Leadership in Agile

Desired Characteristics of Agile Leaders

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Degree project 30 HE credits
Computer and Systems Sciences
Degree project at the master level
Autumn/Spring term 2018
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Abstract

As Agile software development methodologies are becoming an industry standard, there is still very limited research carried out about the desired characteristics of Agile leaders. Most of the previous research focused on leadership did not take into account specifics of Agile software development, while the rest of the studies identified very different characteristics with very little overlap in them. This study investigated what are the most important characteristics of an Agile leader when company and team sizes are taken into account.

Survey was selected as the most suitable research strategy, because it could reach a high number of Agile software developers in limited time and with no associated costs. The data that served as basis of this study was gathered through a web-based questionnaire.

The questionnaire consisted of a screening question, five demographics-related questions and 18 questions about the importance of the different leadership characteristics, such as the leader having vision about the team development, being a role model, having good relationship with the team, having excellent communication skills, to name a few. In total, 166 Agile software professionals have filled out the survey.

The research identified that communication is the only universally desired characteristic, whose importance does not depend on company or team size. Four variables had statistically significant results for both company and team size. When company size was taken into account, results were as follows: work organiser turned out to be the most important for very large companies (1001-5000 employees), quality of work enforcer, decision maker and technical lead for small companies (101-1000 employees). Considering team size, the distribution of results was: role model and people centricity was the most important for very large teams (7-9 members), quality of work enforcer for large teams (4-6 members), while technical lead for very small teams (1-3 members).

Keywords: Agile, leadership, characteristics

Synopsis

Background

Agile methodologies have been a part of the software development industry for more than twenty years. Several Agile methodologies emerged during that time, however the core concepts have always stayed the same: open communication, iterative development, fast delivery. Although initially invented for small teams, Agile has also seen an expansion in large enterprises in the form of methodologies like the Scaled Agile Framework and Large-Scale Scrum. These frameworks can ensure large groups of 70 to 130 people to cooperate and work together. There is a considerable difference in leadership characteristics when it comes to management of the large self-organizing unit compared to small teams operating in relative isolation.

Problem

The problem this thesis addresses is the lack of research on the desired characteristics of an Agile leader in general and depending on the team size and the magnitude of the organization. The knowledge gathered through this study is important for recruiting right individuals to lead agile software development teams.

Research Question

The research question is the following. "What are the desired characteristics of the Agile team leader and in what way they differ depending on the organization and the team size?"

Method

Carrying out a survey has been identified to be feasible, suitable and ethical. As for the data collection, a web-based questionnaire proved to be an effective and fast way to reach members of agile software development community. The close-ended questions collected mainly ordinal and nominal data about the respondent, including the size of the organization and the team and about the importance of 18 characteristics of the leader. The data analysis included descriptive statistics and the Kruskal-Wallis test to distinguish between the characteristics for smaller and larger organizations and teams. The data are collected using Google Forms and the statistical analysis is performed with SPSS.

Result

This research uncovered that out of the 18 characteristics presented, only communication was the one that was universally desired across all company and team sizes. Four characteristics had statistical importance for both company and team size. The results indicated that variables' importance was as follows; For different company sizes:

- work organizer: large, small, very small, finally very large companies
- quality of work enforcer: small, very small, large and very large companies
- decision maker: small, large, very small and very large companies
- technical lead: small, very small, large, very large companies

For different team sizes, the ranking was as follows:

- role model: large, very large, small and very small teams
- quality of work enforcer: small, very large, very small and large teams
- technical lead: very small, small, very large and large teams
- people centricity: large, very large, small and very small teams

Discussion

The results were very well aligned to the results of previous research: overall, all of the characteristics identified previously have received good appreciation from the respondents. Four variables were ranked for company size, and four for team size, while communication turned out to be a universally desired characteristic. Although this research has practical applicability, a larger sample would be more beneficial, for even more relevant results.

Acknowledgement

I would first like to thank my thesis advisor Iskra Popova for her continuous efforts for guiding me throughout this thesis. The door to Iskra's office was always open whenever I ran into a trouble spot or had a question about my research or writing. She consistently allowed this paper to be my own work but steered me in the right direction whenever she thought I needed it. She continuously provided me with valuable feedback to make the research better and better, but in a way that allowed me to learn a lot from writing the paper.

I would also like to thank my family for their continuous support and encouragement throughout the writing of this work. Their backing helped me a lot in finishing this thesis.

Last, but not least, I would also like to thank all the experts who provided me help in the form of answers to my survey's question. Without them, this work would have not been possible to deliver.

Table of Contents

List of Tables

List of Figures

1 Introduction

1.1 Agile Software Development

"Agile ways of working" is an umbrella-term for describing several software development methodologies that aim to overcome limitations imposed by the traditional, Waterfall method. The roots of these techniques are in Takeuchi and Nonaka's article, titled "The new product development game", in which they analysed how some manufacturers managed to deliver products much faster than their competitors. They identified that overlapping development phases have a positive effect on delivery time, and in general, work better than sequential stages. They found that the best performing teams are self-organising, cross-functional and challenging the status quo (Takeuchi, Nonaka, 1986).

The IT community has started applying these findings to traditional, sequential software engineering, from the mid-nineties. As a result, a rather high number of software development methodologies began emerging: Scrum, Crystal, Extreme Programming and Feature Driven Development (Appello, 2010). In 2001, a group of practitioners of these methodologies came up with a blueprint for a unified, lightweight software development methodology. They created the "Agile Manifesto", in which they expressed their values and principles on delivering software in a collaborative, people centric-way (Manifesto for Agile Software Development, 2001).

Today, one of the most widespread Agile development technique is Scrum, which is "a refreshingly simple, people-centric framework based on the values of honesty, empowerment, and collaboration" (Rubin, 2012). Development teams are cross-functional, acting in an empowered, self-directive manner, aligning well with Takeuchi and Nonaka's findings of best performing teams.

1.2 Team and Organisation Size

Efficiently applying Agile development techniques can be different for teams of varying size. A common Agile team size, as described by Quarashi and Qureshi (2014) is seven ± two people. However, Diebold, Ostberg, Wagner, and Zendler (2015) have pointed out that there is a considerable variance when it comes to team size. They have identified teams as small as two and as large as twenty-five people, with the latter characterised by a significant communication and administration overhead.

Another critical aspect of successfully applying Agile is the size of the company the Agile teams operate in. Enterprises with a high number of units cannot take advantage of the same level of self-organisation as small businesses. These large companies need to leverage extensions of Agile methodologies, like LeSS (Large Scale Scrum <70 people) or SAFe (Scaled Agile Framework <125 individuals), as described by Alquadah and Razali (2016). These extended methodologies require different management skills than regular, small-scale Agile.

1.3 Agile Leadership

Agile leadership is usually twofold: product related leadership is handled by the Product Owner, while the Agile leader assumes team leadership. The latter is focused on removing impediments from the team's way, helping team members learn and efficiently apply the methodology and keeping the team self-organised (Sims, Johnson, 2012). Self-organising teams, as defined by Polley and Ribbens (1998),

are small groups of people, possessing relevant skills, operating under reduced or no supervision. These teams have influence over their ways of working and work schedule and operate over extended periods of time.

The topic of leadership in self-managing, Agile teams is at the intersection of two research areas: computer engineering and IT management, both in the field of computing. As the research within this topic requires a multifaceted approach, it did not receive the required attention. Although some research was carried out in this area, the results have very little in common.

1.4 Problem Statement

As Mishra, Garbajosa, Wang, Bosch, and Abrahamsson (2017) point out after analysing publications from Agile conferences, there is a discrepancy between practice and research when it comes to Agile concepts. They identify leadership and mentoring to be the two most under-researched areas in which Agile practitioners have a particular interest.

It looks like every author of the limited number of publications identifies their own set of essential traits an Agile leader should possess. These characteristics differ from publication to publication, with limited overlap in them. Some of the research papers in this area are only focusing on a single team operating in the same context (Moe, Dingsøyr, & Dybå, 2010). As a result, it is still unclear what Agile practitioners, coming from different companies, think about the most important characteristics when it comes to their leaders. There is still no answer if companies of different size value different leadership skills more, or there exist some well-defined, firm-independent traits.

1.5 Aims, objectives and research question

This research aims at exploring what are the leadership characteristics of an ideal Agile leader, taking into account the size of the organisation and team – as per the Agile community. Please note that in all the following sections characteristics, traits and behaviours will be considered to be synonyms and will be used interchangeably.

The findings could serve as a guide for current and future Agile leaders in identifying the leadership characteristics to be strengthened or developed. The results can also be considered by organisations as a starting point for growing their actual and prospective leaders.

1.5.1 Objectives

The objectives of this research are as follows:

- To identify what, if any, role the size of the company and team play in the desired Agile leadership characteristics of an ideal Agile leader.
- To identify if there exist any universal agile leadership characteristics the Agile software development community globally welcomes and acknowledges.

1.5.2 Research Question

The research question this paper focuses on is the following: what are the desired characteristics of the leader in an Agile software development team and in what way they relate to the size of the team and organisation?

1.6 Scope and Limitations

In this study, the phrase “Agile leader” or “Leadership in Agile” refers only to the leader of self-organising teams. The desired leadership characteristics are those important for the team to operate productively, in terms of the quantity and the quality of the software produced.

The organisation size in this research is determined by the number of employees and not by any other parameter, such as revenue or turnover. The culture of the organisation or the sector it belongs to are not taken in consideration although they can often influence the adoption of Agile methods, that in turn can affect how the team members look at the desired characteristics of the Agile leader.

This research is performed within the work on the master thesis, thus many choices regarding the methodology used, and the analysis performed were made taking in consideration the limited time and other resources available.

Another limitation is the author’s previous exposures to Agile leadership, introducing some subjectivity to the study. Previous experience with Agile and Agile leaders played a minor, but important role in creating the questions in the questionnaire.

The questions were provided in English language only. Although it could be assumed that the most of the software developers speak English, there is a limitation that some of them did not answer the questionnaire because of not having good command in English.

Factor analysis could have been used for reducing the number of variables obtained with eighteen characteristics for the leadership in Agile. However, this idea was rejected due to a rather week correlations among the variables and the lack of time.

1.7 Outline

The thesis is divided into five chapters and three appendices. The following chapter presents a review of the literature on Agile and Agile leadership practices. The third chapter is a description of the methodology, followed by the chapter presenting the results. In the last chapter, a discussion of the results is provided, together with possible future research directions and conclusions.

2 Related Research

2.1 Selection of Relevant Articles

To find relevant previous literature two main sources were used: the online library of Stockholm University and Google scholar. The main search keywords used were: Agile, leadership, characteristics and traits. After finding a high number of publications, the papers were filtered down to a reasonable size by reading their abstracts. Only highly relevant articles made it to the next stage, where they were further filtered based on their content.

The final shortlist included nine highly related articles, which will be presented next.

2.2 Overview of Previous Research

One of the most comprehensive, pre-Agile research about the effects of leadership characteristics on the employees' trust in their leader was carried out by Podsakoff, Mackenzie, Moorman and Fetter (1990). They identified the leader to be the **holder and disseminator of the vision**, through which increased optimism and respect can be achieved. The leader also needs to be a **role model**, who should act in line with the team's principles and values. As a third behaviour, they need to **seek acceptance of team goals** so that team members can work towards shared goals. Another desired behaviour is to **expect high-quality work** from followers to keep the standards high. The lead should also **provide support**, by caring about team members and treating them with respect. The last important trait was the leader to **stimulate** the followers' intellect, by challenging their ideas and the status quo at the same time.

Hoda, Noble and Marshall (2013) have carried out qualitative research by talking to 24 New Zealandian and Indian Agile practitioners to identify what leadership roles are present within a self-organising team. Their research reveals six leadership characteristics, which are the following: **mentor, coordinator, translator, champion, promoter** and **terminator**. The mentor helps the team adapt Agile principles initially, and helps the team become more self-organising and adhere to Agile principles. Coordinator is the person to manage customer collaboration and communicate customer expectations towards the team. According to the results, this role is usually not assumed by the leader of the team, but rather the product owner or business analyst. The same is true for the translator: this person is responsible for being the bridge between technical and business representatives; they do understand domain language and can transform it into product requirements. The champion makes sure to get buy-in from senior management, so the team can be in charge of their ways of working. This person makes sure the team is self-organising, without too much intervention from higher levels. The promoter makes sure to involve the client in the software development process as much as possible, helping the team stay self-organising. The holder of the terminator role identifies team members threatening the smooth working of the team and checks with senior management to remove such people from the group.

Bass (2014) conducted semi-structured interviews with 46 software engineers across eight companies and three continents (Europe, Asia and North America). It is important to mention that out of the eight companies considered, at least one was not doing Agile Software Engineering, and at least one seemed to call a traditional model Agile. In the context of these international companies with distributed teams, the author identifies ten crucial characteristics a Scrum Master should have a role of: **Scrum of Scrums facilitator**, **sprint planner**, **source code integration coordinator**, **learning coordinator**, **heartbeat** (progress) **monitor**, **process anchor** (Agile adoption coordinator), **task estimator**, **impediment**

remover, **spike process coordinator** and **test coordinator**. These findings are significant because the research focuses on how large projects can be carried out in a mostly Agile way. The study focuses on how several teams can work together and coordinate (scrum of scrums, source code integration) so that the work flows smoothly.

Parker, Holesgrove and Pathak (2015) described the research agenda for testing assumptions around self-organising teams and their leadership that is derived from selected published papers. They have identified the central leadership characteristics of self-directed teams to be the following: **guiding vision, organising teamwork and collaboration, establishing simple rules, light touch, sharing information, and agile "supervision"**. They emphasised that reiterating the vision has a hugely positive effect on team behaviour, as it could help make consistent decisions within the unit. Teamwork and collaboration heavily depend on the leader's ability to form good relationships with the team members; the leader needs to set moral standards and treat everyone with respect, to create a safe space for the team. Ensuring regular meetings are scheduled and carried out efficiently is also very important. Light touch and simple rules closely relate to each other: the leader needs to establish enough control mechanisms to keep the team running but must not try to implement command and control measures. They claim that self-organising teams perform worse under micromanagement, so the leader needs to give as much freedom to the team as possible. Information sharing helps team members be on the same page and understand the work they need to deliver. The leader also acts as a supervisor of Agile values, keeping an eye on core agile principles to be incorporated into the team's daily life.

Matturro, Fontán, and Raschetti (2015) carried out interviews with 25 Uruguayan Scrum software practitioners from all three Scrum roles: Scrum Masters, Product Owners and Team members. Their research focused on what are the most desired Scrum Master and Product Owner soft skills as seen by other Scrum Masters, Product Owners and Team Members. They utilised somewhat broad categories for identifying desirable soft skills - for example; they used interpersonal skills as a single category. When it comes to Scrum Masters, the following soft skills were identified as relevant by the representatives of all three roles: **commitment**, **communication skills**, **interpersonal skills**, **planning skills**, **teamwork**. Representatives of the different roles perceived essential Scrum Master traits differently: Team Members identified **leadership** as a desired characteristic; Product Owners were expecting good **planning skills**, while Scrum Masters thought **motivation** was a trait necessary for their role.

Kautz, Johansen, and Uldahl (2016) carried out a case study on a department of a mid-sized company, by interviewing 11 Scrum practitioners. The exciting aspect of this research is that it was carried out in a department that recently transitioned from a traditional method to Scrum. This study did not focus on the Scrum Master role itself but took a broader view of leadership in general, when it comes to Scrum. The research identified six general Scrum leadership related characteristics: **team building and internal conflicts solving**, **staff shielding**, **reducing external conflicts**, **team motivation**, **ensuring learning** and **providing technical direction**. This study is unique from the point of view that it takes into account technical leadership besides soft skills. Another significant finding of the research is that the informants perceived the most considerable change in shielding the team since the transition from Waterfall. This suggests that the team felt much better protected while using Agile than utilising traditional methodologies.

Srivastava and Jain (2017) conducted qualitative research to identify general characteristics of leaders in self-organising teams. This research resulted in seven characteristics identified: three related to task-level and four to relationship-level. The resulting traits were: **taking decisions, communicating and committing to tasks, people-centricity, maintaining cohesion, facilitating** and **being open and**

transparent. Taking decisions is essential, so the continuous flow of work never stops, and the team will never get blocked. The team leader should facilitate open and efficient communication, especially when the unit is virtual, so information can freely flow. Commitment to tasks relates to delivering the scope of the work agreed, and the leader should strive to deliver that workload. High team cohesion results from establishing great work relations, with a frequent appreciation of good work, and can result in increased project success and product quality. As a facilitator, the leader needs to act as a coach and to remove impediments from the team's way. Openness and transparency should result from frequent feedback loops, fearless communication and ideas sharing, the team being a safe environment for everyone.

