The amount of hours worked per phase by team 1D is shown in fig. 5.4a. The data of the three team members are summarised into one graph. What can be seen in the graph is that this team started to the point the solution was formalised. Most likely they ran into an issue, moving them back to identification and exploring.

Figure 5.4b shows the exact phases of the team in more detail. Each of the group members has its own arrow inside the model of Elizondo-Noriega et al.. Users 18 and 20 follow a path that is almost identical. In the last step user 20 ends with considering other opportunities. While user 18 is exploring the options instead. Unfortunately, user 62 submitted phase data for one week only. Therefore, the path of that user is only depicted in one step.

In this team, each user follows an almost similar path. One would almost suggest that the path of the team can be determined based on the input of one individual. Whether this is the case requires further analysis with a larger sample. The DM proofed capable of determining the path of the team based on their individual reported phases. Therefore, the DM completely meets SR 13.
The whole team started with the identification of opportunities, after which each followed a nearly identical path. User 18 proceeded to four different phases: 1) knowing the customer, user, and industry, 2) formulating solutions, 3) back to general planification, and 4) knowing the customer, user, and industry once more. User 20 walked through five different phases: 1) knowing the customer, user, and industry, 2) general planification, 3) formulating solutions, 4) back to general planification, and 5) back to the identification of opportunities. User 62 from the start it followed the path to 1) knowing the customer, user, and industry. After which he or she stopped reporting phases.

Figure 5.4.: Diary method: Path based on reported phases of team 1D over time, on the model adapted from Elizondo-Noriega et al. (2014).
5.1.3. Task and activity categories

The tasks and activities of each entrepreneur were tracked using both methods. The methods are tested in their ability to analyse what activities took place (SR 10), in what order (SR 11), and with what frequency (SR 12). The data attributes that are required to perform these analyses are depicted in fig. 5.5.

This section will first discuss the insights based on data of individual users. Followed by an analysis of the data available when looking at a complete team.

![Figure 5.5.: Task and activity analysis goals of research A.](image)

### Activities of individual users

The DM tracked the time spent on the major two tasks of the day. Additionally, it tracked how much time the participants spent on other tasks. The graph depicted in fig. 5.6 shows how many hours user 3 reported per category over a period of seven weeks. User 3 worked on **product development** most of the time since the start. When the **business development**, **finance and administration** tasks were taking place, considerably less time was spent on the **product development**. Based on the individual data, the graph shows that the DM is able to analyse what activities were undertaken, in what order, and how often. Thereby, the DM meets requirements SR 10 to 12 for individual participants. The resolution of DM to detect the order and frequency of the activities is one per day. It is impossible to determine whether the primary or secondary activity reported occurred first or not.

The ESM identified the categories worked on by sampling twice a day at random times. The graph of the number of samples showed similar results compared to DM. Instead, the ESM method shows that the **sales** task has been reported 76
three times. Most likely, this has been a minor task during the day and is therefore captured inside the other tasks combined classification of the DM data.

Another interesting thing to look at is the ratio hours per sample for the major categories across the two methods. This ratio is shown in the last column of table 5.5. The number of hours per sample fluctuates too much to conclude anything. When the research would be performed at a larger scale, the ratios might be determined more exactly.

The ESM meets requirements SR 10 to 12 too. Compared to DM, ESM has a higher resolution to detect the order of activities and the frequency at which different activities are undertaken. The resolution for ESM is as high as the number of samples it records per day. In this research, this is set to two, making it twice as accurate to DM.

<table>
<thead>
<tr>
<th>Activity category</th>
<th>Hours (DM)</th>
<th>Samples (ESM)</th>
<th>Hours per sample</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not business related</td>
<td>21x*</td>
<td>17x</td>
<td>4.5 h/x</td>
</tr>
<tr>
<td>Product development</td>
<td>36h</td>
<td>8x</td>
<td>4.5 h/x</td>
</tr>
<tr>
<td>Marketing / PR</td>
<td>3h</td>
<td>1x</td>
<td>3 h/x</td>
</tr>
<tr>
<td>Sales</td>
<td>0h</td>
<td>3x</td>
<td>–</td>
</tr>
<tr>
<td>Business and organisational development</td>
<td>4h</td>
<td>2x</td>
<td>2 h/x</td>
</tr>
<tr>
<td>Administration, control, and finance</td>
<td>15h</td>
<td>2x</td>
<td>7.5 h/x</td>
</tr>
<tr>
<td>Other</td>
<td>2h</td>
<td>0x</td>
<td>–</td>
</tr>
</tbody>
</table>

Table 5.5.: Comparison of the methods, number of hours (DM) reported per sample (ESM) for the tasks of user 3.

* For the not business related category, the duration of the activity was not surveyed. Therefore, the number of times it is reported as an activity that day is listed instead. Since this was reported through DM, it can be concluded that no business related tasks took place, or only one business related task took place that day.
Activities of teams

The activities of the team are depicted in fig. 5.7. Comparing the data of both methods, the *product development* line is following the same pattern, yet at a different scale. The lines show clear similarities in the reported data between the two methods. Both methods meet SR 10 to 12 on a team level as well.

Figure 5.8 shows which categories the team members worked on. From this chart, it can be seen that users 18 and 20 both worked on the *product development*. Users 18 and 62 worked on the *marketing and PR* of the new venture. Since user 62 only contributed in the first week, not all areas which the team members are specialised in can be determined. However, assumed is that users 18 and 20 reported all their tasks, compared to user 18, user 20 has been busy with a more diverse number of tasks. To determine if the methods are able to analyse the specialisations in the team (SR 8), all team members need to participate consistently. For this reason, research B was organised, as discussed in section 4.6.

![Graph showing reported tasks and activities worked on per category by team 1D.](image-url)
5.1.4. Time spent

The DM tracked the amount of time spent per activity by the participants. Table 5.6 shows how much time was spent by user 3 per activity class. This type of data is exactly what is required by the literature depicted in fig. 5.9. The same analysis is possible on the team level. Therefore, the DM meets CR 4 and could be used for this type of research studies.

![Figure 5.8.: Experience-sampling method: Reported samples per category per team member in team 1D.](image)

![Figure 5.9.: Time spent analysis goal of research A.](image)

<table>
<thead>
<tr>
<th>Activity category</th>
<th>Weeks 37</th>
<th>Weeks 38</th>
<th>Weeks 39</th>
<th>Weeks 40</th>
<th>Weeks 41</th>
<th>Weeks 42</th>
<th>Weeks 43</th>
<th>Weeks 44</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>Product dev.</td>
<td>5h</td>
<td>11h</td>
<td>7h</td>
<td>0h</td>
<td>3h</td>
<td>10h</td>
<td>0h</td>
<td>0h</td>
<td>36h</td>
</tr>
<tr>
<td>Marketing / PR</td>
<td>0h</td>
<td>0h</td>
<td>0h</td>
<td>0h</td>
<td>0h</td>
<td>0h</td>
<td>0h</td>
<td>0h</td>
<td>3h</td>
</tr>
<tr>
<td>Business and o.</td>
<td>0h</td>
<td>0h</td>
<td>0h</td>
<td>2h</td>
<td>2h</td>
<td>0h</td>
<td>0h</td>
<td>0h</td>
<td>4h</td>
</tr>
<tr>
<td>Administration</td>
<td>0h</td>
<td>0h</td>
<td>0h</td>
<td>4h</td>
<td>7h</td>
<td>0h</td>
<td>4h</td>
<td>0h</td>
<td>15h</td>
</tr>
<tr>
<td>Other</td>
<td>0h</td>
<td>0h</td>
<td>0h</td>
<td>0h</td>
<td>2h</td>
<td>0h</td>
<td>0h</td>
<td>0h</td>
<td>2h</td>
</tr>
<tr>
<td>Total per week</td>
<td>5h</td>
<td>11h</td>
<td>7h</td>
<td>6h</td>
<td>14h</td>
<td>10h</td>
<td>7h</td>
<td>0h</td>
<td>60h</td>
</tr>
</tbody>
</table>

Table 5.6.: Analysis of time spent per activity class by user 3.
5.1.5. Conclusion

In the first research, several aspects of the methods have been compared on an individual and team level. ESM showed higher participation rates than DM. The classes the participants belonged to showed a clear difference in participation levels. This might have been caused by the team-by-team discussions that were held in the class 1 only.