Yilmaz, O'Connor, Colomo-Palacios, and Clarke (2017) carried out a case study in the context of a mid-sized software development company, to identify desired characteristics of software development team members. They based their research on the Big Five personality traits and identified thirty significant characteristics divided into five big themes: **Neuroticism**, **Openness**, **Agreeableness**, **Extroversion** and **Consciousness**. They interviewed both Agile and traditional teams and found that although Agile teams possess a higher level of extroversion, high performing teams exhibit a balanced mixture of the main characteristics. An impressive result, however, was that not all the personality traits were represented equally in the software company in which the research was carried out. It is worthwhile to note, though, that this research focused on team members and not leaders of the teams in the context of both self-organising and traditional teams.

Previous research does not only describe success cases when it comes to transitions from Traditional Models to Agile Methods. Moe, Dingsøyr and Dybå (2010) described a case when a Scrum team was not able to take full advantage of the new methodology. They showed how the Scrum Master overreacted in cases when the team members reported problems, resulting in team members keeping quiet, reducing communication efficiency and transparency. The Scrum Master was also unable to organise teamwork in a self-organising way: team members were working alone, exhibiting an unusually high degree of autonomy. The Scrum Master was taking reports from the individual developers, implementing a management style instead of an open communication atmosphere. As a result, team members were not talking to each other, making Scrum less useful and productive.

2.3 Characteristics of Agile Leaders

In the context of the aim and the research question of this study, the literature review presented in the previous section can be used to define the characteristics of an Agile leader.

Of the nine publications described, not all were used to extract the characteristics of Agile leaders. The selection criterion for a certain study to be included was to focus on the leader or leadership of a team practising some Agile development method. Table 1 shows which publications were selected and which ones were not. Besides the column with the identification number of the article, there is a column showing the names of the authors and the year of publication and a column where "Yes" indicates the articles selected for consideration, while "No" those that are not considered. The last column in the table explains why a particular publication was or was not selected.

No.	Author(s)	Selected (Yes/No)	Notes
1	Podsakoff, Mackenzie, Moorman, Fetter (1990)	Yes	Although the article does not focus on Agile teams (as the article is pre-Agile), its establishes a baseline for further research.
2	Hoda, Noble, Marshall (2013)	Yes	This article presents characteristics of the Scrum Master and Product Owner. The two characteristics related to Product Owner are not considered.
3	Bass (2014)	No	The article does not focus on Agile teams in particular.
4	Parker, Holesgrove, Pathak (2015)	Yes	The article is focussed on Agile teams and Agile leadership.
5	Matturro, Fontán, Raschetti (2015)	Yes	Agile leadership characteristics are discussed for Uruguayan Agile practitioners.
6	Kautz, Johansen, Uldahl (2016)	Yes	The article is focussed on Waterfall – Agile transition and the positive aspects of the change including needed traits of the agile leaders are discussed
7	Srivastava, Jain (2017)	Yes	The research is focussed on Agile leaders, establishing necessary leadership traits.
8	Yilmaz, O'Connor, Colomo-Palacios, Clarke (2017)	No	The article does not focus on Agile leadership.
9	Moe, Dingsøyr Dybå (2010)	No	The article does not focus on the team leader, it considers the full team.

Table 1 The list of relevant publications used/not used in identifying the characteristics of an Agile leader.

The publications in Table 1, with "Yes" in the column "Selected" were used to identify characteristics of Agile leaders, and behaviours in the referred articles. Some of these characteristics are essentially the same, however, have alternative names in different publications.

Table 2 lists 18 characteristics for Agile leadership. Next to each characteristic a reference number to Table 1 is indicated in parentheses; the number refers to the publication that discusses this characteristic. In the same way, the last column in Table 2 shows the alternative name(s) of the characteristic as used in another publication(s) from Table 1.

No.	Characteristic	Alternative names
1	Visionary (1)	Guiding vision (4)
2	Role model (1)	-
3	Goal acceptance seeker (1)	-
4	Work organiser (4)	Planning skills (5), coordinator (2), task commitment (7)
5	Quality of work enforcer (1)	-
6	Decision maker (7)	-
7	Technical lead (6)	-

8	Team worker (5)	-
9	People-centric (7)	Supporter (1), interpersonal skills (5)
10	Stimulator (1)	-
11	Communicator (7)	Information sharer (4), communication skills (5), openness and transparency (7), collaborator (4)
12	Terminator (2)	-
13	Motivator (6)	-
14	Team shield (6)	-
15	External conflicts solver (6)	-
16	Team cohesion establisher (7)	Team builder (6)
17	Simple rules establisher (4)	Light touch (4)
18	Facilitator (7)	Mentor (2), agile supervisor (4), learning insurer (6)

Table 2 Leadership characteristics identified by previous research

3 Methodology

3.1 Research Strategy

According to Denscombe (2014), a research strategy has to be suitable, feasible and ethical. He sets out numerous possible approaches, like surveys, case studies, phenomenology and grounded theory. For this research, survey has been selected, as it was deemed to be a suitable research strategy: it allows the collection of opinions of team members about Agile leaders in a rather quick and economic way (Randolph, 2008). This strategy has already proved successful in case of leadership-related research (in different domains) by Van Dierendonck et al. (2017) and Gurley, K. & Mendiola, B. (2016).

Some of the research presented in the previous chapter used case study as a research strategy. However, this research was interested in the opinions of Agilists working in companies and teams of different size. Hence a case study could not have been an option. It would have required selecting of a single software engineering company with Agile practitioners, the employees, being selected as informants. That way the research would have generated very accurate data, however, within the context of a single company only. This approach, was not deemed appropriate, as the study had a particular interest in collecting answers from Agile practitioners at organisations and teams of different sizes.

3.2 Data collection method

Two suitable methods were identified to obtain useful information for answering the research questions: interviews and questionnaires, as these could enable access to a larger pool of Agile practitioners from different companies and teams. Both of these methods have positive and negative aspects attached to them. Interviews, for example, could offer a deeper insight into respondents' reasoning, while the time to conduct enough of them is much longer (finding the right people, carrying out the interview itself, coding). Questionnaires, on the other hand, can reach a much higher number of Agile practitioners, even in a limited time. However, the resulting information may yield less background information, as there is no possibility for follow-up questions. Questionnaires have proved successful in case of the Multifactor Leadership Questionnaire (Bass & Avolio, 1990) and Authentic Leadership Questionnaire (Walumbwa, Avolio, Gardner & Wernsing, 2008).

Given the timeframe of this research, out of the two possible choices, the method of using questionnaires has been selected. This decision was motivated by the following: the study aimed at finding specific leadership behaviours, it was necessary to have a relatively high number of respondents, and there was no need for a very detailed understanding the background of a response (Johannesson, & Perjons, 2012). Even though interviews, in theory, could have resulted in a richer data set, with much more background information (Denscombe, 2014), this was not a top priority for this study. It would not have been possible to conduct enough interviews with a variety of Agile practitioners living in different countries, while obtaining the necessary information and the data processing would have taken an extended time.

Since this study aimed at taking answers from Agile practitioners from different companies, who can be living in different countries or even continents, a web-based questionnaire was deemed to be an appropriate data collection method. Web-based questionnaires can reach a broader range of Agile practitioners; people from different countries can be surveyed, and they tend to yield more information than paper-based counterparts. However, as a downside, they have the possibility of being answered by respondents with a limited amount of knowledge (Randolph, 2008). To try to minimise this issue, a

screening question has been introduced to ask about the informants' background in Agile. This was necessary, as all software engineers use the Internet (thus they can all have access to the questionnaire), but due to the limited knowledge in the field, their responses would have skewed the resulting data.

An alternative to this approach could have been a paper-based questionnaire, where carefully selected informants could have been requested to fill out the survey. This option, however, was not considered in the end, given the overhead in terms of time and money, the lack of sampling frame defining addresses, and the fact that software developers mostly prefer online communication.

When it comes to the format of the questions, a choice between open-ended and closed-ended questions had to be made. Open-ended questions can yield better insight into the preferred leadership behaviours; however, their results are harder to summarise. Closed-ended questions significantly limit the chance to influence the participants, and their outcome is more manageable to discuss and summarise (Johannesson, & Perjons, 2012). Since it was desired to minimise misunderstandings and get responses to the very same questions from all the respondents, closed-ended questions have been utilised in the survey. As shown by Hlebec, Reja, Vlozar and Vehovar (2003), results to close-ended questions are more straightforward to code and produce more cohesive results. Knapp and Heidingsfelder (2001) analysed drop-out rates for open and close-ended questions and found that close-ended ones yield a better response rate. Hence, the author considered this type of questions to be the most appropriate for this research.

3.3 Questionnaire Design

As mentioned earlier, the research heavily relied on close-ended questions. Even though already validated questionnaires exist for measuring different leadership behaviour (for example, the Multifactor Leadership Questionnaire, Bass & Avolio, 1990)), those could not be utilised as they do not focus on Agile software development, and do not take specifics of this domain into account. As a consequence, a questionnaire based on Table 2 from Chapter 2 has been built.

The questionnaire consisted of 24 questions in total. This rather low number was a deliberate choice, as Fan and Yan (2010) have pointed out that a long survey negatively impacts the response rate. Out of these 24 questions, all were closed-ended ones, tracking ordinal and nominal data.

A screening question was presented first, to make sure answers are collected from Agile practitioners. The next questions were requesting data about the informant's gender, role, residence, company and team size, and the importance of the eighteen specific leadership traits identified by previous research. Informants were asked to take into account an ideal Agile leader (ideal for the team and company size they operate in) when grading those behaviours. In this section, the informants were asked to rate every behaviour on a scale from 1 to 7: the value 1 represented "No importance" while 7 "Extremely high importance". The middle of the scale (4) was defined as "Moderate importance" and was meant to express neutrality. The respondents were free to assign the same numeric value to two or more different leadership traits; there were no constraints whatsoever. Selecting a scale of seven was not a random choice: Preston and Colman (2000) found that scales with 7-10 steps generated the most reliable scores, while scales with 5, 7 and 10 steps were the easiest to use. Since a scale of ten would have been an overkill for this research, a scale of seven has been selected.

The questions were formulated in a way to be simple to understand and not influencing in any form. The entirety of the questionnaire is available in Appendix B.

The questionnaire was designed in a way not to ask for more information than needed for the research (Denscombe, 2014). All the questions yielded important data for the study and had practical relevance to the final results.

Google Forms was used as a means of recording data, as the survey was easily distributable, using a single, permanent link to the questionnaire. Google Forms is a tool most people know about, surveys can be filled out without registration, and the layout of the forms is simplistic and intuitive, it was a good choice for driving up response rate.

3.4 Participants and Sampling

The first step in selecting a sampling method was to define the target population of the survey. The target population consisted of the Agile practitioners from all software engineering domains (financial services, telecommunications, or publishing, to name a few) and was not limited to a single physical space (one company or one country).

The first task was to choose between two main sampling methods: probabilistic and non-probabilistic sampling. In case of probabilistic sampling, every single member of the target population has a known, non-zero probability to be included in the sample. This method has the advantage that it eliminates subjectivity, and results in very low bias and high representativeness (Kitchenham, & Pfleeger, 2002). As per Denscombe (2014), probabilistic sampling can only be an option when the target population is known well in advance, there is an available sampling frame, and random selection of the participants is utilised. Since there is no exact list of Agile practitioners maintained anywhere (e.g. there is no sampling frame of the target population), requirements for probabilistic sampling could not be fulfilled, and as such, it was not an option for this research.

Non-probabilistic samples are created when the informants are chosen because of their availability, or because the researcher believes they are representatives of the target population (Kitchenham, & Pfleeger, 2002). This sampling method is more prone to bias, and the samples are not representative. However, non-probabilistic sampling was the only feasible method for this research, as the target population is a very specific one (Agile practitioners) and its members are not trivial to identify (Kitchenham, & Pfleeger, 2002). This research strategy has already proved successful in different contexts and industries. Kumar and Govender (2016) used it with students implementing software projects in an Agile way. Kelidbari, Fadaei and Ebrahimi (2016) used it when researching servant leadership in the context of a university of medical sciences. Teklemariam and Mnkandla (2017) also utilised non-probability sampling for evaluating project management practices in Ethiopia.

Many LinkedIn and Facebook groups are organising around the topic of Agile software development – as a first step, the permanent link to the questionnaire was posted to these forums, asking their members to fill it out.

Additionally, as the researcher has been in the software industry for almost ten years now, some internal mailing lists could be utilised for obtaining a larger number of respondents. This strategy in reaching the respondents, in essence, corresponds to convenience sampling strategy that runs counter to the rigour of scientific research (Denscombe, 2014). Nevertheless, in case a decent number of responses, usually when more than 30 responses are valid, the non-probabilistic sampling can produce data that are sufficiently accurate for the research. This study uses the demographic data to analyse the structure of the sample aiming to check to what extent the sample is representative of the targeted population

3.5 Data Analysis

The first part of the data analysis usually consists of organizing the data collected. In case of this research, this was done by coding the descriptive data into numeric ones, and by categorising the answers obtained into four different categories, by the organisation size, and by the team size. The questionnaire used for the research collected nominal and ordinal data where the resulting answers are non-overlapping categories hence it was rather straightforward to make the categorisation. Also, all responses needed to be checked for any missing answers.

Descriptive analysis was used for the demographic data from all respondents, regardless of the category they belong to, to check if there is a resemblance between the sample and the target population.

The next step was the analysis of eighteen Likert-type questions about the importance of different characteristics of the Agile leaders. There are different analysis approaches of the data obtained with Likert-type questions. One school suggests that the relative magnitude and distance between two responses cannot be considered equal and therefore the variable is of ordinal type. Another school states that the aim of the researcher is to combine similar items to generate a composite score for the participants implying that by doing it the resulting variable is of interval type (Joshi, Kale, Chandel & Pal, 2015). Because different characteristics of the Agile leader are respected, summarising any items into a composite score is not suitable without performing factor analysis. This kind of analysis was out of scope for this research. Hence the eighteen identified variables have been analysed as ordinal data. According to Jameison (2004), it is appropriate to analyse such data as ordinal values, and as such, this was the approach taken for this study.

The statistical analysis consisted of several phases: 1) presenting the facts resulting from the data collected, 2) looking for the patterns and connections among the variables, 3) selecting the Kruskal-Wallis test as appropriate statistical test 4) presenting and interpreting the outcomes from the test.

Resulting data was visualised using stacked bar charts, while statistical correlations were documented using the resulting tables from the Kruskal-Wallis test. This is also documented with descriptive text, detailing their meaning and their relevance.

The following tools were used to produce the analysis mentioned above:

- Google Forms for categorising the data and for creating the bar charts
- SPSS for the statistical tests

3.6 Ethical considerations

Throughout the data collection phase, the four principles set out by Denscombe (2014) were kept in mind:

1. **Protection of participants' interests**: No ethical risks of this nature have been identified throughout this research. Since there is no possible physical or psychological harm associated with filling out questionnaires, there were no ethical considerations of this sort necessary. The questionnaire tracked no respondent-identification data or another type of sensitive information, as such, data leakage was not a concern.
2. **Voluntary participation**: no participant was forced to take part in the research. The respondents were informed about the purpose of the research and were presented an informed consent form (see Appendix A). All participants agreed to take part in the research and accepted that their

responses would be used for investigational purposes. All answers recorded throughout the research were treated confidentially, and participants were made aware of that by the consent form.

3. **Openness and honesty**: all participants were given information on the topic and purpose of the research.
4. **Lawfulness**: there was no legal concern associated with this research. Sensitive (or even respondent identifying) data were not collected, informants' IP addresses were not tracked, and responses could not be linked back to respondents.

These principles were implemented throughout this research and the participants were made aware the researcher obeyed to all of them through the consent form presented at the very beginning of the questionnaire, shown in Appendix A as a part of the questionnaire. All respondents had to accept this form before proceeding with answering the questions.

4 Results

4.1 Data collection and analysis

The first step in the data collection process was to select virtual groups of software developers and place the link to the questionnaire to these forums, asking their members to fill it out. These groups were the following:

- LinkedIn: Agile developers, Agile and lean software development, Scrum Practitioners
- Facebook: IT Professionals, Scrum master growth community, Scrum

Additionally, the questionnaire was circulated using other channels: company-owned distribution lists (Inspired Gaming in the United Kingdom, Ericsson in Hungary) and physically approaching Agile software practitioners (author's colleagues and acquaintances). The survey was open for a bit over a month, between mid-April and May of 2018. The questionnaire was set not to accept responses once no further fills were obtained for five consecutive days.