The phase data shown by the DM method showed interesting patterns. The data of the example user showed the different phases over time. By drawing the path on the entrepreneurship process model of Elizondo-Noriega et al. (2014), it was shown that the user progressed through the phases exactly as the model suggested. It was shown that DM is able to analyse the phases the entrepreneur and team go through, thereby meeting SR 13.

In terms of activities of the participants, where DM showed the major tasks only, ESM allowed to show the minor tasks as well. The tasks reported by the ESM included all major tasks of the DM too. The methods showed similar patterns and insights. Both methods have shown their ability to analyse what activities were undertaken by the entrepreneur or the team. They were also able to determine the order of these activities and at what frequency different activities were started. Therefore, DM and ESM meet SR 10 to 12.

Worth mentioning is the difference in resolution at which the methods are able to analyse activity order and frequency. The DM is able to determine this at the resolution of one per day. With two samples per day, the ESM is able to analyse these twice as accurately.

Analysing how much time was spent by the participants creating their new venture was shown possible. Since only the DM tracks the duration of activities, the DM is the only method meeting CR 4.

The participation rates of the teams were not high and consistent enough to analyse them further. Therefore, another research is required to evaluate the team diversity and collaboration insights of both methods.

Figure 5.10 shows the analyses that are field-tested with research A. The results showed that DM meets SR 10 to 13 and CR 4. The ESM meets all requirements it was designed to be capable of analysing. These include SR 10 to 13. These results answer question SQ 5.
5.2. Research B

This second research trial tests the proposed methods over a period of about a week. Research A (see section 5.1), showed what data are made available using the two methods on individual and team levels. This extra research was conducted to get more insights into the behaviour of the team itself. The period between the exams and the mid-term presentations was chosen to gather all the data. The deliverables of the teams were known. The list of activities and tasks that the students would work on was derived from these deliverables.

Since the deliverables are very diverse, the team members will most likely have to split the work and/or collaborate. This is useful to determine whether the methods are able to see if the students collaborated or not, testing SR 9 and answering question SQ 7.

The team diversity will also be determined for this period. Due to the high amount of workload, it is assumed that the students who are specialised in a certain domain will also report having worked on the tasks and activities. Depending on what tasks the team members work and whether they collaborated or split the tasks, the diversity of the group might also be visible using these methods. This field-tests whether the methods meet SR 8, thereby answering question SQ 6.

Section 5.2.1 discusses the participation first. After which a selection was made of the team that would be the example in the following sections. The diversity of the team is determined next in section 5.2.2. Section 5.2.3 follows with a comparison of the methods on the level of collaboration they are able to detect. In section 5.2.4 the conclusions based on the gathered insights of the two methods are drawn.
5.2.1. Participation

Since the students were obligated to track their tasks and activities for one week, the participation level is definitely going to be higher. In order to see any patterns in the data, all team members should report what they are busy with. The increased participation will become useful in the analysis on the team dynamics. As this research focuses on the team, the individual data are not further investigated.

Participation of teams

As mentioned before, the participation levels are important in this research. Especially those of the teams. Table 5.7 shows the average participation levels of the teams using the DM. The data in the table shows higher levels per group near the end. The students worked towards the mid-term presentations, scheduled on the 17th of November. The closer the deadline got, the more they reported working on their final tasks.

The participation data of the ESM are shown in Table 5.8. Similar to Research A, the participation percentage is 100% if all team members reported at least once on that given day. It is clearly visible that the students reported more frequently with the ESM than with the DM.

Based on the participation data, team 2Q was chosen as the example team to discuss some of the insights gathered. All team members of team 2Q participated in the DM and in the ESM.

Participation overall

Figure 5.11 depicts the participation over the complete class of students. Like table 5.7, the graph of DM (see fig. 5.11a) shows a slight increase in reports near the end. The increased level of participation is also shown in the ESM graph (see fig. 5.11b).

Since the participation was only registered for about a week, the level of notifications was increased to get more reports per day. In fig. 5.11, the lines indicate the percentage of people reporting once, twice, or thrice a day. The total is determined by taking the sum of these percentages.
Figure 5.11.: Participation (%) per method per week.

Table 5.7.: Participation (%) per team with the diary method (DM) per day.
The table is sorted on the anonymized name of teams, in ascending order. The data of the example team are highlighted.

<table>
<thead>
<tr>
<th>Team</th>
<th>Size</th>
<th>Joined</th>
<th>Thu 10</th>
<th>Fri 11</th>
<th>Mon 14</th>
<th>Tue 15</th>
<th>Wed 16</th>
</tr>
</thead>
<tbody>
<tr>
<td>2M</td>
<td>5</td>
<td>5</td>
<td>80.0</td>
<td>80.0</td>
<td>60.0</td>
<td>60.0</td>
<td>60.0</td>
</tr>
<tr>
<td>2N</td>
<td>4</td>
<td>4</td>
<td>50.0</td>
<td>50.0</td>
<td>50.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
<tr>
<td>2O</td>
<td>4</td>
<td>4</td>
<td>25.0</td>
<td>25.0</td>
<td>25.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
<tr>
<td>2P</td>
<td>4</td>
<td>4</td>
<td>75.0</td>
<td>75.0</td>
<td>25.0</td>
<td>75.0</td>
<td>75.0</td>
</tr>
<tr>
<td>2Q</td>
<td>4</td>
<td>4</td>
<td>75.0</td>
<td>50.0</td>
<td>25.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
<tr>
<td>2R</td>
<td>4</td>
<td>4</td>
<td>75.0</td>
<td>25.0</td>
<td>25.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
<tr>
<td>2S</td>
<td>4</td>
<td>4</td>
<td>75.0</td>
<td>50.0</td>
<td>50.0</td>
<td>75.0</td>
<td>75.0</td>
</tr>
<tr>
<td>2T</td>
<td>4</td>
<td>4</td>
<td>75.0</td>
<td>50.0</td>
<td>50.0</td>
<td>75.0</td>
<td>75.0</td>
</tr>
<tr>
<td>2U</td>
<td>4</td>
<td>4</td>
<td>100.0</td>
<td>75.0</td>
<td>100.0</td>
<td>100.0</td>
<td>100.0</td>
</tr>
</tbody>
</table>

Table 5.8.: Participation (%) per team with the experience-sampling method (ESM) per day.
The table is sorted on the anonymized name of teams, in ascending order. The data of the example team are highlighted.

<table>
<thead>
<tr>
<th>Team</th>
<th>Size</th>
<th>Joined</th>
<th>Thu 10</th>
<th>Fri 11</th>
<th>Mon 14</th>
<th>Tue 15</th>
<th>Wed 16</th>
</tr>
</thead>
<tbody>
<tr>
<td>2M</td>
<td>5</td>
<td>5</td>
<td>40.0</td>
<td>40.0</td>
<td>40.0</td>
<td>40.0</td>
<td>0.0</td>
</tr>
<tr>
<td>2N</td>
<td>4</td>
<td>4</td>
<td>25.0</td>
<td>75.0</td>
<td>0.0</td>
<td>30.0</td>
<td>75.0</td>
</tr>
<tr>
<td>2O</td>
<td>4</td>
<td>4</td>
<td>25.0</td>
<td>0.0</td>
<td>50.0</td>
<td>25.0</td>
<td>25.0</td>
</tr>
<tr>
<td>2P</td>
<td>4</td>
<td>4</td>
<td>25.0</td>
<td>50.0</td>
<td>50.0</td>
<td>50.0</td>
<td>50.0</td>
</tr>
<tr>
<td>2Q</td>
<td>4</td>
<td>4</td>
<td>0.0</td>
<td>25.0</td>
<td>25.0</td>
<td>100.0</td>
<td>50.0</td>
</tr>
<tr>
<td>2R</td>
<td>4</td>
<td>4</td>
<td>50.0</td>
<td>25.0</td>
<td>50.0</td>
<td>25.0</td>
<td>50.0</td>
</tr>
<tr>
<td>2S</td>
<td>4</td>
<td>4</td>
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<td>0.0</td>
<td>0.0</td>
<td>25.0</td>
<td>0.0</td>
</tr>
<tr>
<td>2T</td>
<td>4</td>
<td>4</td>
<td>75.0</td>
<td>25.0</td>
<td>25.0</td>
<td>25.0</td>
<td>50.0</td>
</tr>
<tr>
<td>2U</td>
<td>4</td>
<td>4</td>
<td>25.0</td>
<td>50.0</td>
<td>50.0</td>
<td>50.0</td>
<td>100.0</td>
</tr>
</tbody>
</table>
5.2.2. Diversity

Let's assume that the team members who worked on certain tasks are also the expert in that domain inside the team. The literature states that team diversity is an important aspect to succeed, as discussed in section 2.4. Therefore, if the team members show their own work domains in the data, it could indicate that the team is diverse.

Figure 5.12 shows what each team member worked on according to the data of the DM. From this chart, it shows that user 56 is specialised in detailed product specifications and editing videos. User 61 specialises in developing life-cycle use cases. User 75 is an expert in defining profile persona and developing presentations. Whereas, user 42 is the domain leader in building end-user profiles. The team split the work across the team members quite evenly. Therefore, based on the DM data this could state that team is diverse. This analysis concludes that DM meets SR 8.

Figure 5.12: Diary method: Reported number of hours worked per category by the team members of team 2Q.

In fig. 5.13, the reported activities by the ESM are shown. A lower diversity would be determined based on these data. From the chart it looks like users 56 and 75 are both working with others. User 61 specialised in calculating the total addressable market and quantify the value proposition. Whereas user 42 is the expert in identifying beachhead markets. With the exception for non mid-term related tasks, the tasks still look distributed evenly. This shows that ESM also meets SR 8, this concludes the answer for question SQ 6 too.
5.2.3. Collaboration

To detect possible collaboration slots, it is assumed that when team members report that they worked on the same activity on the same day, they must have collaborated. The table 5.9 shows the collaboration data based on the data reported with the DM. In this table, five teams are shown that collaborated according to the definition. Each time it detected a collaboration, the number of students that collaborated is shown. The number of hours that they collaborated is shown between brackets.

The tasks developing the presentation and editing the video show up multiple times across these teams. It seems logical that these tasks also need to be collaborated upon. The DM showed capable of analysing whether collaboration took place, thereby it meets SR 9.

The collaboration data detected by ESM are shown in table 5.10. With ESM, seven teams that collaborate have been discovered. Six times the editing and recording of the video was reported. The develop market segmentation task is reported as collaborated four times.

Interesting to see is that using the ESM data, it was reported three times that three team members worked together on the same task. Furthermore, at the end of the week the students were shown to collaborate more often than at the beginning. This might be related to the deadline that closed in at the end. The ESM meets the collaboration analysis requirement (SR 9) too. Thereby, concluding the answer for question SQ 7.
Table 5.9.: Collaboration of team members detected using the diary method (DM).

For each team, the reports of the team members have been compared per day. If two team members worked on the same activity, it is assumed that they collaborated. When two or more team members collaborated together, the total number of team members that worked together is shown. The number of hours that they worked together is shown in brackets. The table is sorted on the name of the teams, in ascending order. The data of the example team are highlighted.
Table 5.10.: Collaboration of team members detected using the experience-sampling method (ESM).

For each team, the reports of the team members have been compared per day. If two team members worked on the same activity, it is assumed that they collaborated. When two or more team members collaborated together, the total number of team members that worked together is shown. The number of samples that they worked together is shown in brackets. The table is sorted on the name of the teams, in ascending order. The data of the example team are highlighted.
5.2.4. Conclusion

The second research period proved useful. The participation levels were a lot higher for both methods compared to research A. This was to be expected, since the research was made obligatory for the students this time.

Although full participation was required, there was a clear difference between the participation level of ESM and DM. The ESM method showed higher participation levels throughout research B.

The higher participation level enabled analysis of the teams in more detail. Figure 5.14 shows the analyses this researched focuses on and how they relate to the requirements. It was shown that the different specialisation domains of the team members can be determined. With the DM multiple domain experts could be determined. The data of the ESM showed different findings. The minor tasks that show up in ESM, but are hidden in DM, might have influenced these results for ESM too much. Both analyses showed that the methods are able to determine the diversity of the team, answering question SQ 6. Therefore, they both meet SR 8.

Whether teams collaborated or not was detected by both methods too. Thus, to answer question SQ 7, SR 9 passed for both methods too. The ESM showed more collaborations than DM. The tasks that showed collaboration took place made sense for both methods.

How the students experienced the research has interesting value too. This will be covered in next section 5.3.

![Figure 5.14: Team analysis goals of research B.](image-url)

5.3. Experience and verification

This section starts by discussing how the participants experienced the methods. Followed by verifying how the methods performed and whether the analyses are correct. How it is experienced to use the method to track phases and activities is discussed in section 5.4.

In order to determine how the students experienced the research, a questionnaire was handed out to them at the end of the research period. This questionnaire can be found...
in chapter D. With the questionnaire they were asked to evaluate their experience of each method. The survey application (Paco) and the research itself were also reviewed by the questionnaire.

Some interesting answers on the questionnaire were shown in fig. 5.15. The students were asked to state whether they agreed or disagreed with the statements. With a seven-point likert scale, they were able to state that they agreed by answering 1, or disagreed completely by answering 7.

The first result shown is related to the survey application Paco. The statement was: “I experienced no issues with the Paco application.” As can be seen in fig. 5.15a, the majority agreed. However, there is also a part of the group that did experience issues. One of the issues reported by students is the fact that they did not receive notifications sometimes. Figure 5.15b shows that 57.69% did not receive a notification on every workday. Through the survey and by email, a number of students experienced issues with the Paco survey application. For most of them, the result was that they stopped contributing. The issues related to the survey application will be further discussed in section 5.4.