As mentioned before, Google Forms was used as a tool for designing and managing the questionnaire and collecting responses. Once the survey was inactivated and data collection was deemed to be complete, data were downloaded in .csv format, and subsequently imported into SPSS for efficient and fast data processing.

The first step of the data preparation was to code the descriptive data into numeric values, as the dataset contained string-based answers, e.g. "Moderate importance" for leadership characteristics related variables, "1-3" for team size, or "5000+" for company size. The strings were coded as numbers and new variables were created. The level of importance associated to each characteristic of an Agile leader became an integer in the range of 1-7, while the four different strings used for the team and the organisation sizes resulted in integers in the range of 1-4. Old variables with string data were kept as well for safety.

In total, 166 Agile practitioners have filled out the questionnaire from over 20 different countries and four different continents. This number does not contain the respondents who indicated they were not practising any form of Agile software development. Those answers, due to their low relevance to this research, were removed from the dataset. The remaining records were analysed for missing values, but they turned out to be complete, so no further entries had to be removed from the dataset.

An important decision was to pick between a parametric or non-parametric test. To make that choice, data were analysed for distribution using SPSS, as parametric tests are only accurate when data is distributed normally, while non-parametric tests do not require normal distribution (Qualls, Pallin & Schuur, 2010). After running the normality check in SPSS, it was observed that most of the data were not following a normal distribution. An example result can be seen in Table 3, where the dependent variable "Team worker" was analysed against factor lists of "Company Size" and "Team Size". As it can be seen, none of the cases exceeded a significance level of $\alpha=0.05$, and as such, the conclusion of non-normality was drawn.

	Company Size	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Team Worker	1.00	.190	39	.001	.896	39	**.002**
	2.00	.230	56	.000	.882	56	**.000**
	3.00	.193	23	.027	.874	23	**.007**
	4.00	.239	48	.000	.876	48	**.000**

a. Lilliefors Significance Correction

	Team size	Kolmogorov-Smirnov[a]			Shapiro-Wilk		
		Statistic	df	Sig.	Statistic	df	Sig.
Team Worker	1.00	.234	17	.014	.810	17	**.003**
	2.00	.207	59	.000	.906	59	**.000**
	3.00	.169	61	.000	.902	61	**.000**
	4.00	.217	29	.001	.884	29	**.004**

a. Lilliefors Significance Correction

Table 3 Result of tests of normality for "Team Worker"

4.2 Demographics

Out of the 166 respondents, only as few as 24 (14.5%) were female, while the overwhelming majority, 142 (85.5%) were male. These figures align very well with UNESCO's findings on the split between male and female computing professionals in Europe (most of the respondents indicated they were residing within the EU). According to their report, in the European Union only 17.2% of all computer scientists were female in 2018 ("Girls and women under-represented in ICT", 2018). According to Denscombe (2014) surveys with sufficiently high number of respondents allow for result generalisations – with these percentages in the population matching so well, this opportunity is particularly promising.

The informants were working across all the Agile roles: the majority, 61.4% indicated their job was team member, 15.7% were Scrum Master, 4.2% Product Owner, 2.4% Project Manager, while 14.4% indicated a custom role, falling into the "Other" category. The respondents were from 20 different countries (across four continents, with a strong over-representation from Europe) with the most responses received from Hungary, the United Kingdom and Romania, respectively. The full list of countries the survey reached can be found in the appendices.

The resulting data represented a reasonably good mixture of company and team sizes. 23.5% were employees of companies with 0-100 people, 33.7% of the respondents were working in companies of size 101-1000, 13.9% in companies with 1001-5000 employees, while the remaining 28.9% in companies with more than 5000 employees. Team size-wise the split was the following: 10.2% were working in small, 1-3 people teams, 35.5% were part of 4-6 people teams, the majority, 36.7% were working in teams of 7-9, while the remaining 17.5% were part of very large, 9+ people teams.

4.3 Descriptive statistics

Descriptive statistics was used to develop an initial, overall understanding of how the respondents - from organisations and teams of different sizes - think about the importance of different leadership characteristics presented in the questionnaire. Table 4 shows the numbers of respondents in each category.

Organisation size	**0-100**	**101-1000**	**1001-5000**	**5000+**	**All**
Number of responses (%)	39 (23.5%)	56 (33.7%)	23 (13.9 %)	48 (28.9 %)	166 (100%)
Team size	**1-3**	**4-7**	**7-9**	**9+**	**All**
Number of responses (%)	17 (10.2%)	59 (35.5%)	61 (36.7%)	29 (17.5%)	166 (100%)

Table 4 Number of responses according to the organisation size and the team size

To visually represent the data, two stacked bar charts were created for each characteristic. The next sub-sections present the charts for the characteristics which follow an interesting pattern from the standpoint of the frequency distributions. All the other charts, not presented in this chapter, are available in Appendix C.

4.3.1 Visionary

Informants were presented a description of this characteristic as someone who has a vision of the team's future. This characteristic incorporates the ability to come up with a plan to get the team from one stage of maturity to another one and to present and reiterate a compelling view of the future; it does not, however, include following through that plan.

As an interesting result (although this trait received some "rather not important" answers), none of the informants indicated this characteristic was not important at all (that is, nobody chose "no importance").

One particularly important aspect about this characteristic was how the percentage of "Extremely important" grew with the team size. For very small teams (1-3 members) the percentage of that answer was only 5.88%, which increased to 10.17% for teams of size 4-6. For the next team size category (7-9 people) the percentage had almost doubled, reaching a level of 19.67%, while for the largest teams (9+ members) it reached 27.59%.

Overall, the percentage of the respondents who thought this characteristic was rather important grew steadily with the increase of the team size, however, it somewhat dropped for the team size of 9+ people.

When considering the company size, no such pattern could be observed. An interesting finding was that very small (0-100 people) and small companies (101-1000 people) appreciate this characteristic the most: 87.18% of the respondents from the former and 87.5% of the latter category said it was a rather important characteristic.

According to the results, being visionary is the least appreciated in companies with 1001-5000 employees: 8.7% of the respondents indicated this characteristic was a rather unimportant one (with 3.45% saying it has low importance), while only 78.26% thought it was a rather important one.

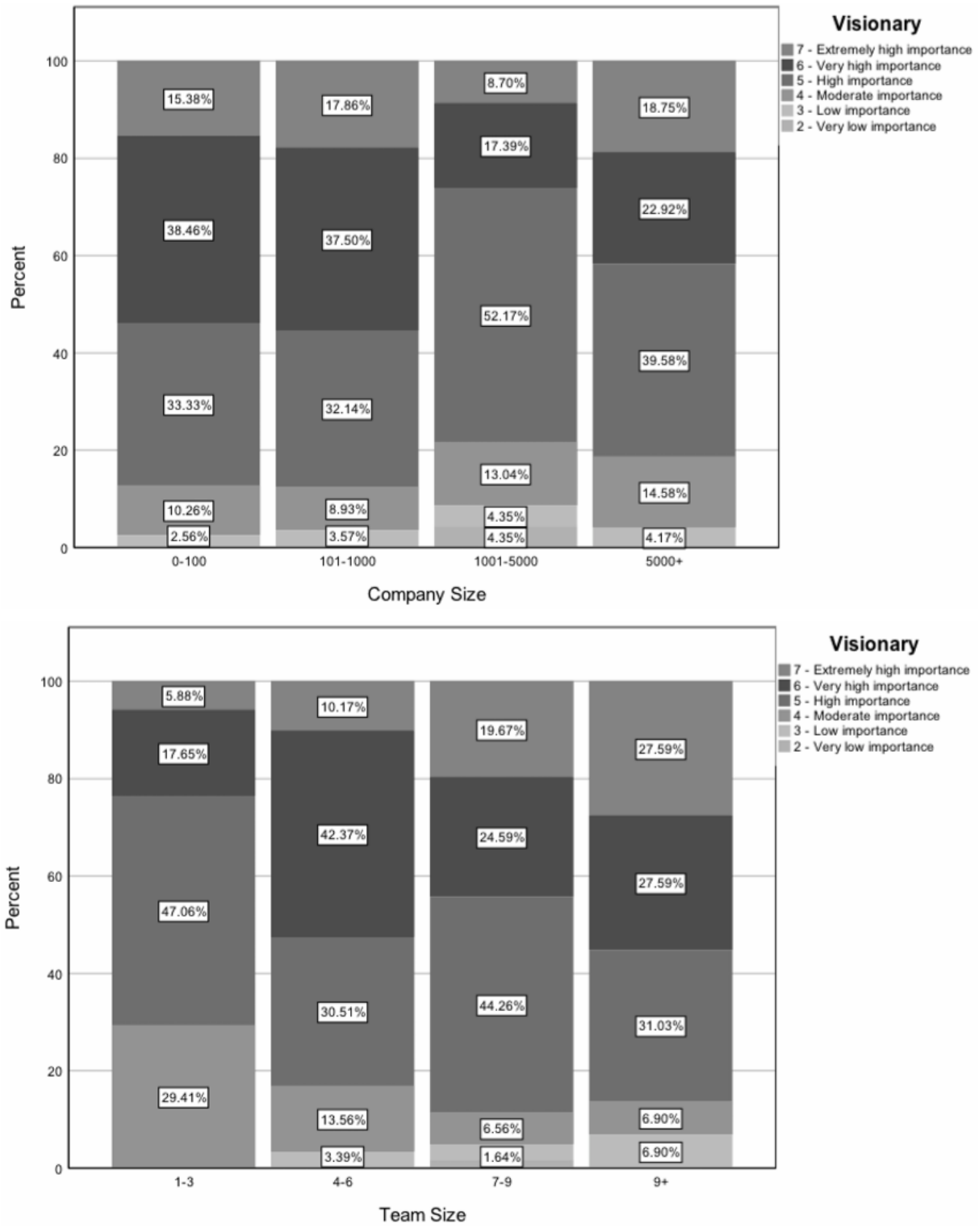


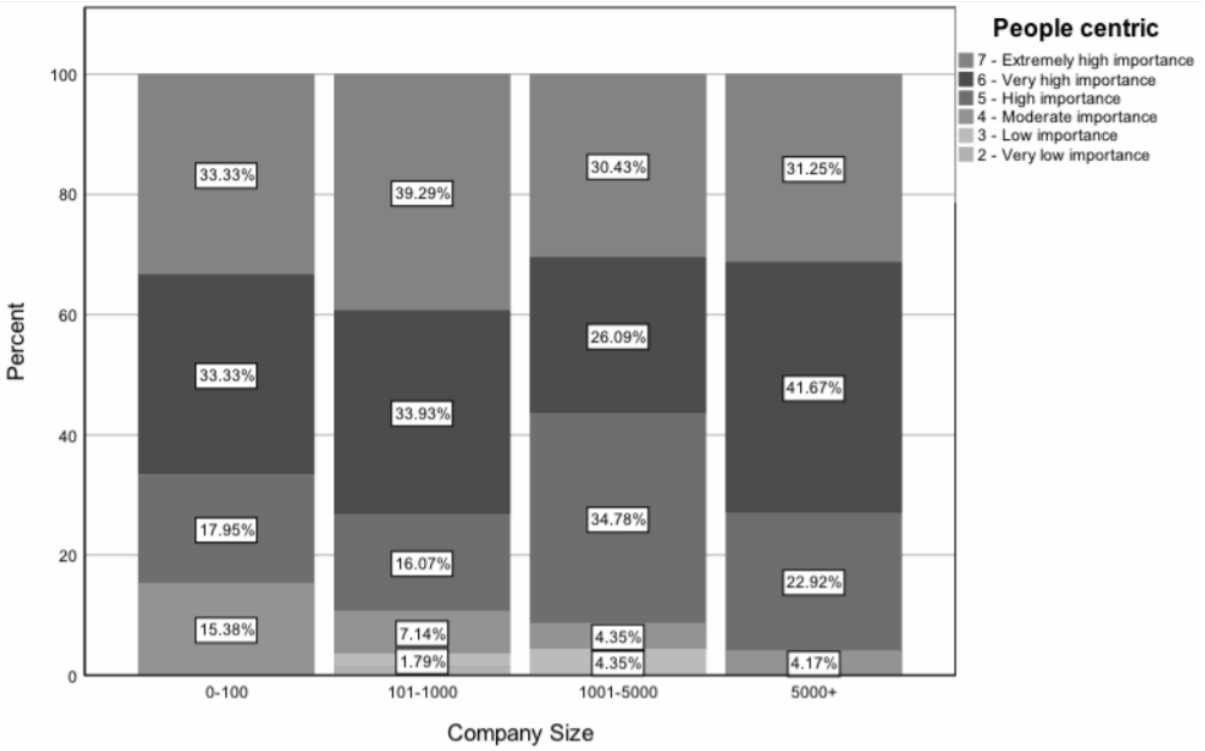
Figure 1: Visionary –distribution of importance for different company and team sizes

4.3.2 People-centric

The people-centric related question tried to investigate the importance of the leader to get along well with the members of the team on a more personal level. This characteristic included listening to people's problems as they arise, and, in general, caring about team members.

Just like in case of the visionary characteristic, none of the respondents thought being people-centric was not important at all. An interesting tendency can be observed for people centricity when company size is taken into account. The percentage of the respondents who think this trait is rather important increases together with the organisation's size. For small companies (0-100 people), 84.62% of the respondents considered this characteristic a rather important one (High, very high and Extremely high importance combined). In case of companies with 101-1000 people, this percentage increased to 89.29%. An even higher result, 91.3% was measured for companies with 1001-5000 employees, while 95.83% of the informants working for large companies (5000+ people) considered this trait rather important.

When it comes to team size, the perceived importance of this characteristic was growing together with the team size for the first three categories (70.59%, 89.29% and 91.3%, respectively). However, for teams larger than nine people, the desirability of this trait dropped to 84.023% breaking the tendency.



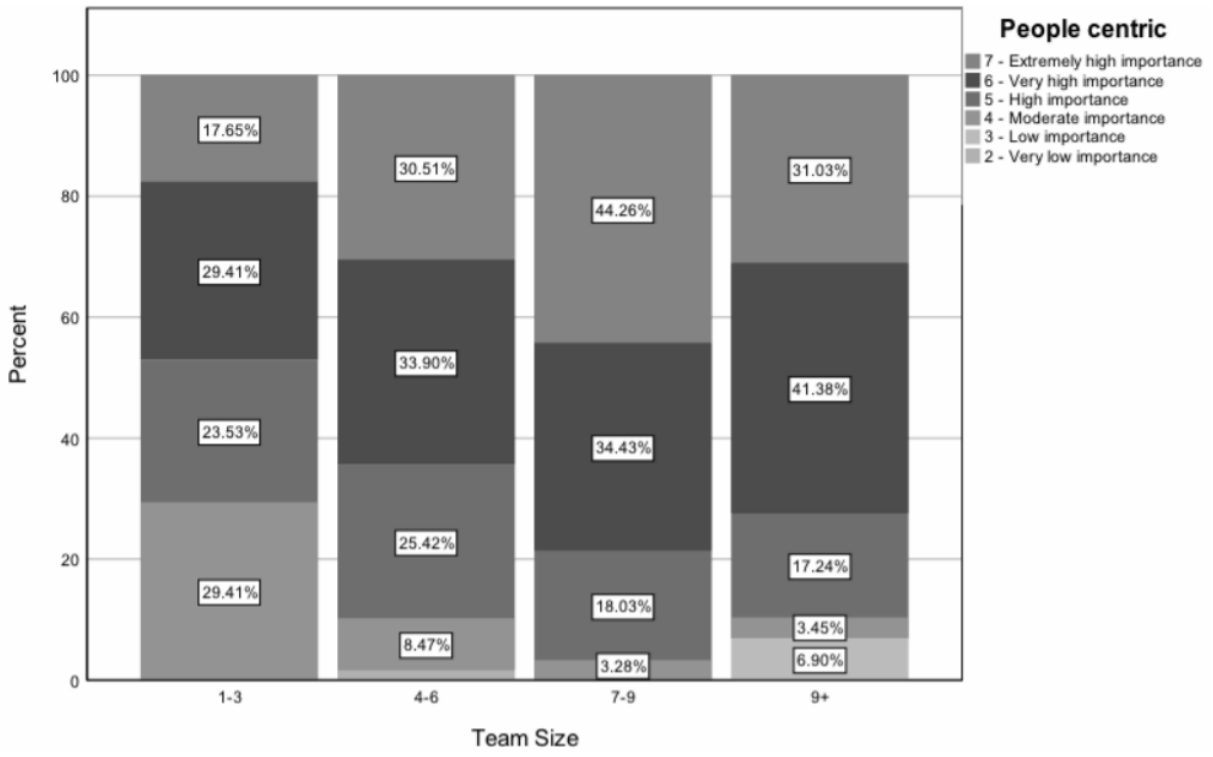


Figure 2: People-centric – distribution of importance for different company and team sizes

4.3.3 Communicator

A next measured variable was the importance of good communication when it comes to ideal leaders of Agile teams. The respondents had to indicate the importance of open and honest communication, that can facilitate fearless discussions within the Agile team. Since Agile ways of working are revolving around frequent and fair communication, it was expected this trait to receive high appreciation from the members of the community.

Communication was the only variable measured where none of the informants indicated no, very low or low importance. Although only a very few informants have indicated moderate importance for communicator, a rather counter-intuitive tendency could be observed when company size was taken into account. As the company size increases (e.g. as more and more people get involved in the discussions) the perceived importance of communication decreases slowly, but steadily. In case of the smallest companies (0-100 employees), 97.44% of the informants indicated that communication was a rather important trait. For companies with 101-1000 employees, this number decreased to 96.43%. For the next two categories (1001-5000 and 5000+ employees) the measured percentage levels were 95.65% and 93.75% respectively. Despite this decrease, the measured importance of communication, overall, was the highest across all the characteristics.

Another interesting finding was to see teams of which size appreciate communication the most. Surprisingly, more informants from teams composed of 7-9 people indicated a slightly higher importance (98.36% said it was rather important) than the ones from 9+ people (96.55%). Respondents belonging to teams of 4-6 people also indicated less importance of this trait (93.22%) than peers from teams of 1-3 (94.12%). According to these answers, it seems like the importance of communication is not directly proportional to the number of team members.

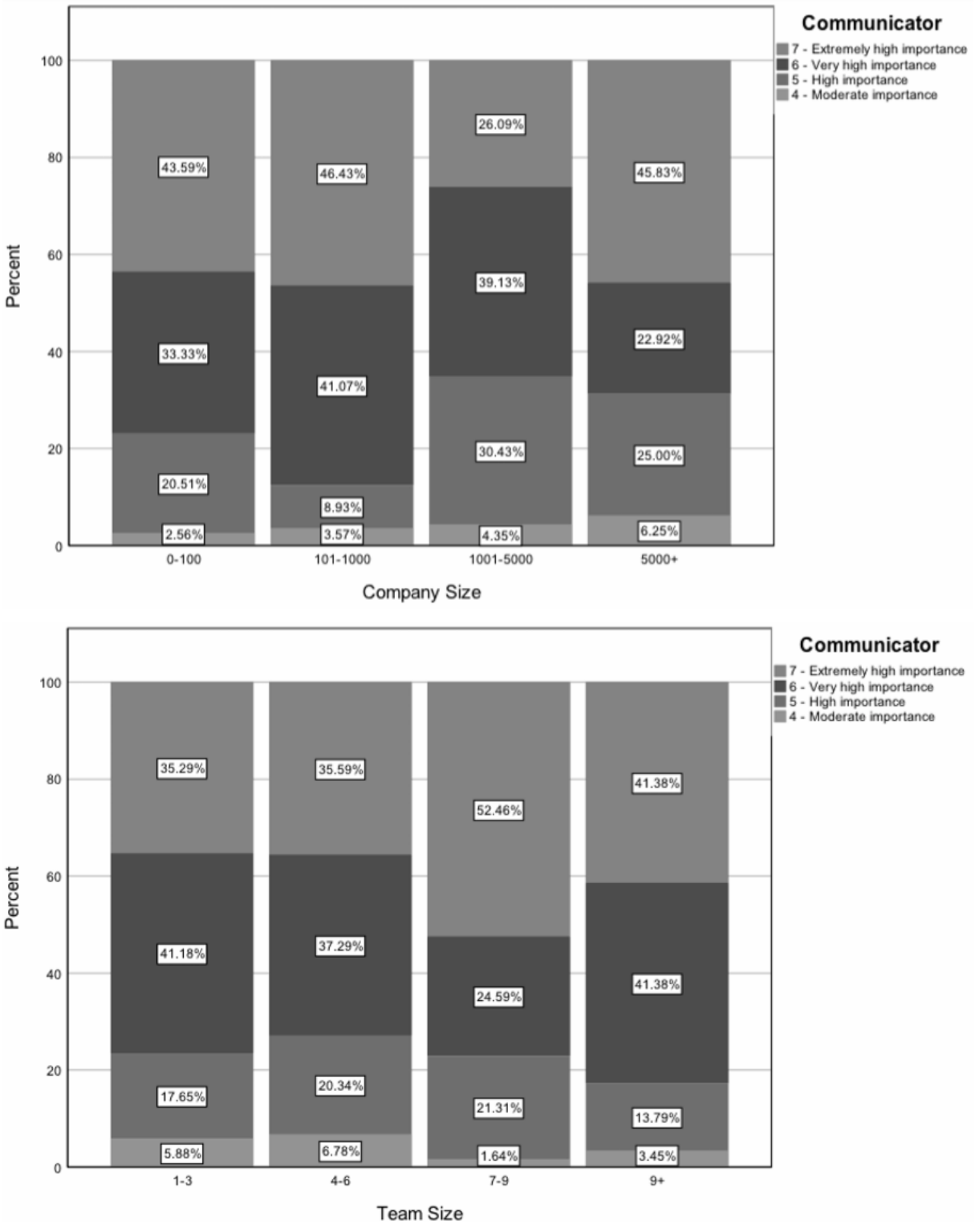


Figure 3: Communicator – distribution of importance for different company and team sizes

4.3.4 Terminator

The "Terminator" characteristic was meant to capture the ability of a leader to identify those team members who cannot live and work by the Agile values and escalate the problem to the higher management to remove those members from the team. Some informants expressed their concern regarding this leadership behaviour, mentioning it was a too harsh approach, and this characteristic

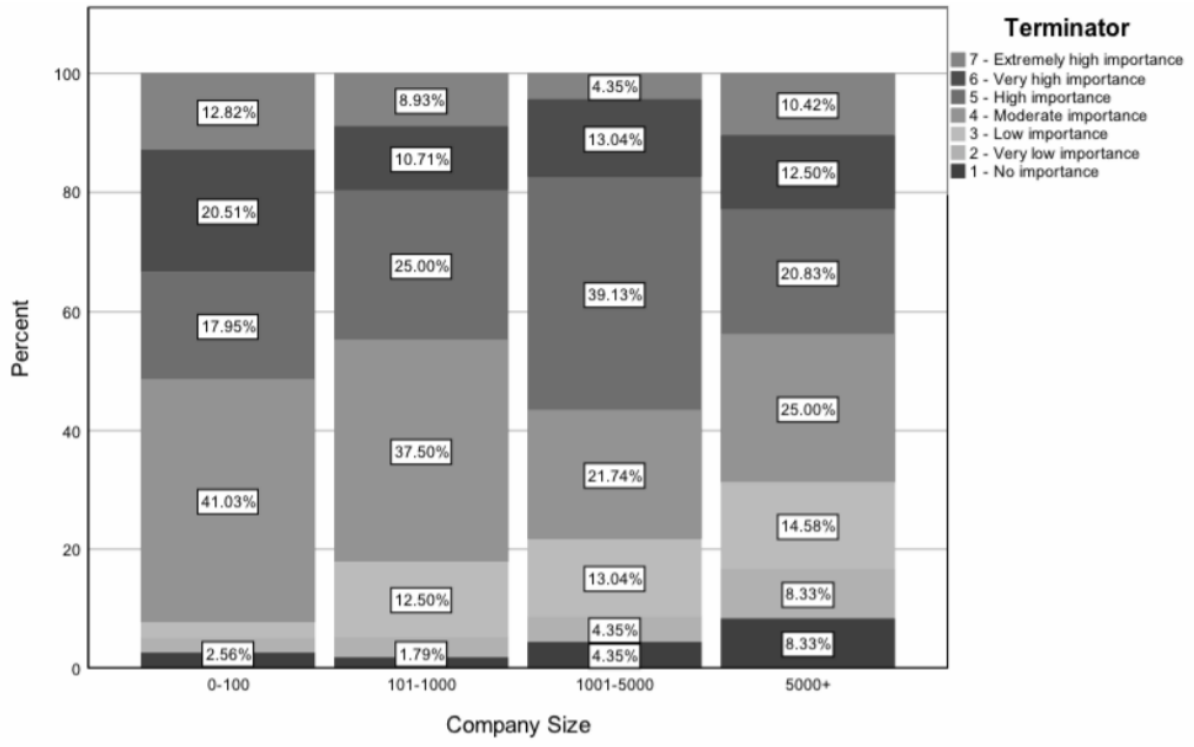
should only be exercised as a last resort. Some respondents even mentioned this trait was not very well aligned with Agile values.

The result for this characteristic is a partly intuitive one: as the size of the company increases, the number of people who think it is a rather unimportant trait increases monotonically. This was somewhat expected: as the size - and the number of HR rules - of the organisation grows, it gets continuously harder to remove people from a team. The percentage number of the informants who considered this trait was a rather unimportant one was 7.69%, 17.86%, 21.74%, 31.24% respectively.

Even though less appreciated than most of the other characteristics, many of the respondents still indicated it was a desired one. People working for companies of 1001-5000 employees indicated the highest perceived importance: 56.52% of those informants thought this characteristic was a rather important one for Agile leaders.

On the team level, as the size of the group grows, so does the number of people who think this trait has no importance whatsoever (e.g. chose “No importance”). There were no informants from small teams (1-3 members) who indicated no importance, which grew to 3.39% for teams of 4-6 members. For the last two categories (7-9 and 9+ team members) the results were 4.92% and 6.90% respectively.

The highest importance on team level was recorded for groups of 9+ members: 58.62% of those informants considered it a rather important characteristic, followed by teams of 1-3 members (52.94%). The next in line were teams of 7-9 members (49.18%), and 4-6 members (38.98%)



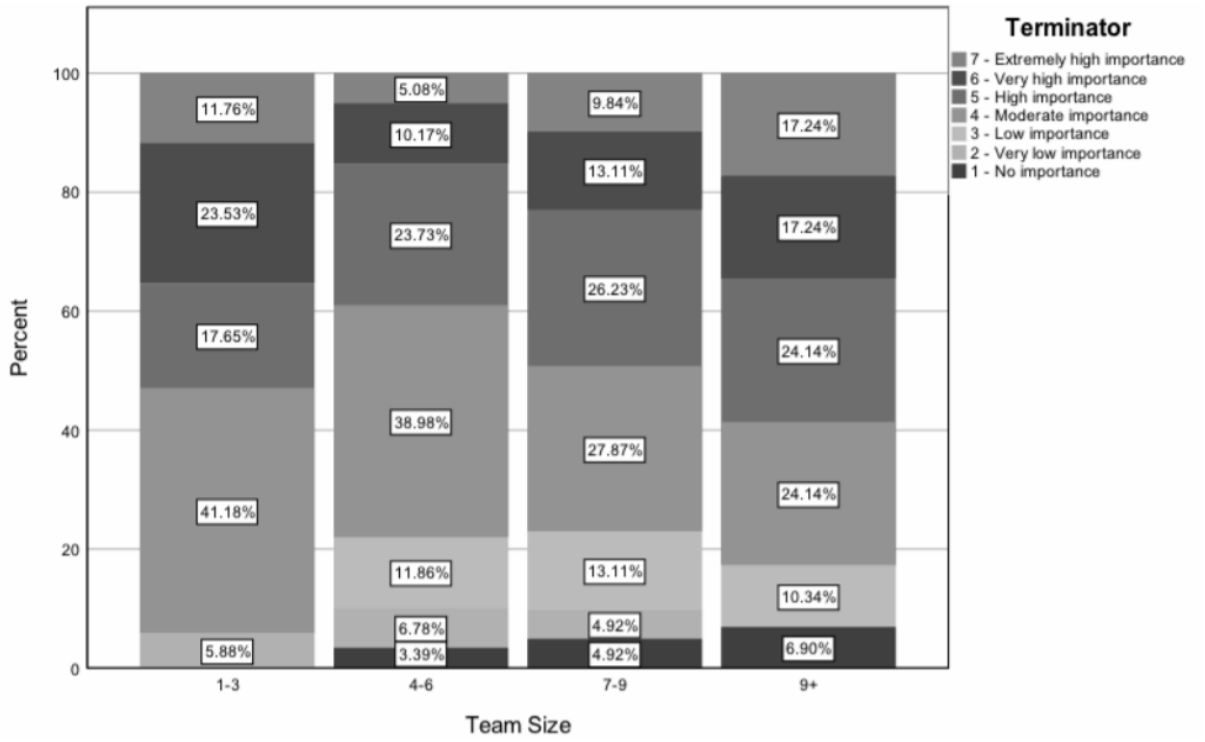


Figure 4: Terminator – distribution of importance for different company and team sizes

4.4 Statistical test

To answer the research question and analyse the relationships between different variables, the first step was to select a statistical test, that can tell if the organisational size and/or team size have a significant influence on the eighteen variables identified.

Since parametric tests were not an option due to the distribution of the data, it was clear that a non-parametric test had to be used to analyse data. In such cases, a commonly applied test is Mann-Whitney U test (Shankar & Singh, 2014), "which is also known as the Wilcoxon rank sum test, tests for differences between two groups on a single, ordinal variable with no specific distribution" (McKnight & Najab, 2010a). Since this research defined ordinal variables (the results obtained for the importance of the eighteen variables were converted into ordinal data), grouping variables were in place (organisation and team size) this test seemed suitable at first. However, a strong limitation of the Mann-Whitney U test is that it can only compare two groups, while in this research both grouping variables - company and team size - defined four distinct groups. To overcome this limitation, a generalisation to the Mann-Whitney U test, namely the Kruskal-Wallis test was selected. "The Kruskal-Wallis is a nonparametric statistical test that assesses the differences among three or more independently sampled groups on a single, non-normally distributed continuous variable" (McKnight & Najab, 2010b). The Kruskal-Wallis test requires independence of observations; this concern was addressed by questionnaire design. No participant could be part of more groups and all the participants belonged to a group (as answering those questions required selecting a radio button, and there were no empty answers to those questions).

After executing the Kruskal-Wallis test on the dataset, the following results were obtained (considering a significance level of α=0.05):

- When company size was used as a grouping variable, the test resulted in significant values for four variables out of eighteen: work organiser, quality of work enforcer, decision maker, technical lead
- When team size was used as a grouping variable, the test resulted in significant values for four variables out of eighteen: role model, quality of work enforcer, technical lead, people-centric

In the next sections, However, for large companies it starts dropping and decreases ev the results for the variables with statistical significance and their relevance will be presented.

4.4.1 Company size as grouping variable

In the next section company size categories will be referred to as the following:

- 0-100 employees – very small
- 101-1000 employees – small
- 1001-5000 employees – large
- 5000+ employees - very large

4.4.1.1 Work organiser

The table below summarises the resulting values for the variable "work organiser" with company size used as grouping variable:

	Company Size	N	Mean Rank
	Very small (0-100)	39	81.96
	Small (100-1000)	56	91.26
	Large (1001-5000)	23	99.17
	Very large (5000+)	45	68.19
Kruskal Wallis H	9.489		
df	3		
Asymp. Sig	0.023		

Table 5 Kruskal-Wallis test results for work organiser trait

The results of this test suggest that the trait work organiser is the most important for Agile leaders in companies of large size, followed by companies of size: small, very small and very large (in this order). The importance of this characteristic increases for the first company size category, but interestingly enough, it drops significantly for very large companies.

4.4.1.2 Quality of work enforcer

The table below summarises the resulting values for the variable "quality of work enforcer" with company size used as grouping variable:

	Company Size	N	Mean Rank
	Very small (0-100)	39	92.90
	Small (100-1000)	56	96.07
	Large (1001-5000)	23	84.20
	Very large (5000+)	45	60.86

Kruskal Wallis H	17.062
df	3
Asymp. Sig	0.001

Table 6 Kruskal-Wallis test results for quality of work enforcer trait

The results for this characteristic suggest that the importance of the Agile leader to be a quality of work enforcer increases from companies of very small size to small size but drops significantly for larger sizes. The order of importance for this trait was the following: small, very small, large, very large companies. It is worth mentioning that the mean rank for very large companies turned out to be the lowest one, overall.