The questionnaire surveyed whether the methods were experienced as time consuming. Figures 5.15c and 5.15d show the results for DM and ESM respectively. As can be read from these graphs, the students indicated that this is not an issue.

Figure 5.15.: Interesting results on some of the questionnaire questions.

As discussed in section 4.4, the classification for research A was adapted to explain the different types clearly. In the team-by-team discussions with class 1 on the 21st of September, the students indicated that the phases and activities are clear and understood. Figure 5.16a shows that the majority agreed, but further improvements could be made. One of the comments written by a group of students on the questionnaire was that not all their tasks fit the descriptions. Attending lectures and working on some deliverables for the courses did not match a specific option.
One of the assumptions was that the students would only work on major two tasks per day. Figure 5.16b shows that the students would have liked to report more activities and phases. On the other hands, the reported suggestions to improve the research contrasted this. It showed that the students had the feeling they did work on their new venture enough, due to the high amount of notifications in which they reported not to be working on their venture.

Whether the methods would affect their behaviour eventually is important to validate. The results in fig. 5.16c show that the students did not think that their behaviour changed due to the fact that it was monitored.

With the development of the analysis software, reports were made available to the students during the research. Giving them feedback with reports showed fruitful. Students indicated that if these results would be made available in real-time it motivates them to contribute, as can be seen in fig. 5.16d.

Figure 5.16.: Interesting results on some of the questionnaire questions.

(a) The activity classes were clearly defined ($n = 26$, $\bar{x} = 3.31$, $\sigma = 1.61$).

(b) I worked on more tasks than I was able to report ($n = 25$, $\bar{x} = 3.72$, $\sigma = 1.76$).

(c) Reporting changed the way I spent my time ($n = 25$, $\bar{x} = 5.88$, $\sigma = 1.24$).

(d) When data would be reported in real-time, it would motivate me ($n = 27$, $\bar{x} = 3.11$, $\sigma = 1.31$).

In the team collaboration analysis of section 5.2.3, the edit or record video and develop presentation tasks were discovered as being collaborated upon by most groups. Whether this is the case was verified with the questionnaire. The results presented in fig. 5.17 show the results. When a participant reported the value 1, he or she worked on that tasks on their own, no one else contributed. When a participant reported 7, he or she did not work on that task at all. Any value in between shows that they collaborated with other team members to perform that task. Figure 5.17a shows that 35.91% of the participants collaborated on the edit or record video task. Whereas, 78.58% collaborated on the develop presentation task as is shown in fig. 5.17b.
On a seven-point likert scale, the participants were asked whether they collaborated on the task classifications and to what degree. Where 1 resembles no collaboration, worked on by this participant completely. At the other end, 7 states that someone else worked on the activity instead. All the values in between show the degree that this participant worked together with someone else.

5.4. Discussion

This section, discusses the experiences and results gathered in research A and B. It starts by discussing the preparation steps and the start of the research in section 5.4.1. Followed by an evaluation on how the researched is participated and managed over time in section 5.4.2. The results and findings of the research are connected back to the literature in section 5.4.3. Finally, recommendations are shared on how to research with these methods in section 5.4.4.

5.4.1. Preparations and start

To get started with the survey application (Paco) each participant will need a Google account. Unfortunately, Google required verification through mobile numbers and alternative email addresses to proceed. Therefore, it was decided that the students would need to create these account during the introduction presentation if they want to stay anonymous to Google.

At the start of the research, the methods and research goal were presented to the students. The students were willing to track their process to create their new ventures. The students used their existing Google accounts, some of which were already anonymous by itself.

The list of phases and activities were discussed during the presentation as well. Class 1 started one week earlier than class 2. After the first week, this enabled the opportunity to discuss the progress, difficulties, and options in a team-by-team setting. Two minor changes were made to the research. The first change was to allow pings to stay active for a longer period of time. The students indicated that they are not able to respond to the pings directly, or sometimes see the pings after an hour before they are able to reply. Therefore, the configuration was changed to allow the students to reply within 2.5 hours, before it was considered as a non-response. The second change was made to ensure that no notifications would be sent during the weekends. By accident, it was configured to ping every day instead of every weekday.

These team-by-team discussions only took place with class 1. Due to scheduling issues, the
discussions could not take place in class 2. The participation levels of research A, presented in section 5.1.1, showed peak participation levels for class 1 in the week that those discussions took place (week 38). This is in strong contrast to the participation levels of class 2. It could be related to the fact that some students were present in the second week, who were absent during the presentations. Or the fact that the research was brought to their attention once more. The effect might also be caused by the more individual approach of this second week.

5.4.2. Management and participation

Aside from the preparations, presentations, discussions, and a few emails over the time of the research, only limited time was required to host the research. Most time was consumed to prepare documentation, and provide reports to the students. Although this last step mainly resulted in automating the process in the analysis software.

From the discussions and questionnaire results, it can be concluded that a consensus on the definition of the phases and activities is important to achieve. Especially when researching causal relations to recognise patterns between tasks and its outcome. The ESM participation levels were higher than those of DM. This might be related to the fact that the DM requires more time to report about their activity. It could also be, that the DM reports were only submitted if the participants actually worked on a business related activity. In section 5.1.1, it showed that the participation levels decreased over time with both methods in research A. The main cause for the decline is the increasing number of non-responding participants. In class 2, the majority of the group stopped contributing after two weeks. The questionnaire revealed that some participants experienced issues with the survey application (Paco). One of the reported issues was the problem in which notifications did not arrive. Another issue required the participants to authenticate every time they were about to report, raising the bar to participate significantly.

With the questionnaire, discussed in section 5.3, students reported that they received a high amount of notifications, while they did not work on their new venture that often. This made them feel as if they were lagging behind. Several students mentioned that this was the reason they stopped to participate.

Preparing for the exams was named as another reason why they quit participating. At the university, weeks 43 and 44 were scheduled for exams and project work. This provides an explanation why the most consistent participants eventually stopped too.

In research B, the participation was made obligatory to ensure that all team members would contribute consistently. A handful of students reported technical issues prevented them to participate. A group of students did not participate from the start, but participated when the deadline came closer. Some of these students provided additional insights through the questionnaire. The two main reasons why they did not participate from the start included 1) being tired of exams or being on holiday and 2) not having worked on their new venture yet. In other words, the participation level could be considered a lot higher if the non-responses
at the start are converted to non-business related activity reports.

5.4.3. Findings and literature

As Gartner (1988) stated, it's not about the traits an entrepreneur has, it's about the behaviour they show. Tracking the activities of the entrepreneurs would enable this kind of analysis.

The methods both accomplished to analyse the activities. As a method, they can be used to discover new activities or to verify existing frameworks. In this research, the activities were classified based upon the framework provided by Mueller et al. (2012). For the students in research A, it might have been partially incorrect or applied to an earlier phase not recognised by the framework yet. The classification of the activities can be further examined with the two methods. The correctness of frameworks including, but by no means limited to, those of Gartner and Katz (1988); Liao et al. (2005). The classification used in this (see section 4.1) can be adapted to include the correct activity categories with further research, this does require a larger sample size.

The DM showed capable of tracking the phases, as reviewed in section 5.1.2. The classification of the phases were based on the literature of Elizondo-Noriega et al. (2014). As shown in section 5.1.2, multiple phases were identified by the methods. With the new methods, the gestation of ventures can be analysed further. This would be helpful to modernise the results of research like those of de Ven and Engleman (2004); Carter et al. (1996). It could help to further analyse how many cycles the new venture reinvented itself according to the framework of Elizondo-Noriega et al. (2014).

The DM also allowed to track the time spent on activities, examined in section 5.1.3. In the literature of Verheul et al. (2007), a panel study was used to research how much time was spent by entrepreneurs. This type of analysis might be affected by the ability to recall the amount of time spent correctly. With the DM, the amount of time to recall is reduced, limiting its bias effects.

Where the literature mostly used PSED to analyse the phases and activities, it might be based on biased responses, as discussed in section 2.4. The recall period is not present with the ESM, and limited to a day with the DM, thereby limiting its effects on the data. The resolution at which the methods are able to track the activities and phases would enable further research to discover patterns that might have been missed in earlier research.

The diversity of the teams were analysed with both methods. The methods were able to indicate what tasks and activities the individual team members mainly worked on, as argued in section 5.2.2. With this analysis capability, the methods can be helpful to determine the different paths diverse versus non-diverse teams take. Verifying the methods on team diversity such as those of Sandberg and Hofer (1987); Chrisman et al. (1998); Cooper and Bruno (1977). It might also help to further analyse the productivity of the teams based on their diversity and individual skills. Enabling research to strengthen the findings of Harrison.
et al. (2003); Ensley et al. (2002).

Analysis of the collaboration processes were shown to work with both methods, as discussed in section 5.2.3 and verified in section 5.3. Previous research analysed how different teams require more or less collaboration (Drazin et al., 1999; Hoegl, 2005; Hoegl and Parboteeah, 2007). With the DM and ESM, this research could be verified and/or further extended to include different type of teams. For new venture teams, the reward of their efforts is most often shared with all team members. Harrison et al. (2002); Hackman (2004); Kramer et al. (2014) argued that when team performance rewards are shared, it has the highest positive effect on its performance. The methods could, therefore, be used to further analyse whether this also holds for new venture teams with future research.

5.4.4. Recommendations

Based on the experiences gained through the trial runs of both methods, some recommendations can be made when these methods would be applied in other research studies.

Before conducting the research, it is important to determine the exact activities and phases they go through. As discussed in section 5.4.3, the activities did not completely match with the activities of the students in research A. For this reason, the activities were classified differently in the follow-up research (B). Not being able to report what they were working on exactly was found frustrating by these students.

When the research should start and finish should be considered carefully. As discussed in sections 3.5 and 3.6, the methods can be experienced time-consuming (Wheeler and Reis, 1991). With research A, the goal was to track all activities and phases since the start. However, it might have been started too early, as the students were still learning about entrepreneurship and how to get started. As the saying goes, “timing is everything.”

Additionally, it is important to determine according to what schedule it should sample. In this research, the schedule to sample was set to be twice or thrice randomly distributed over each workday. Through the questionnaire, students reported that they did not like to report that they are not working on their business, during lunch for example, while earlier that morning they did work but it was not sampled. However, for entrepreneurs that work full time, this might not be an issue.

Providing documentation on how to participate in the research was found helpful by the participants. After explaining what the research was all about, the documentation was used to show the students what steps they need to perform. Allowing the students to perform them on their mobile phones right away. The documentation was also made available through a website. It was accessed frequently by the students and helped a few students to participate even though they lost their old mobile or encountered errors intermittently.

In the research, the students were given the opportunity to access their individual reports. The questionnaire results, presented in section 5.3, showed that this was found motivating to participate. Discussions with the students about the results made them also more commit-
ted. Providing this kind of feedback can be very important for the success of the research. Especially when the participants are busy with other tasks in the meanwhile, like setting up their businesses for example.

5.5. Conclusion

By conducting the research as specified in chapter 4, the data was gathered to test both methods. Through the literature review, the analyses conducted related to tracking entrepreneurs by other researchers were discussed. Figure 5.18 shows how tracking attributes enables performing these analyses. The different analyses have been performed by field-testing the methods in research A and B.

With research A, what data the methods could show when running over a longer period of time was analysed. Participation in the research started off high and decreased over time. Participation in class 1 thrived after team-by-team discussions on the research. This showed an effective method to boost the commitment and participation in the research. Through the use of an example user and team, the phases discovered by the DM were discussed. Mapping the phases of the user showed how he or she followed a trajectory predicted by Elizondo-Noriega et al. (2014). The team analysis of the phase data showed that the team members followed a nearly identical path. The DM proved capable of analysing the phases, thus it meets SR 13.

The activities over time showed exactly what the example user and team worked on. It was shown that ESM is able to detect all major activities as discovered by DM. The ESM showed minor tasks as well, where the DM generated more data about the major tasks instead. SR 10 to 11 were met by both methods.

With the DM, the duration of tasks was tracked. The method was able to analyse how much time the participant spent on certain activities. This analysis showed that the DM meets CR 4. The participation, activity, phase, and time spent analyses answered question SQ 5.

In research B, the higher participation levels enabled the option to aggregate the data to discover patterns of teams. By analysing the participation rates, it was shown that making the research obligatory raised the level of participation. Participation was highest close to the deadline. By analysing the participation of the teams, an example team was selected for further analysis.

On which activity classes the team members worked most of the time was determined first. Through this analysis, the specialisations of the team members were shown.

Assumed is teams with a higher level of diversity, show more diverse specialisations in the team. In the analysis, this was shown to be the case with the example team. This analysis showed that both methods are able to identify the team diversity (SR 8). Thereby answering question SQ 6.
Whether the team collaborated on an activity or not was determined with both methods. Based on the assumption that team members that collaborate, both report having worked on that activity that day, reports were analysed. Both methods were able to show that the teams collaborated on several activities (SR 9). The reported collaborated activities that were shown most frequently included developing the presentation and recording the video. Through this analysis, question SQ 7 was answered.

The analyses conducted by the two research studies have been summarised in table 5.11. This overview clearly shows that DM is able to meet all the analysis requirements. The ESM was designed to be as non-intrusive as possible. Therefore, it was decided to track only what activity was performed on the moment it sampled. Tracking the phases and duration of the activities would increase the time required to answer the questions. These were left out to limit the impact on the focus of the participants during the research.

The data gathered with both research periods showed the abilities of both methods. To determine how the students experienced both methods, their experiences were evaluated. It was shown that the research did not influence their time spent in their experience. Some students reported having issues with the survey application (Paco), this affected their ability to participate in the research. The analysis how the participants experienced the methods answered question SQ 8.

Both the DM and ESM were able to discover the main activities of the entrepreneurs. The DM proved valuable in determining the amount of time spent and what phases the entrepreneurs were working on. With DM, participants are not interrupted in their workflow.
Table 5.11.: Overview of selected methods and which analysis requirements they meet.

<table>
<thead>
<tr>
<th>Analysis requirement</th>
<th>DM</th>
<th>ESM</th>
</tr>
</thead>
<tbody>
<tr>
<td>SR 8 (Team diversity)</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>SR 9 (Collaboration)</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>SR 10 (Activities)</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>SR 11 (Activity order)</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>SR 12 (Activity frequency)</td>
<td>Yes</td>
<td>Yes</td>
</tr>
<tr>
<td>SR 13 (Phases)</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>CR 4 (Time spent)</td>
<td>Yes</td>
<td></td>
</tr>
</tbody>
</table>

The requirements that are left empty could not be met by design, as the ESM does not track the duration of tasks and phases they go through.

A risk of DM was that the fact that it is reported at the end of the day, might show a minor hindsight bias. However, compared to ESM, both methods showed the same activity classes. The impact of this bias can therefore be considered non-existent.