4.4.1.3 Decision maker

The table below summarises the resulting values for the variable "decision maker" with company size used as grouping variable:

	Company Size	N	Mean Rank
	Very small (0-100)	39	84.39
	Small (100-1000)	56	98.00
	Large (1001-5000)	23	88.65
	Very large (5000+)	45	63.41

Kruskal Wallis H	14.824
df	3
Asymp. Sig	0.002

Table 7 Kruskal-Wallis test results for the decision maker trait

Although the numbers themselves differ, the tendency is somewhat similar to the characteristic presented in the earlier section (Quality of work enforcer). The importance of the decision maker trait is very high for very small companies and it even increases when moving to small ones. However, for large companies, it starts dropping and decreases even further for very large companies.

4.4.1.4 Technical lead

The table below summarises the resulting values for the variable "technical lead" with company size used as grouping variable:

	Company Size	N	Mean Rank
	Very small (0-100)	39	89.36
	Small (100-1000)	56	97.97
	Large (1001-5000)	23	76.09
	Very large (5000+)	45	65.41
Kruskal Wallis H	13.521		
df	3		
Asymp. Sig	0.004		

Table 8 Kruskal-Wallis test results for the technical lead trait

Once again, a very similar pattern can be seen as experienced with the quality of work enforcer trait. The importance of this characteristic starts high up for very small companies, grows even larger for small ones, but decreases significantly for the larger companies.

Figure 5 presents the measured mean ranks of different variables for different company sizes (from tables 4-7). It is interesting to see that, while work organiser is the least desired characteristic for very small and small companies, it is, by far, the most desired one for both large and very large companies.

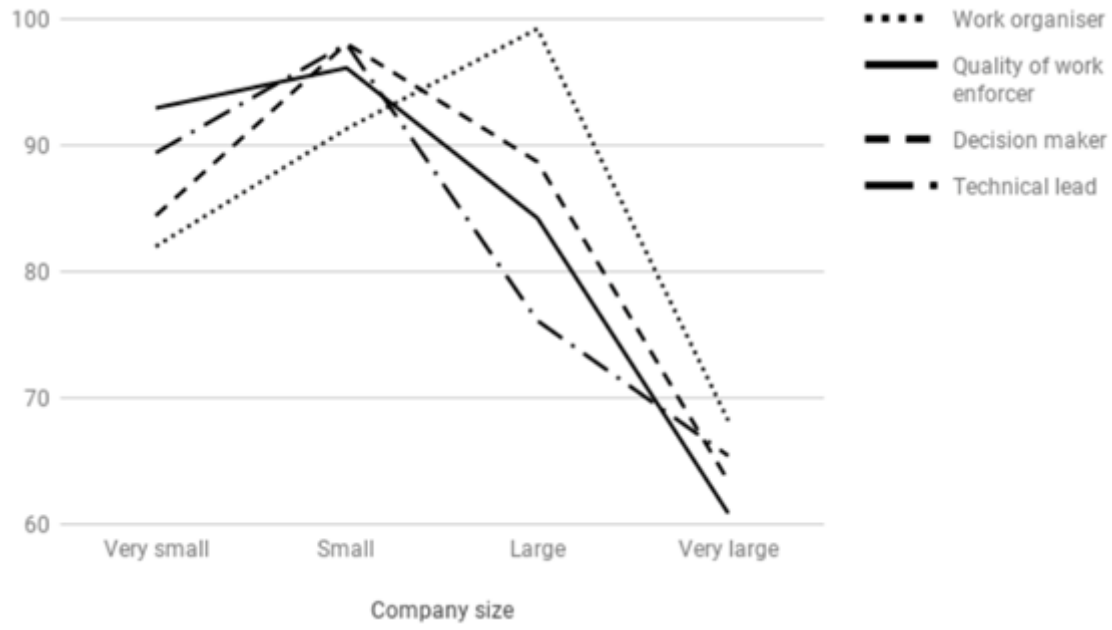


Figure 5: Overall ranking of the characteristics per company size

4.4.2 Team size as grouping variable

In the next section team size categories will be referred to as the following:

- 1-3 members – very small
- 4-6 members – small
- 7-9 members – large
- 9+ members - very large

4.4.2.1 Role model

The table below summarises the resulting values for the variable "role model" with team size used as grouping variable:

	Company Size	N	Mean Rank
	Very small (1-3)	17	59.21
	Small (4-6)	59	77.60
	Large (7-9)	61	96.61
	Very large (9+)	29	82.16

Kruskal Wallis H	10.571
df	3
Asymp. Sig	0.014

Table 9 Kruskal-Wallis test results for the role model trait

The role model trait is not a very high scored one when it comes to very small teams. A high increase can be observed for the next two team size categories, reaching 77.60 for small and 96.61 for large teams in mean ranks. However, for teams over nine members, a drop to 82.16 can be spotted.

4.4.2.2 Quality of work enforcer

The table below summarises the resulting values for the variable "quality of work enforcer" with team size used as grouping variable:

	Company Size	N	Mean Rank
	Very small (1-3)	17	73.85
	Small (4-6)	59	93.86
	Large (7-9)	61	72.07
	Very large (9+)	29	92.10

Kruskal Wallis H	8.337
df	3
Asymp. Sig	0.04

Table 10 Kruskal-Wallis test results for the quality of work enforcer trait

The perceived importance of this trait is a rather interesting one. For very small teams it starts at 73.85 when it comes to mean ranks, with a high increase for small teams (93.86). The importance drops for large teams (72.07) but reaches high up again for very large teams (92.10).

4.4.2.3 Technical lead

The table below summarises the resulting values for the variable "technical lead" with team size used as grouping variable:

	Company Size	N	Mean Rank
	Very small (1-3)	17	97.65
	Small (4-6)	59	93.08
	Large (7-9)	61	70.07
	Very large (9+)	29	83.97

Kruskal Wallis H	8.927
df	3
Asymp. Sig	0.03

Table 11 Kruskal-Wallis test results for the technical lead trait

The pattern followed by this trait is very similar to the one observed for role model, with some slight changes in the magnitude of the resulting numbers and inverse sign. For very small teams this is an extremely important characteristic (97.65 on the mean rank) but drops for small teams and decreases even more for large ones. For very large teams the perceived importance of this characteristic starts increasing once more.

4.4.2.4 People centricity

The table below summarises the resulting values for the variable "people-centric" with team size used as grouping variable:

	Company Size	N	Mean Rank
	Very small (1-3)	17	58.97
	Small (4-6)	59	78.90
	Large (7-9)	61	95.25
	Very large (9+)	29	82.52

Kruskal Wallis H	9.513
df	3
Asymp. Sig	0.023

Table 12 Kruskal-Wallis test results for the people-centric trait

As a rather expected pattern can be observed for the first three team size categories when it comes to the perceived importance of people centricity. For very small teams the importance level is quite small, but it increases steadily over the next two categories. However, as a rather surprising aspect, for very large teams the importance of people centricity decreases significantly.

Figure 6 presents the measured mean ranks of different variables for different team sizes (from tables 8-11). An interesting aspect depicted by that figure is how the two most and least desired characteristics change place for very small and large teams. On the other hand, for small and very large teams the order of the importance of these traits are the same.

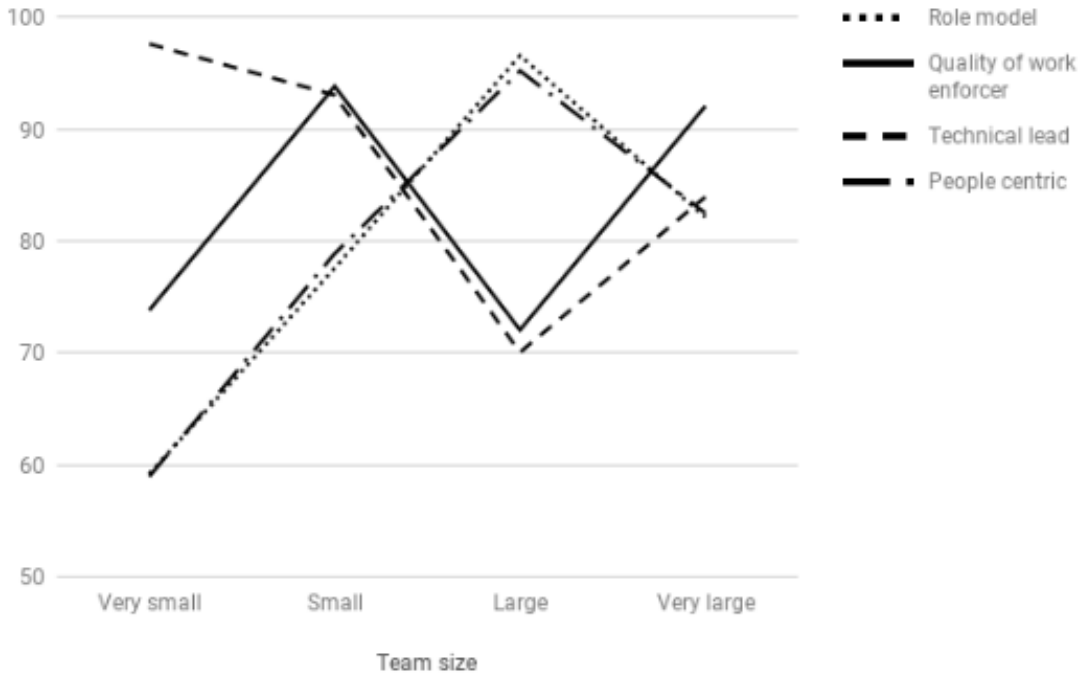


Figure 6: Overall ranking of the characteristics per team size.

5 Discussion

5.1 Analysis of the results

The research question this paper proposed was "what are the desired characteristics of the leader in an Agile software development team and in what way they relate to the size of the team and organisation". In total, eighteen different characteristics and behaviours were identified through literature research, whose importance was measured using a questionnaire targeted to the members of Agile software development community.

The responses gathered by the questionnaire are very well in line with the results of previous research. All the eighteen characteristics identified in those studies (presented in Table 2) have been indicated to be “rather important” by the informants, regardless of the company or team size. Hence the findings from this research are aligned with those found by Podsakoff et al. (1990), Hoda et al. (2013), Parker, et al. (2015), Matturro et al. (2015), Kautz et al. (2016) and Srivastava et al. (2017).

One characteristic, namely communication was identified as a generally desired Agile leadership trait regardless of the company and the team size, as this was the only one which received no answer indicating no, very low or low importance. The distribution of the answers indicating moderate, high, very high or extremely high importance were very similar, thus showing that this characteristic is important regardless of the company or the team size, and all Agile leaders should focus on their communication style.

For the rest of the characteristics, the answers varied more or less with respect to the company size and team size. Out of the eighteen distinct traits tested for differences, only four presented statistically significant differences between the four groups of company sizes. The ranking of the importance of each of these four characteristics is presented in Table 13. “Very small company” refers to companies with 0 to 100 employees, “Small company” to those with 101 to 1000, “Large company” to companies having 1001 to 5000 employees and “Very large company” to those with more than 5000 employees.

	Work organiser	**Quality of work enforcer**	**Decision maker**	**Technical lead**
Very small company	3	2	3	2
Small company	2	1	1	1
Large company	1	3	2	3
Very large company	4	4	4	4

Table 13 Ranking of the most desired characteristics per company size

As it can be seen, out of the four variables, almost all have a higher importance for small companies than for any other size. Quality of work organiser, decision maker, technical lead all have the highest importance for companies of size 101-1000. The only variable that was regarded as having the highest importance for large companies was work organiser. All the variables are regarded as having less importance for very large companies than for any other company size. One possible reason for that could be the much higher level of diversity in terms of thinking, priorities and projects very large companies represent.

The same number of characteristics, four, were identified to producing statistically significant differences in the answers obtained from teams of different sizes. Table 14 presents the ranking of importance for the four characteristics with respect to the team size.

	Role model	Quality of work enforcer	Technical lead	People-centric
Very small team	4	3	1	4
Small team	3	1	2	3
Large team	1	4	4	1
Very large team	2	2	3	2

Table 14 Ranking of the most desired characteristics per team size

When it comes to the team size and the importance of the characteristics of the leader, the role model came out as having the highest importance for large teams (7-9 people); the quality of work enforcer was the most important for the small teams (4-6 members), the technical leadership was unrivalled in importance for the very small teams (1-3 people), while the people centricity was again the most important for the large teams. None of the variables had the highest rank for the very large teams (9+ people), which might have a similar reason of very high diversity, as in case of company size.

5.2 Limitations

The following main limitations have been identified with this research:

- **Sample size:** the present research was carried out based on the responses of 166 Agile practitioners. Although this number is not too low, an even higher sample size could yield even better results. One another aspect connected to the dataset is the overrepresentation of European countries (with the most responses gathered from Hungary, Romania and the United Kingdom). A more representative sample of the target population would allow for generalisation of the findings and could provide the possibility to deduce conclusions that would be generally-usable in practical applications.
- **Reliability:** Even though a screening question was used to filter out respondents who don't currently practice (or haven't ever practiced) any Agile software development methodology, it was very easy to fill the questionnaire out regardless of that question. Several informants could also have filled out the questionnaire selecting random answers to the questions, without providing relevant information. These answers could have skewed the data and influenced the final results.
- **Subjectivity of the author:** as someone being part of the Agile community for almost ten years, an inherent subjectivity in proposing the research question and creating the research instrument can be identified. Also, some of the respondents have been colleagues to the author, which represents a bias in selecting informants.
- **Research instrument:** although a web-survey was an appropriate choice for collecting data, ranking complex leadership traits and behaviours on a seven-step scale is not easy. This is a complex task and most probably no respondent would fill the survey out again with the very same answers. Momentary feelings and thoughts can have a very high impact on the responses and, as such, on the final results and conclusions.

Although these limitations play a big role in the validity of this study, when it comes to reproducibility things are much more straight-forward. The research instrument is given (and available in Appendix A), the channels through which data was collected were named in Chapter 4, and the timeframe was also specified. This makes it easy to carry out the same research with similar conditions.

As mentioned earlier, from the point of view of distribution of male and female respondents, this research aligns very well with UNESCO's statistics about male and female software engineers in the EU. This could be a point for generalisation, but this path has not been investigated due to time constraints.

5.3 Future work

Future research, with no constraints with time and resources present in this research, could replicate this study using another sampling strategy and with a much higher number of valid responses. Obtaining answers from a larger number of Agile practitioners that are selected using some random sampling strategy could highly increase the generalisability of this research – at the cost of increasing the complexity of the work. That way it would be clearer whether the lack of statistical significance this study faced, is due to the non-existing correlation between leadership traits and company or team sizes, or the relatively low number of informants. Also, that type of research could propose generally valid advice on what are the most important leadership traits of an Agile leader, taking a more holistic view.

One other possibility would be to repeat the research focusing on one specific country, so Agile leaders of a particular country could be provided with targeted advice taking into account their country only. It could also be interesting to carry out distinct research in different countries, then compare the results. That way cultural differences could be highlighted and reasoned about.

5.4 Conclusions

Agile software development has been gaining popularity since its inception in the nineties. Although these techniques are becoming an industry standard, there is very limited research on how an Agile leader should behave, or what traits they should have.

The aim of this research was to provide practical advice to Agile leaders of companies and teams of different size on what leadership characteristics they should improve. This research uncovered that one of the characteristics, namely communication, is an extremely important one, no matter what organisation or team size is an Agile leader working in. This work also ranked four characteristics with different importance for organisations of different size. Another four characteristics were found to be of different importance with respect to the team size.

Although this research has some practical applicability, a higher sample size would be necessary to better investigate the relationships between the characteristics' importance, the organisation and the team size.

To the best of the knowledge of the author of this study, there are no ethical or societal consequences that the findings in this research could impose. The author's advice is those using the results presented in the study to have in consideration the limitations of this research that might have influenced the results obtained. It is also recommended that the type or the sector where the company operates, as well as the culture in the organisation to be respected whenever the decisions regarding the characteristics the Agile leader should possess are made.

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Appendix A – Questionnaire

Survey on desired characteristics of an Agile leader

You are kindly invited to be a part of the research conducted by Tamas Gyorfi, a master's student at the Stockholm University. The aim of this research is to identify the most important characteristics of the leader of an Agile software development team that would unleash the high productivity of the team. In addition, the research will investigate how they differ depending on the size of the team and the organization.

The data you provide will be kept confidential and used only for the purpose of this research. The anonymity of all respondents will be preserved and no IP address for accessing the survey will be traced. The participation is voluntary and you can exit the survey at any time. In case you want to contact the researcher, please use his email address, gyorfi_tamas@yahoo.com.

By participating in this survey you will help the researcher and contribute to the enrichment of the scientific knowledge. The results from the research can be obtained upon request. Please note: respondents under the age of 18 are not permitted to take part in this research. Expected time to fill out the questionnaire is 10 minutes.

By clicking “Next” on this page it is considered you give consent to participate in the survey. Thank you very much.

* Required

1. **Are you currently a member of a software engineering team practicing an Agile method?** *
   Mark only one oval.

   ◯ Yes (Continue to the questionnaire)
   ◯ No (Exit) *Skip to "Thank you very much for filling out this survey!."*

General questions

General

2. **Please specify you gender**
   Mark only one oval.

   ◯ Female
   ◯ Male

3. **Please specify your country of residence**
   Mark only one oval.

   ◯ Afghanistan
   ◯ Akrotiri
   ◯ Albania
   ◯ Algeria

4. **Please specify your role on the Agile team**

Mark only one oval.

- Team member
- Scrum Master
- Product owner
- Project manager
- Other

5. **Roughly how many employees does your current organisation have? (The size of the whole company, not only software development)**

Mark only one oval.

- 0-100
- 101-1000
- 1001-5000
- 5000+

6 **The team you a e working in is made up of how many people?**

Mark only one oval.

- ◯ 1-3
- ◯ 4-6
- ◯ 7-9
- ◯ 9+

Agile leadership questionnaire

In the next statements please rate the importance of each attribute or behavior for "the ideal leader" in an agile team and company of similar size to yours. The phrase "Ideal leader" is used to refer to the leadership yielding the best performance of the team.

7. **The ideal leader has a vision on the team's future.**

Mark only one oval per row.

	No importance	Very low importance	Low importance	Moderate importance	High importance	Very high importance	Extreme high importance
.	◯	◯	◯	◯	◯	◯	◯

8. **The ideal leader not only expects the team to, but also act according to the Agile values and principles.**

Mark only one oval per row.

	No importance	Very low importance	Low importance	Moderate importance	High importance	Very high importance	Extremely high importance
.	◯	◯	◯	◯	◯	◯	◯

9. **The ideal leader makes sure to get consensus for future team goals, so everyone is happy to work towards the same shared objectives.**

Mark only one oval per row.

	No importance	Very low importance	Low importance	Moderate importance	High importance	Very high importance	Extremely high importance
.	◯	◯	◯	◯	◯	◯	◯

10. **The ideal leader establishes standards and rules in ways of working in order to make sure the work is carried out smoothly.**

Mark only one oval per row.

11 **The ideal leader expects and enforces high quality work from team members.**
Mark only one oval per row.

	No importance	Very low importance	Low importance	Moderate importance	High importance	Very high importance	Extremely high importance
.							

12. **The ideal leader makes decisions when appropriate, so the team does not get blocked and can focus on delivery.**
Mark only one oval per row.

	No importance	Very low importance	Low importance	Moderate importance	High importance	Very high importance	Extremely high importance
.							

13. **The ideal leader provides technical direction to the rest of the team for overall high quality.**
Mark only one oval per row.

	No importance	Very low importance	Low importance	Moderate importance	High importance	Very high importance	Extremely high importance
.							

14. **The ideal leader works towards previously established goals, as part of the team.**
Mark only one oval per row.

	No importance	Very low importance	Low importance	Moderate importance	High importance	Very high importance	Extremely high importance
.							

15. **The ideal leader cares about the members of the team and listens to their problems as they arise.**
Mark only one oval per row.

	No importance	Very low importance	Low importance	Moderate importance	High importance	Very high importance	Extremely high importance
.							

16. **The ideal leader intellectually challenges the members of the team (and the status quo when appropriate).**
Mark only one oval per row.

	No importance	Very low importance	Low importance	Moderate importance	High importance	Very high importance	Extremely high importance
.							

17 **The ideal leader communicates in an honest and open manner with the team and shares information with them; creates a safe space to talk about problems.**

Mark only one oval per row.

	No importance	Very low importance	Low importance	Moderate importance	High importance	Very high importance	Extremely high importance
.	◯	◯	◯	◯	◯	◯	◯

18. **The ideal leader identifies those members who have a negative effect on the team, and makes sure they are removed from the group.**

Mark only one oval per row.

	No importance	Very low importance	Low importance	Moderate importance	High importance	Very high importance	Extremely high importance
.	◯	◯	◯	◯	◯	◯	◯

19. **The ideal leader makes sure to keep the team morale high together with people's motivation.**

Mark only one oval per row.

	No importance	Very low importance	Low importance	Moderate importance	High importance	Very high importance	Extremely high importance
.	◯	◯	◯	◯	◯	◯	◯

20. **The ideal leader protects the team from pressure coming from the outside (e.g. project management).**

Mark only one oval per row.

	No importance	Very low importance	Low importance	Moderate importance	High importance	Very high importance	Extremely high importance
.	◯	◯	◯	◯	◯	◯	◯

21. **The ideal leader makes sure the team works well with its external environment (e.g. Product Owner, involved clients).**

Mark only one oval per row.

	No importance	Very low importance	Low importance	Moderate importance	High importance	Very high importance	Extremely high importance
.	◯	◯	◯	◯	◯	◯	◯

22. **The ideal leader makes sure personal relationships are proper within the team and keeps those up permanently.**

Mark only one oval per row.

	No importance	Very low importance	Low importance	Moderate importance	High importance	Very high importance	Extremely high importance
.	◯	◯	◯	◯	◯	◯	◯

23 **The ideal leader establishes just enough (and not more) rules to keep the team going and delivering.**

Mark only one oval per row.

	No importance	Very low importance	Low importance	Moderate importance	High importance	Very high importance	Extremely high importance
.							

24. **The ideal leader makes sure the team and management both adhere to Agile principles as part of a larger group.**

Mark only one oval per row.

	No importance	Very low importance	Low importance	Moderate importance	High importance	Very high importance	Extremely high importance
.							

Thank you very much for filling out this survey!

The results of this study will be made available on this website: www.tamasgyorfi.net please check back towards the end of the summer!

For SurveyCircle users (www.surveycircle.com): The Survey Code is: VNSU-ZYBP-PJD8-XFGM

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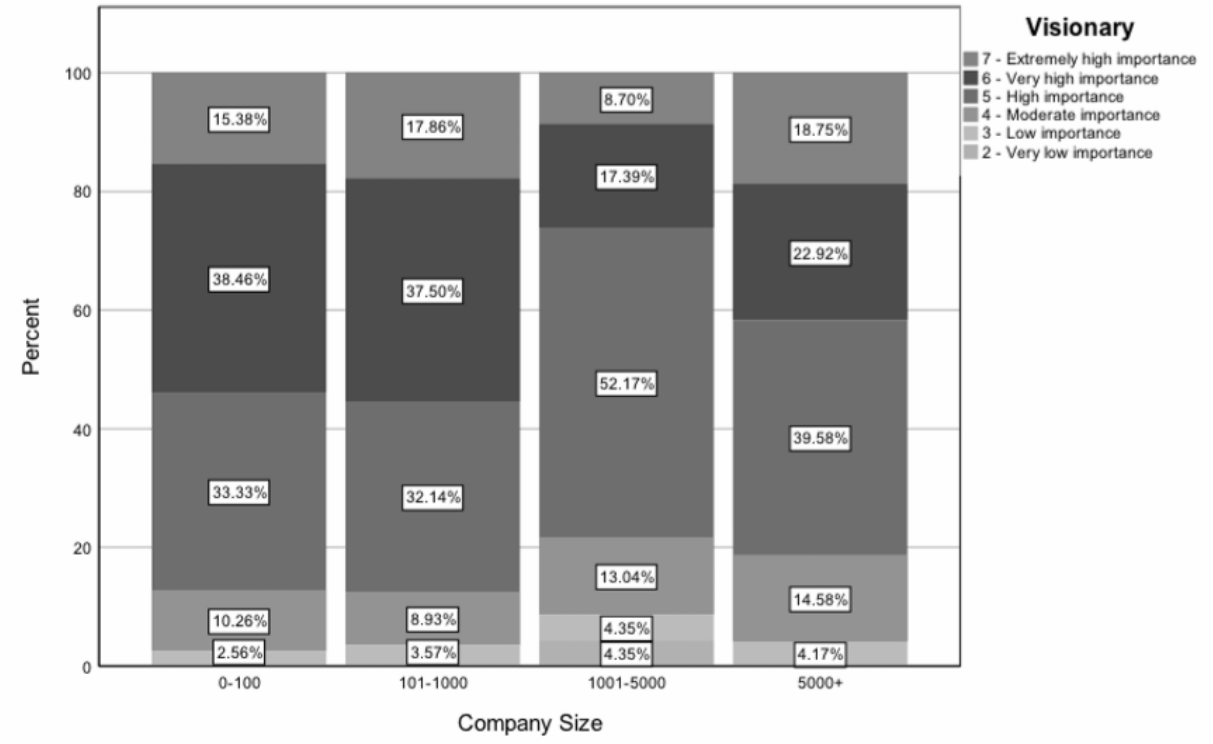
Google Forms

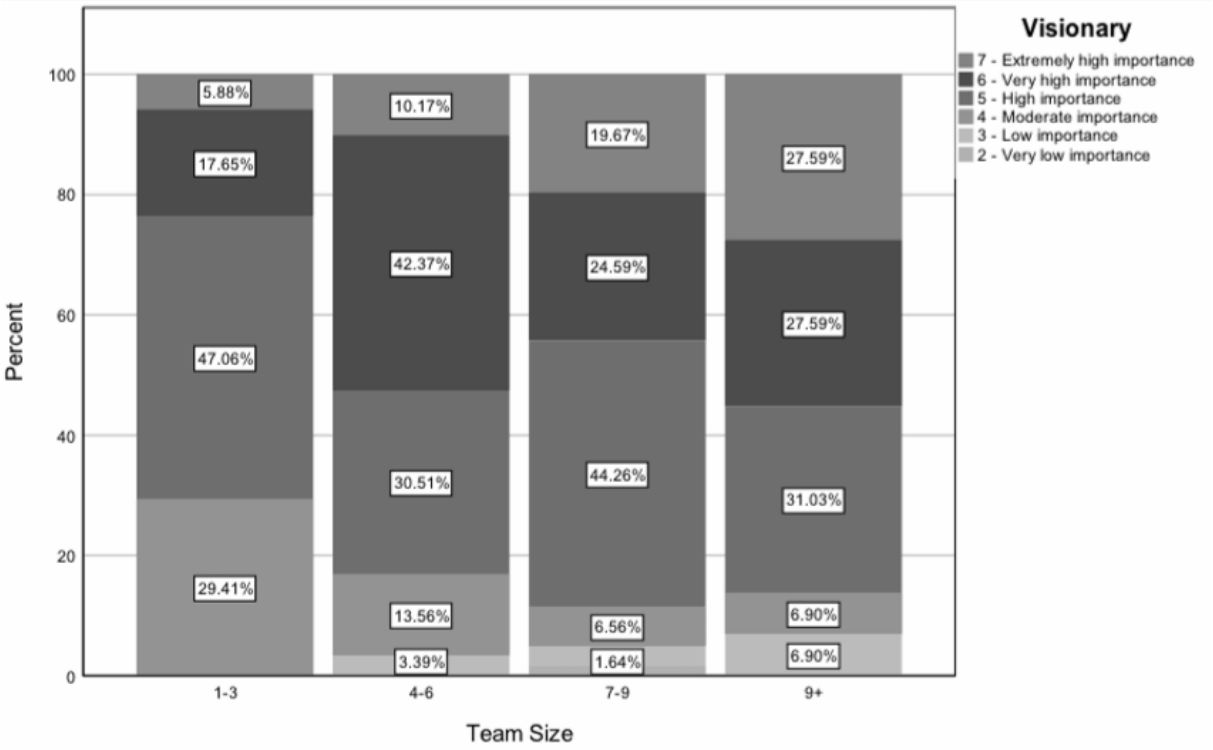
Appendix B – Results for variables measured

Respondents by country

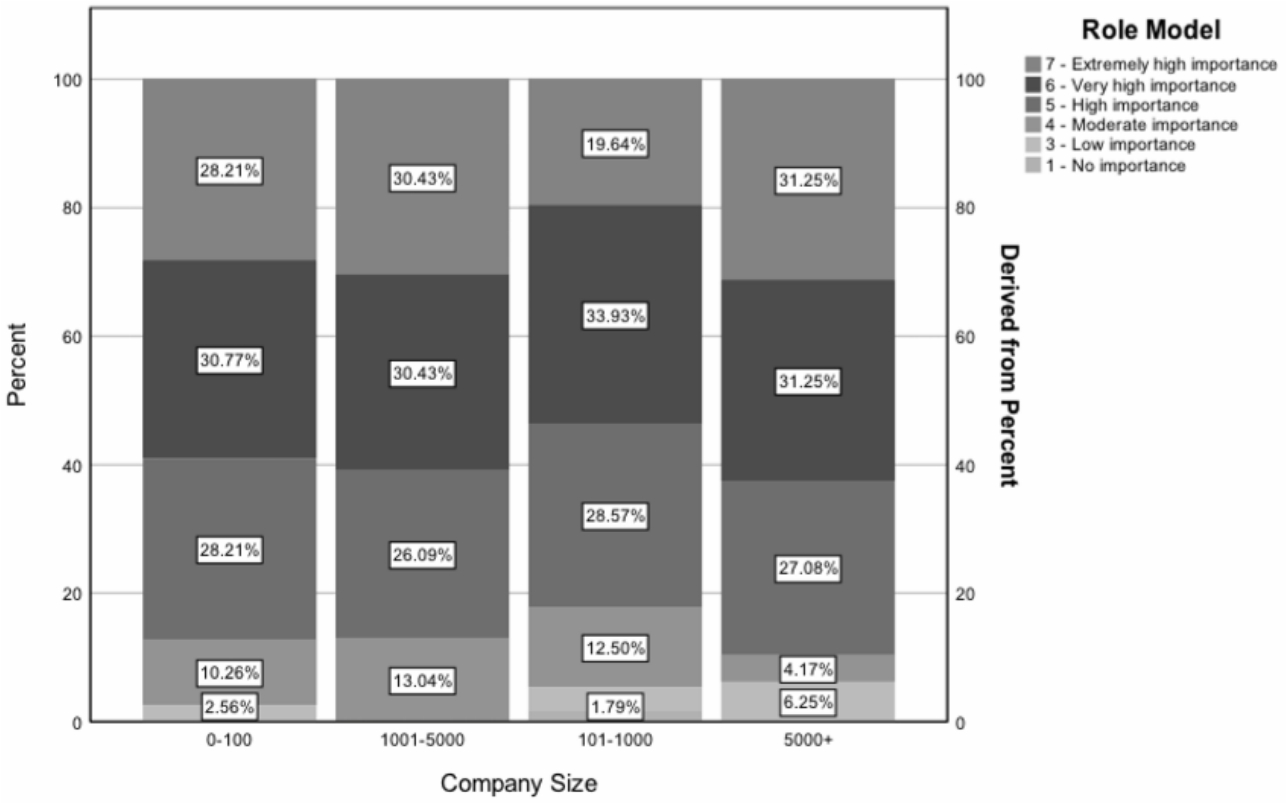
Country	Frequency	Percent	Valid Percent	Cumulative Percent
(Unknown)	1	.6	.6	.6
Australia	1	.6	.6	1.2
Austria	1	.6	.6	1.8
Belarus	1	.6	.6	2.4
Canada	1	.6	.6	3.0
Czech Republic	2	1.2	1.2	4.2
Germany	2	1.2	1.2	5.4
Greece	1	.6	.6	6.0
Hungary	74	44.6	44.6	50.6
India	2	1.2	1.2	51.8
Ireland	1	.6	.6	52.4
Israel	1	.6	.6	53.0
Latvia	1	.6	.6	53.6
Portugal	3	1.8	1.8	55.4
Romania	28	16.9	16.9	72.3
Saudi Arabia	1	.6	.6	72.9
Sweden	2	1.2	1.2	74.1
Switzerland	6	3.6	3.6	77.7
United Arab Emirates	1	.6	.6	78.3
United Kingdom	30	18.1	18.1	96.4
United States	6	3.6	3.6	100.0
Total	166	100.0	100.0	