ESM showed a higher overall participation level in both research periods. Compared to DM, it was able to show what minor activities the entrepreneurs worked on. As well as at what time they worked exactly on certain activities. It could not determine how long they worked on each activity.

The analyses performed with these methods in the field-tests showed their capabilities. As fig. 5.18 shows, a lot of research is performed to track the entrepreneurs with these kind of analyses. The DM and ESMs could be used to verify these papers, or to further extend their results with findings that might have been missed by biases, as discussed in section 2.4.
6. Conclusion and future work

By researching the literature, it was found that most of the research on the activities of entrepreneurs gather data with methods that require the participants to recall events. Thus, basing their conclusions on data that is possibly biased. Further research showed that the activities have not been investigated due to the lack of methods to track them.

To research what and how to track the activities of entrepreneurs, the main research question (MQ) was formulated as “How to track the business creation activities of entrepreneurs?” The phases and activities of this process were explored in the literature. A list of requirements was formulated by taking together the limitations and considerations of the research studies on the activities of entrepreneurs. Analysis of similar activity tracking studies in other research areas, did not provide a suitable method.

Originally, the diary method (DM) and experience-sampling method (ESM) are used to track experiences as they occur. With modification, these two methods would be suitable to track the activities of entrepreneurs throughout their new venture creation process. To determine what insights the methods are able to give, they were field-tested with students enrolled in business creation courses. These students were chosen, as they all work on their own business ideas to create a new venture. The students all start at the same time, are guided by lectures through the process, and present their business ideas at the end of the period. This allows further comparison between the teams and enables to track a large group in the same period of time. By their behaviour, they are categorised as student and nascent entrepreneurs, making them a good proxy of entrepreneurs.

The data gathered by the Paco survey application, was aggregated by a newly developed analysis software application. With the use of the analysis software, analysis was performed near real-time. The goal of the analysis software was to analyse the data on individual, team-level, and overall. The individual reports generated by the analysis software were sent to the participants as a reward for their effort.

Over a longer period of time, the methods were able to distinguish what phases and activities the entrepreneur worked on. Through the tasks and activities it tracked, the business creation process of several student entrepreneurs were mapped. Involving the participants in the research was shown to be effective to raise the participation level.

When a complete team participated, the methods were able to detect who worked on which tasks. Even showing whether certain team members were solely responsible for a certain activity class. This allowed further analysis on the the team diversity. How the team
collaborated over time was also discovered by both methods.

The students experienced the research as non-intrusive. Allowing them to continue with their business creation process, while contributing to research. The reports that were made available to the students, were considered as a reason to participate more consistently.

The methods, show a lot of insights that will be valuable for mapping the business creation process of entrepreneurs. Other domains that are in need of a method to track the activities of creative teams will also be able to use these. Both methods proved suitable for different use cases. Depending on the scenario and the goal of the research, either of them, or both can be used as a research method.

The DM gave insights in the major activities of each day. The method consumed more time than ESM. As the method asks about the activities at the end of the day, it allows to raise more questions to get a better insights on how time was spent. In the first research trial (A), the students were asked in what phase they were operating and how long each activity took that day. The method showed a perfect example of the phases detected and predicted by the literature. Due to the briefness of research B, the phases were not tracked.

By sampling throughout the day, the ESM is able to determine what the entrepreneurs are working on exactly at the sampled moment in time. The frequency of samples can be adjusted. As the samples interrupt the workflow of the participants, care should be taken not to interrupt them too much. With two samples per day, the ESM showed higher participation rates than DM. Where DM is limited to the activities that the participants are able to recall, the ESM samples them as they happen. It is, therefore, able to record activities that would otherwise not be revealed by the research.

6.1. Limitations and future work

From the start of this research, the goal has been to determine a method that is able to track the activities of entrepreneurs. Research was conducted twice to test the proposed methods. In these test runs, students were asked to participate in the research to track their business creation process. The students were enrolled in two different minors on new venture creation.

The fact that these students participated in a course on new venture creation, might have influenced the research. The phases and activities reported by the students, could have been affected by timing and topics of course content and its deliverables. The lecturers gave the opportunity to present and discuss the research during the lectures. This might have affected the judgement of the students about the research and its freedom to participate. How this influenced the research could go both ways. Further research is required to determine whether this affected their activities, phases, and willingness to participate.

Although the idea of the research was to test what insights can be found with the methods. The trial run itself already showed textbook examples how the students were becoming entrepreneurs. The sample size of the research was too small to conclude anything on the
patterns. In further research, interesting aspects might be proven. Such as, whether all student entrepreneur follow a similar trajectory; how differences in their activities relate to their team performance; or, how many cycles it takes for the students to reach their final business idea.

To compare the methods with each other, the students reported with the DM and ESM simultaneously. The fact that the ESM notifies the participants to register what they are working on, could influence what they remember when they need to report their major tasks at the end of the day with DM. Further research is required where these two methods are tested independently, to determine whether this limited the findings of this research.

Two courses opted in to research the new venture creation process. This created a perfect opportunity to track a large group of student entrepreneurs while they work on their business ideas. Whether the methods would work on non-student entrepreneurs too is to be determined. Furthermore, all students were about the same age. The ease to get started with the research might be biased by this fact. How this would perform with more experienced serial entrepreneurs, for example, could be interesting to research.

To detect collaboration, it was assumed that the students would have reported the same activity for that period of time. Whether the collaborated activity classes are also reported as being collaborated upon has been verified. However, it might over or under detect these occurrences currently. It could just as easily mean that they worked on different tasks within the same activity class. With other methods, the ability to detect whether collaboration took place can be verified.

At the start of the research, the idea to compare their activities and relate it to the performance of the teams was presented. The participation levels were too low to explain the behaviour of all team members in a team completely. Additionally, the sample size to verify these patterns would be small, as only 21 teams participated. This would be interesting to research, as a lot of research states that the team cohesion, diversity, and patterns in their activities relate to the venture performance.

In the research, some students experienced technical or usability issues with the survey application Paco. It was discovered that there is a need for further improvements to this application. For unknown reasons, the application stopped notifying students in some cases. Other students were confronted with a login screen every time they opened the application. These and other issues caused many participants to drop out over time. Unfortunately, no clear patterns on the cause of these issues emerged from the data.

With the use of the research method, the activities and phases of entrepreneurs can be determined in more detail. The literature on the activities of entrepreneurs has only shown the tip of the iceberg. By analysing the new venture creation process, the full range of activities and processes can be discovered. Both methods would be helpful to accurately map the process, when used to research from the start to the moment the first product or service is sold.
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Glossary

**Google Account** is an account type that is necessary to make use of Google services. Since Paco depended on the authentication services of Google, participants were required to login with a Google account. To ensure anonymity, users were told they are allowed to create a temporary account. 56, 67

**hindsight bias** occurs when the participant of a study is reflecting on what actions and judgements they made, while the results are known. The fact that they know the result, influences their ability to reflect on it correctly (Fischhoff, 1975; Huber and Power, 1985; Wasserman et al., 1991; Golden, 1992; Cassar and Craig, 2009). 1, 26, 29, 33, 34, 40, 41, 62, 97

**Paco** is the survey application used for both methods in this research. 9, 41, 42, 49, 53, 56, 61, 63, 67, 89, 91, 92, 96