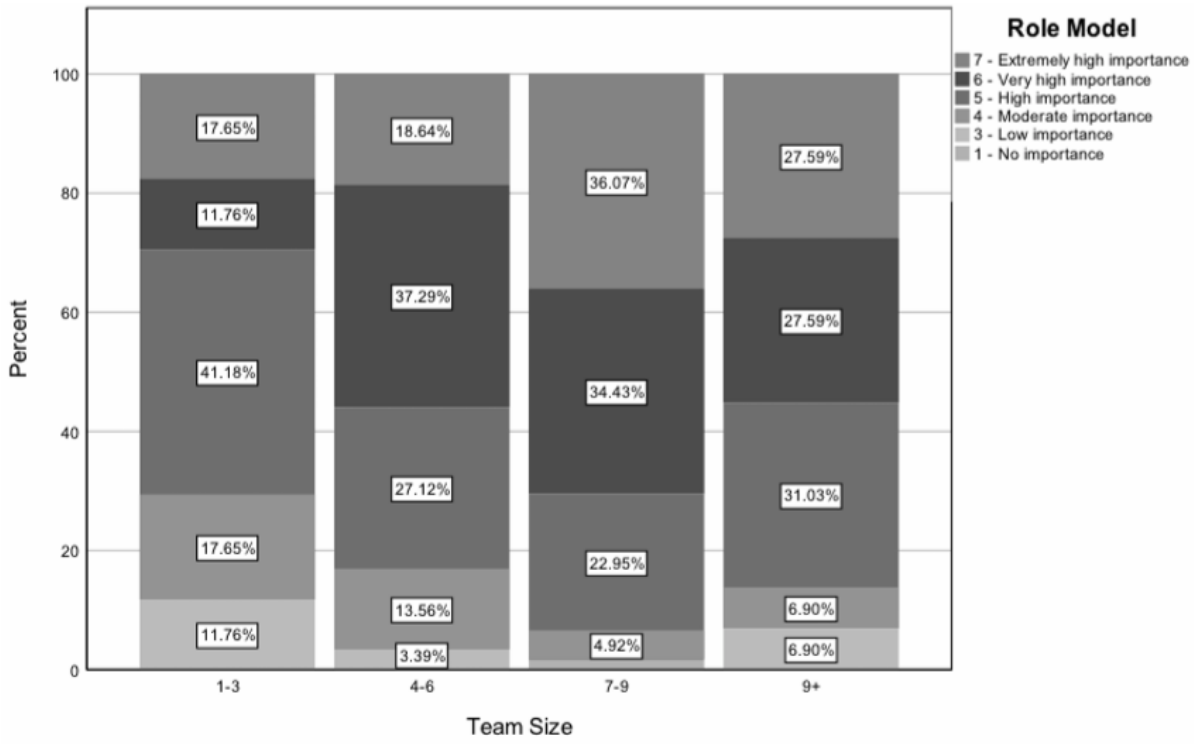
Visionary


Visionary
7 - Extremely high importance
6 - Very high importance
5 - High importance
4 - Moderate importance
3 - Low importance
2 - Very low importance
Percent
100
80
60
40
20
0
15.38%
38.46%
33.33%
10.26%
2.56%
17.86%
37.50%
32.14%
8.93%
3.57%
8.70%
17.39%
52.17%
13.04%
4.35%
4.35%
18.75%
22.92%
39.58%
14.58%
4.17%
0-100
101-1000
1001-5000
5000+
Company Size


Visionary
7 - Extremely high importance
6 - Very high importance
5 - High importance
4 - Moderate importance
3 - Low importance
2 - Very low importance
Percent
100
80
60
40
20
0
5.88%
17.65%
47.06%
29.41%
10.17%
42.37%
30.51%
13.56%
3.39%
19.67%
24.59%
44.26%
6.56%
1.64%
27.59%
27.59%
31.03%
6.90%
6.90%
1-3
4-6
7-9
9+
Team Size

Role model


Role Model
7 - Extremely high importance
6 - Very high importance
5 - High importance
4 - Moderate importance
3 - Low importance
1 - No importance
Percent
Derived from Percent
100
80
60
40
20
0
28.21%
30.77%
28.21%
10.26%
2.56%
30.43%
30.43%
26.09%
13.04%
19.64%
33.93%
28.57%
12.50%
1.79%
31.25%
31.25%
27.08%
4.17%
6.25%
0-100
1001-5000
101-1000
5000+
Company Size


Role Model
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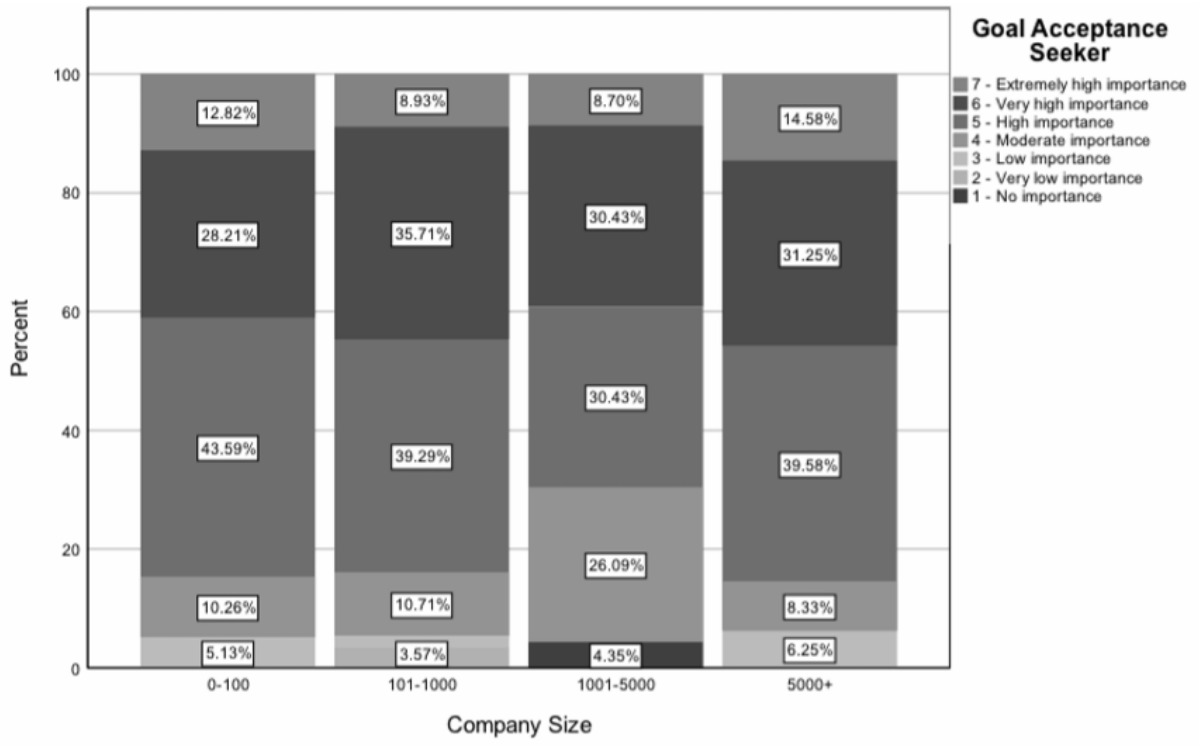
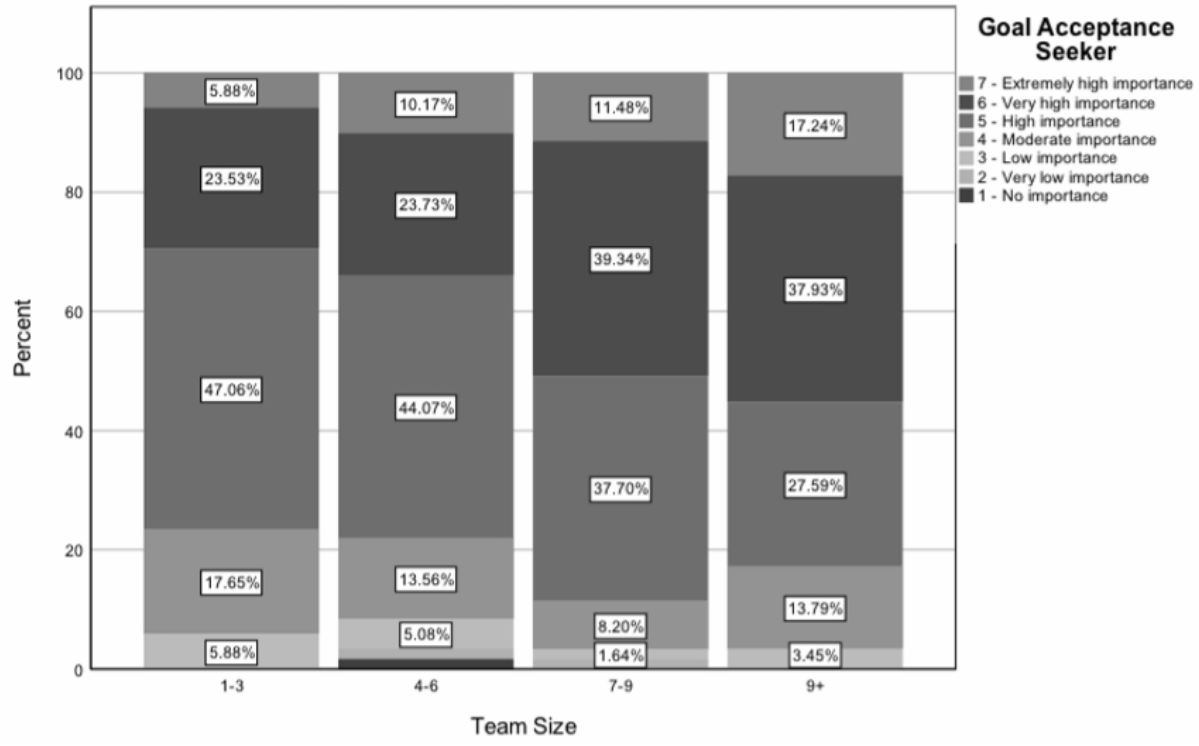
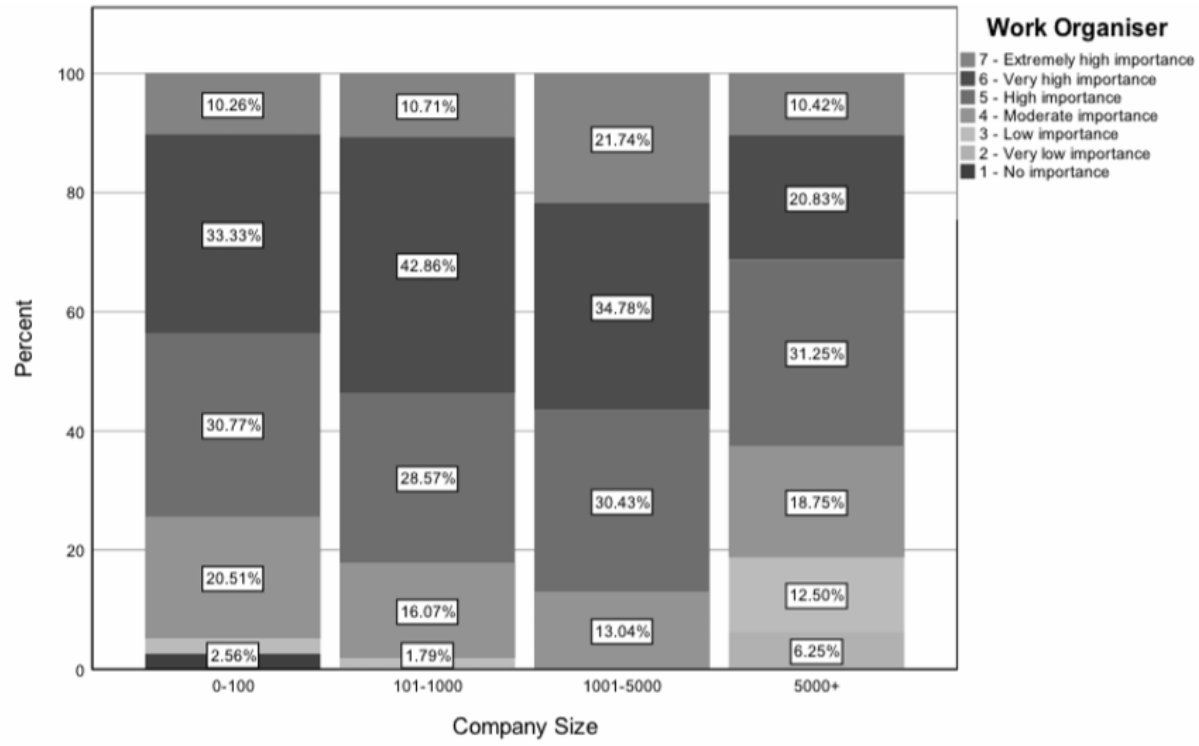
Team Size

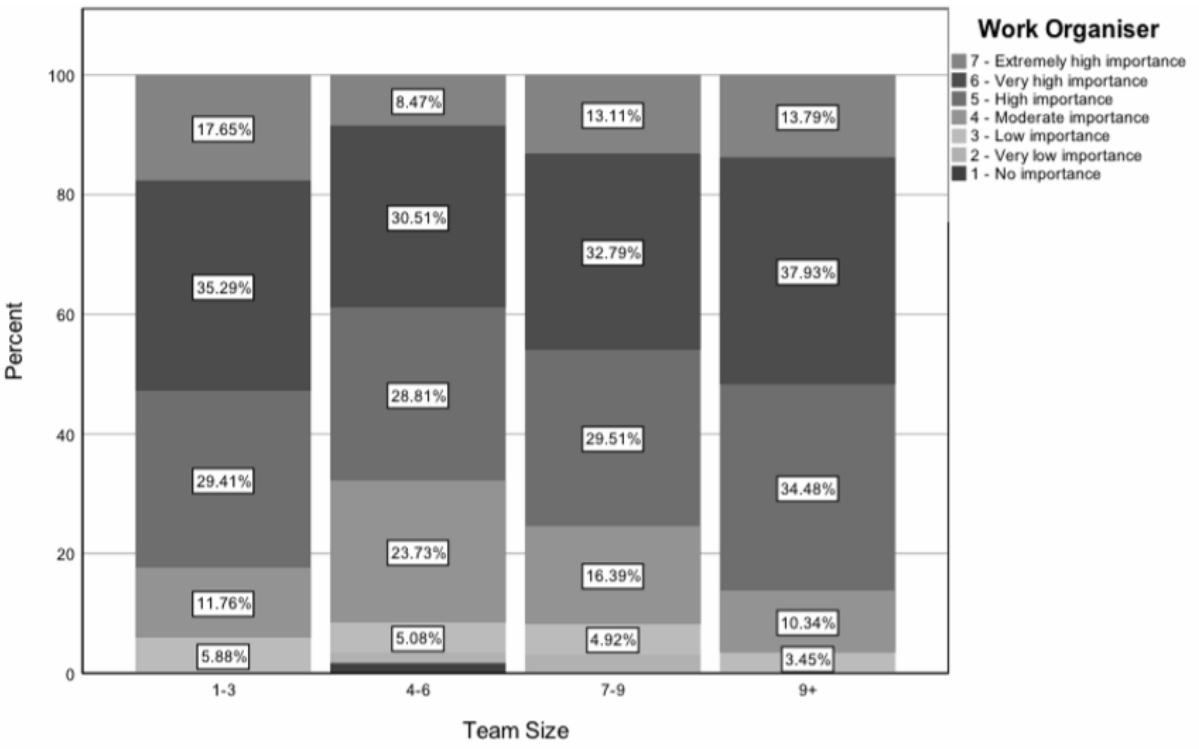
Goal acceptance seeker





Work organiser





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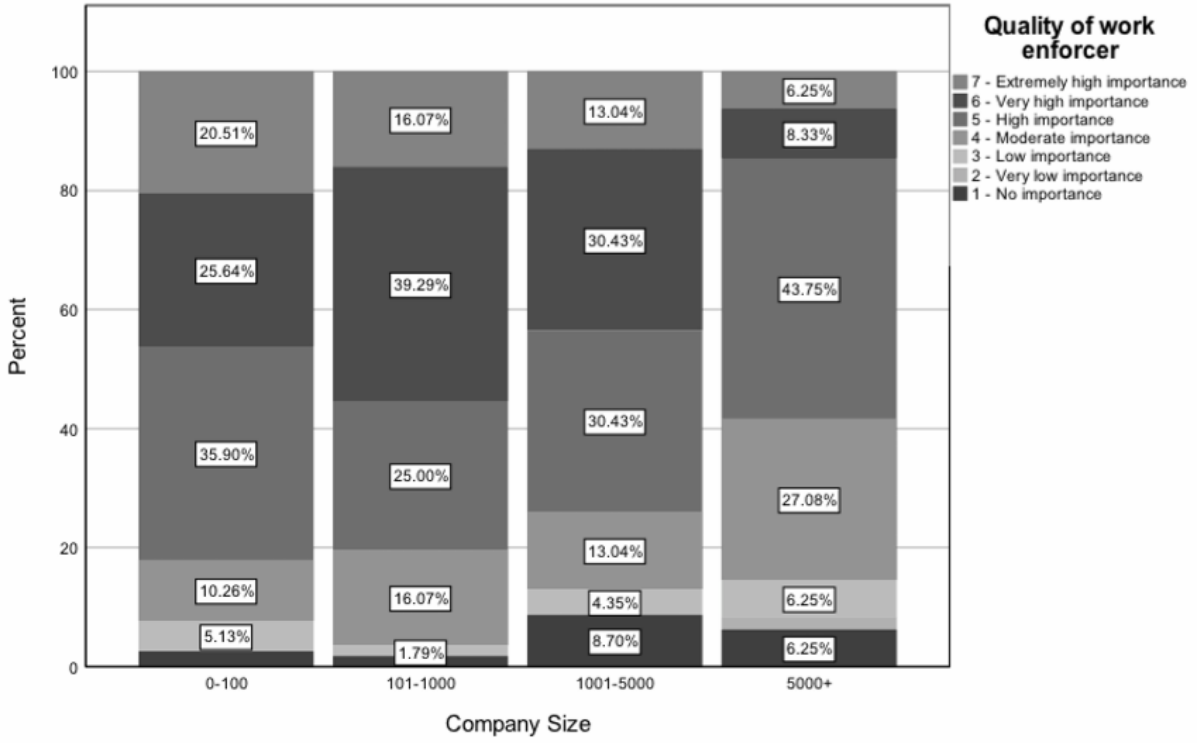