**quasi-natural experiment** is an experiment type in which the research is conducted in a real life environment. Compared to field experiments, the difference is that the researcher has no or takes no control over the independent variable that influences the environment. They are similar to quasi-experiments in the way that they both do not use truly randomised assignment of the participants to treatment or control groups. 6, 43

**self-report** is the type of report that happens when the participant report data manually, without having received a notification to do so. 56

**social desirability bias** occurs when for some reason the expectations of the researcher become known to the participants that are being researched. The participants therefore respond to the questions to meet the outcome expectations of the researcher (Crowne and Marlowe, 1964; Rosenthal, 1966). 26, 29, 33–35, 40

**stereotype bias** occurs when the participants of the research feel the need to answer the questions based on a form of stereotype definition of whom they represent. The definition they formed might not even be accurate. But in any case, since this affects how the participants are perceived, the effect of the stereotype definition is what is researched, not the real participants in question (Aldrich, 1999). 26, 29, 33, 34, 40
**survival bias** occurs when the research tries to determine what happened in the past by researching the group that already achieved the goal. As discussed in section 2.4, a lot of the research on nascent entrepreneur activities is researched by sending a survey to entrepreneurs that are publicly registered. Due to this bias, the research would not include all the other people that tried to become registered but failed. As 50% of the entrepreneurs fail to create their business (Aldrich, 1999), the outcomes of the researched would be seriously biased. 26, 29, 33
**Acronyms**

**ATUS** American Time Use Survey. 14

**CEO** Chief Executive Officer. 25

**CR** could have requirement. 36–38


**DV** dependent variable. 50

**EET** Entrepreneurship Education and Training. 21, 29

**ERC** Entrepreneurial Research Consortium. 25, 27


**ESP** Experience Sampling Program. 41

**IV** independent variable. 6, 50

**MR** must have requirement. 33, 34

**MTE** Med-Tech Entrepreneurship. 57, 66, 67

**NVTM** New Venture Top Management Teams. 23

**PR** public relations. 46, 77–79

**PSED** Panel Study of Entrepreneurial Dynamics. 23–27, 93

**SR** should have requirement. 34–38

**TBE** Technology-Based Entrepreneurship. 57, 66, 68

**TMT** Top Management Teams. 21, 24

**WR** would be nice to have requirement. 38, 39
Appendices
A. Manual screenshot
You should now see Paco’s main screen.

Let's join the experiment for our study.
B. Website screenshot
Welcome Time Spent

In order to participate in this research, you will need to setup Paco on your mobile phone.

Paco is a research application that allows us to send you a notification at random intervals during the day.

When a notification appears on your phone, try to open it within 15 minutes to answer what you are doing at that moment.

Two notifications will show up per workday, between 10 AM and 6 PM. Additionally, a third notification will appear around 6:45 PM to ask you more specifically what you worked on that day.

Please be as honest as possible during this research, if you did not work on your business at all, that is also important to know. The data you enter will only be available to us, not to the teachers of the course that you participate in.

With the exception of generalized anonymous recommendations based on the feedback that we gathered during the week, to allow the teacher to address topics which the group is not familiar with.

This website will provide you access to installation guides, your weekly reports and statistics, and to future surveys.

Getting Started

Please choose the type of mobile phone you have, to follow the instructions for that model.

Unfortunately, Paco only supports iOS and Android phone models, if you have a different phone than these two, please contact us if you haven't done so already.
C. Report screenshot
Your statistics report Overview

This statistics report shows data from 2016-09-12 until 2016-11-05 and was generated on 2017-02-03.

Participation score

Task sampling participation score
End of day diary participation score

In these 55 days, your participation score in Part 1 (task sampling throughout the day) is 44.7%.
Your participation score in Part 2 (end of the day diary survey) is 57.9%.

Time logged across weeks

Based on the reported time spent, through the end-of-the-day diary survey.
Time logged per category across days

Based on the reported time spent per category, through the end-of-the-day diary survey.

Time logged per phase across days

Based on the reported time spent per phase, through the end-of-the-day diary survey.
Time logged per category across weeks

Based on the reported time spent per category, through the end-of-the-day diary survey.

Time logged per phase across weeks

Based on the reported time spent per phase, through the end-of-the-day diary survey.
Samples reported per category across weeks

Based on the reported time spent per category, through task sampling throughout the day.

Samples reported per category

Number of samples

Time in weeks

- Not specified
- Not business related
- Product development
- Marketing / PR
- Sales
- Business and organisational development
- Administration, control, and finance

Samples taken

Based on random sampling throughout the day, where you were able to report what you worked on at that moment.
Reported tasks at end of day

Based on the reported time spent per category, through the end-of-the-day diary survey.
The tasks reported in these 55 days are:

<table>
<thead>
<tr>
<th>Category</th>
<th>Phase</th>
<th>Reported</th>
<th>Total time</th>
<th>Average certainty (1 = not certain, 7 = very certain)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Not specified</td>
<td>None</td>
<td>1 times</td>
<td>0.0h</td>
<td></td>
</tr>
<tr>
<td>Not business related</td>
<td>None</td>
<td>21 times</td>
<td>Unknown</td>
<td></td>
</tr>
<tr>
<td>Product development</td>
<td>Contextualizing / Identification</td>
<td>2 times</td>
<td>12.0h</td>
<td>6.5</td>
</tr>
<tr>
<td>Product development</td>
<td>Contextualizing / Planification</td>
<td>1 times</td>
<td>2.0h</td>
<td>5.0</td>
</tr>
<tr>
<td>Product development</td>
<td>Exploring</td>
<td>2 times</td>
<td>9.0h</td>
<td>6.5</td>
</tr>
<tr>
<td>Product development</td>
<td>Reflecting</td>
<td>1 times</td>
<td>3.0h</td>
<td>7.0</td>
</tr>
<tr>
<td>Product development</td>
<td>Generating</td>
<td>2 times</td>
<td>10.0h</td>
<td>6.5</td>
</tr>
<tr>
<td>Marketing / PR</td>
<td>Validating / Prototyping and design</td>
<td>1 times</td>
<td>3.0h</td>
<td>7.0</td>
</tr>
<tr>
<td>Business and organisational development</td>
<td>Contextualizing / Planification</td>
<td>1 times</td>
<td>2.0h</td>
<td>6.0</td>
</tr>
<tr>
<td>Business and organisational development</td>
<td>Exploring</td>
<td>1 times</td>
<td>2.0h</td>
<td>4.0</td>
</tr>
<tr>
<td>Administration, control, and finance</td>
<td>Contextualizing / Planification</td>
<td>1 times</td>
<td>4.0h</td>
<td>6.0</td>
</tr>
<tr>
<td>Administration, control, and finance</td>
<td>Reflecting</td>
<td>1 times</td>
<td>7.0h</td>
<td>6.0</td>
</tr>
<tr>
<td>Administration, control, and finance</td>
<td>Validating / Prototyping and design</td>
<td>1 times</td>
<td>4.0h</td>
<td>6.0</td>
</tr>
<tr>
<td>Other</td>
<td>Contextualizing / Planification</td>
<td>1 times</td>
<td>2.0h</td>
<td>7.0</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>37 times</td>
<td>60h</td>
<td>6.1</td>
</tr>
</tbody>
</table>
D. Questionnaire
Time Spent Survey
Final Questionnaire

Dit blad wordt automatisch ingedeeld, graag kruisjes zetten met een dunne stift of pen. Indien je je antwoord wilt corrigeren, vul dan het incorrect gegeven antwoord op de volgende manier:

Geliène blokletten te gebruiken bij het invullen van de open vragen.

We vragen om jouw studentnummer, email en groep om de data zo goed mogelijk te kunnen koppelen aan jouw onderzoeksdata. Zodra alle data gekoppeld is wordt jouw data geanonimiseerd.

1 Persoonlijk

1.1 Wat is je studentnummer?

1.2 Bij welke groep sta je ingedeeld?

Groep:

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15

1.3 Welk email adres heb je gebruikt binnen de onderzoeks applicatie (Paco)?

2 Ervaring

2.1 In hoeverre hebben je projectgroepen of commissies geholpen bij je studie (inclusief deze minor)?

Aantall

1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16+

2.2 In hoeverre ben je het eens of oneens met de volgende stellingen?

Ik zie mijzelf als een echte ondernemer. 

Binnen drie jaar na mijn afstuderen ben ik voor mijn eigen start-up aan de slag.

eens  o  o  o  o  o  o  o  o  o  o  o

oneens

2.3 Heb je zelf een start-up op dit moment? Zo ja, hoe lang al?


2.4 Stel je bent ondernemer met een volle agenda, wat zou jou in dat geval motiveren om mee te doen aan dit onderzoek?
3 Random pings gedurende de dag

3.1 In hoeverre ben je het eens of oneens met de volgende zaken? De activiteiten waar je uit kon kiezen tijdens het onderzoek staan beschreven op de laatste bladzijde.

- Het invullen van de samples kostte mij veel tijd. 
- De pings verstoorden mijn focus tijdens werkzaamheden.
- De momenten waarop een ping binnenkwam merkte ik snel op.
- De pings kwamen meestal op gunstige tijdstippen binnen.
- Wat ik aan het doen was op dat moment, kwam vaak overeen met één van de opties.
- De activiteiten waar ik uit kon kiezen waren duidelijk ongeschreven.

4 Vragen aan het einde van de dag

4.1 In hoeverre ben je het eens of oneens met de volgende zaken?

- Het invullen aan het einde van de dag kostte mij veel tijd.
- Bij het invullen had ik een goed beeld van de taken die ik had uitgevoerd die dag.
- Wat ik gedaan had tijdens de dag kwam vaak overeen met één van de opties.
- Ik werkte meestal aan veel meer dingen dan ik kon aangeven.

5 Rapportages

5.1 In hoeverre ben je het eens of oneens met de volgende zaken?

- De rapportages zouden mij motiveren om mee te doen aan het onderzoek.
- Indien de data real-time beschikbaar is, zou ik extra gemo-

5.2 Wat zou er verbeterd kunnen worden aan het rapport om het voor jou interessanter te maken?
6 Onderzoeksapplicatie - Paco

6.1 In hoeverre ben je het eens of oneens met de volgende stellingen?
- De app was makkelijk te installeren.    eens ○ ○ ○ ○ ○ ○ ○ ○ oneens
- Ik heb geen problemen ervaren met de app. eens ○ ○ ○ ○ ○ ○ ○ ○ oneens
- Ping kwam elke werkdag binnen.             eens ○ ○ ○ ○ ○ ○ ○ ○ oneens
- De app was makkelijk in gebruik.          eens ○ ○ ○ ○ ○ ○ ○ ○ oneens
- Problemen met de app zorgden ervoor dat ik niet meer actief meeheid. eens ○ ○ ○ ○ ○ ○ ○ ○ oneens

6.2 Wat zou er verbeterd kunnen worden aan de app?

7 Onderzoek

7.1 In hoeverre ben je het eens of oneens met de volgende stellingen?
- Van tevoren wist ik wat er van mij verwacht werd. eens ○ ○ ○ ○ ○ ○ ○ ○ oneens
- Door het bijhouden van de vragenlijst werd ik bewust van wat ik deed. eens ○ ○ ○ ○ ○ ○ ○ ○ oneens
- Door het registreren heb ik uiteindelijk de werkelijke invulling van mijn tijd aangepast. eens ○ ○ ○ ○ ○ ○ ○ ○ oneens
- Ik vond me erg bekehken tijdens dit onderzoek. eens ○ ○ ○ ○ ○ ○ ○ ○ oneens
- Ik heb het gevoel dat de privacy van mijn gegevens goed zijn gewaarborgd tijdens dit onderzoek. eens ○ ○ ○ ○ ○ ○ ○ ○ oneens

7.2 Hoewel tijd ben je kwijt geweest aan het onderzoek per week (in minuten)?

7.3 Uiteindelijk ben ik gestopt met meedoen aan het onderzoek, omdat:

7.4 Wat zou er verbeterd kunnen worden aan het onderzoek?
8 Samenwerken

8.1 Kun je voor de onderstaande taken aangeven of je hier voornamelijk alleen aan hebt gewerkt (ik), samen hebt gewerkt (weerden) of dat anderen hieraan hebben gewerkt (anderen)?

Product development .................................................. ik ○ ○ ○ ○ ○ ○ ○ ○ anderen
Marketing or public relations ........................................ ik ○ ○ ○ ○ ○ ○ ○ ○ anderen
Sales .................................................................................. ik ○ ○ ○ ○ ○ ○ ○ ○ anderen
Business and organisational development ...................... ik ○ ○ ○ ○ ○ ○ ○ ○ anderen
Managing employees ....................................................... ik ○ ○ ○ ○ ○ ○ ○ ○ anderen
Administration, controlling and finance ......................... ik ○ ○ ○ ○ ○ ○ ○ ○ anderen
Other ................................................................................... ik ○ ○ ○ ○ ○ ○ ○ ○ anderen

8.2 In hoeverre ben je het eens of oneens met de volgende stellingen?

Met een aantal uit deze groep heb ik eerder samengewerkt vooraf aan de minoor. eens ○ ○ ○ ○ ○ ○ ○ ○ oneens
Er was een duidelijke taakverdeling binnen de groep. eens ○ ○ ○ ○ ○ ○ ○ ○ oneens
Op basis van elkaars expertise konden we het werk goed verdelen. eens ○ ○ ○ ○ ○ ○ ○ ○ oneens

9 Taak afhankelijkheid

Geef voor elk van de onderstaande zes taken aan welke andere taken eerst afgerond moesten worden voordat aan deze taak gewerkt kon worden. De regels (horizontale rijen) zijn de taken waar hoe gaat, de kolommen (verticalen) zijn mogelijke taken die eerst afgerond moesten worden. Zet een kruisje indien er afhankelijkheid bestaat. Als voorbeeld stelt dat de taak Managing employees afhankelijk is van Sales, dan zet je een kruisje op regel 5 (A5. Managing employees), kolom 3 (A3).

Bij deze vraag mag je meerdere afhankelijkheden (kruisjes) per regel opgeven. Indien je meerdere iteraties hebt doorgemaakt, dan alleen afhankelijkheden zoals in de eerste iteratie hier aangegeven a.w.b.

9.1 Per horizontale taak, hoe is deze afhankelijk van andere taken?

A 6. Administration and finance .............................................

Einde onderzoek. Hartelijk dank voor jouw bijdrage!

Extra toelichting: Omschrijving van de taken tijdens het onderzoek (in Pano):

Product development (problem definition, opportunity framework, value proposition, etc.)
Marketing or public relations (generating publicity, customer discovery and segmentation)
Sales (selling/visiting (potential) customers)
Business and organisational development (who are my partners, competitor analysis, forming legal entity)
Managing employees (who do we need, who does what)
Administration, controlling and finance (cashflow activities)