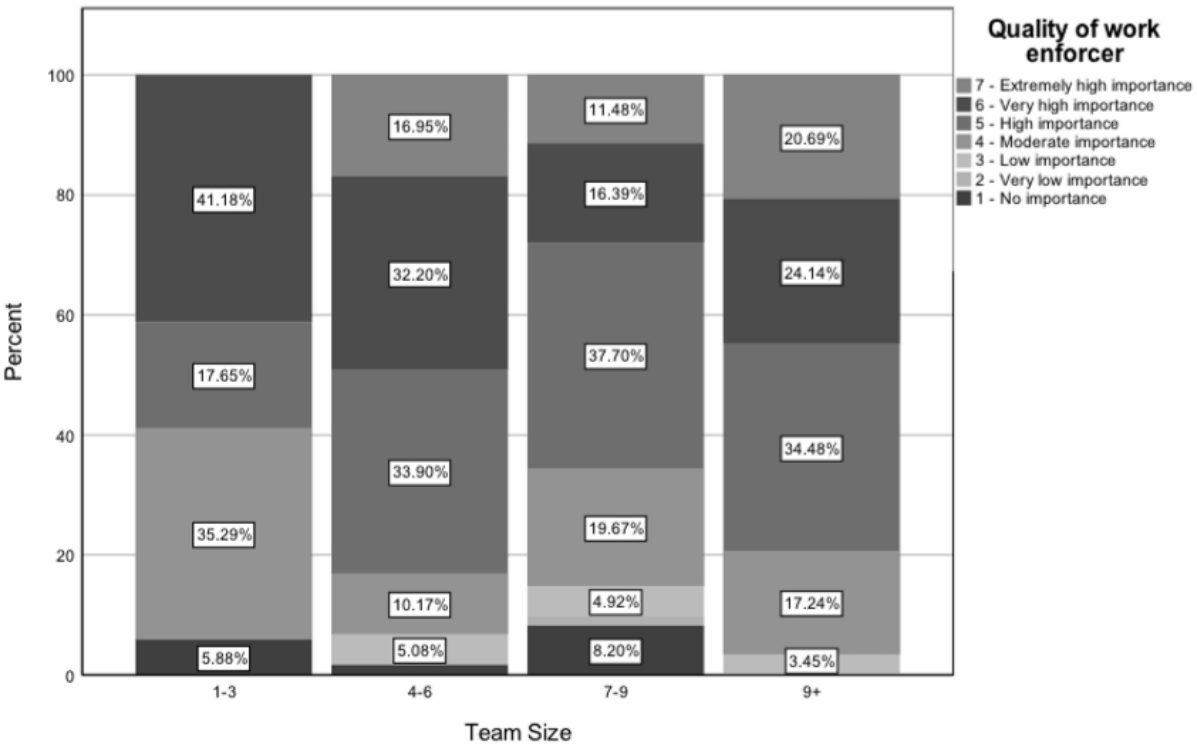

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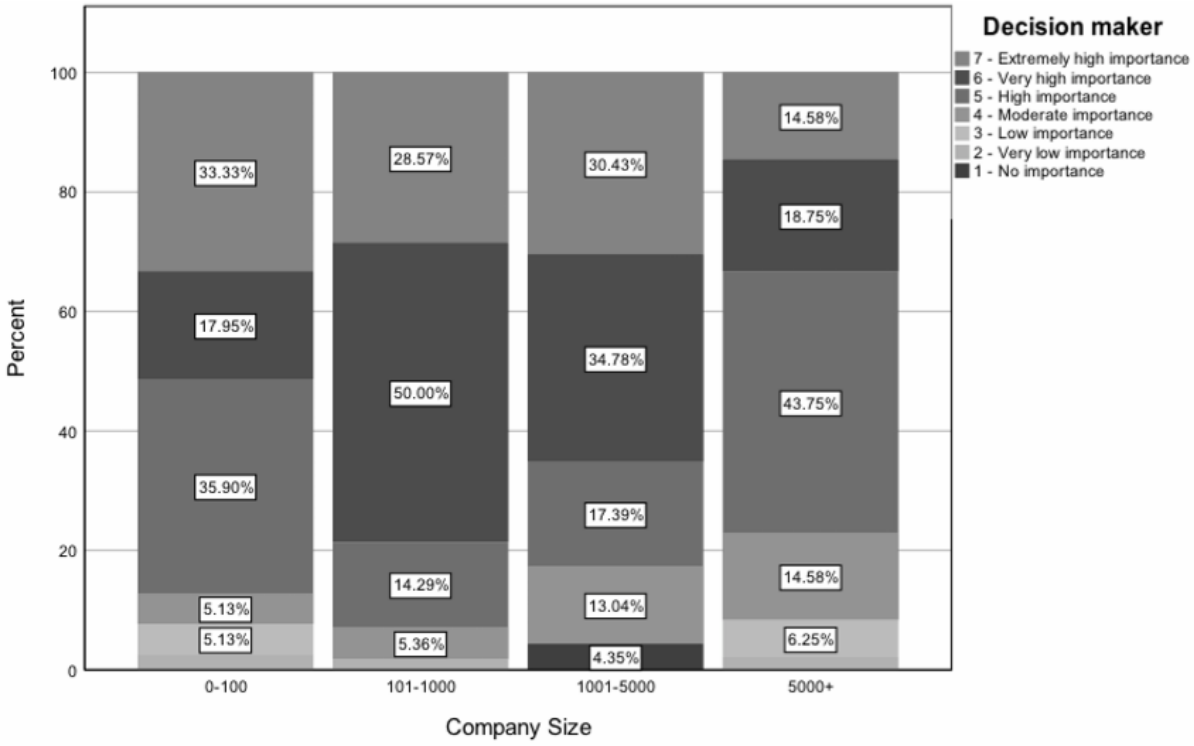
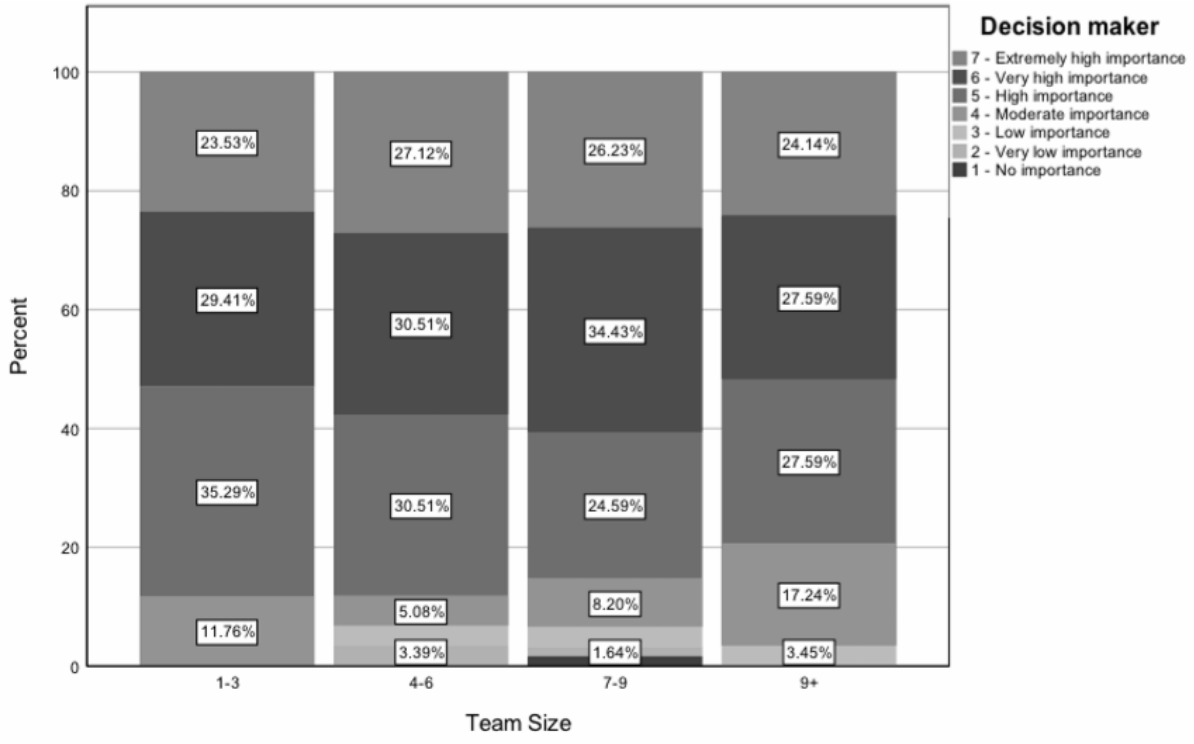
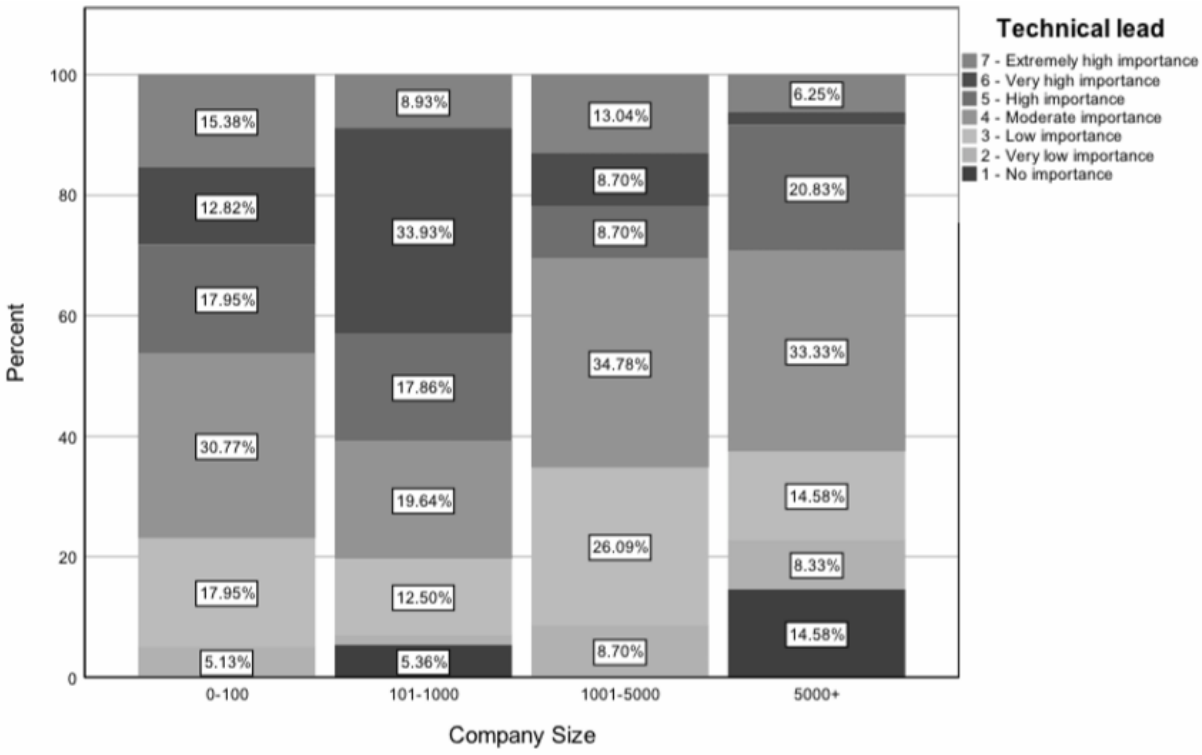
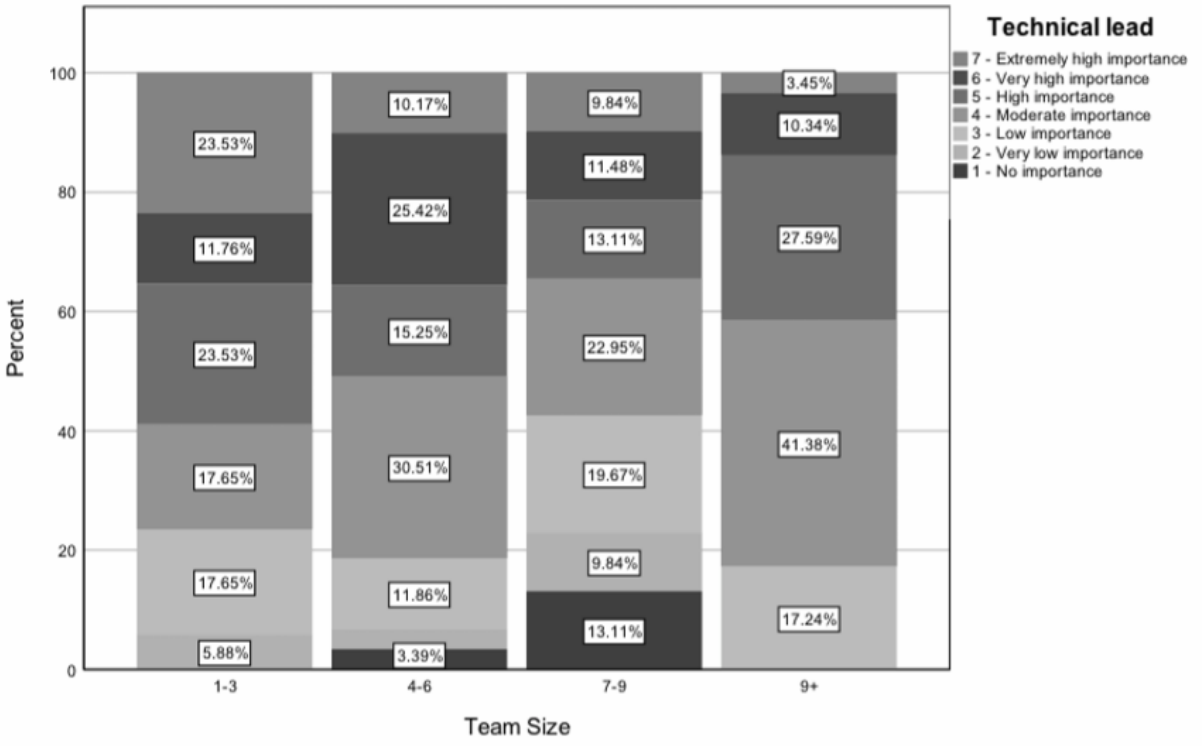


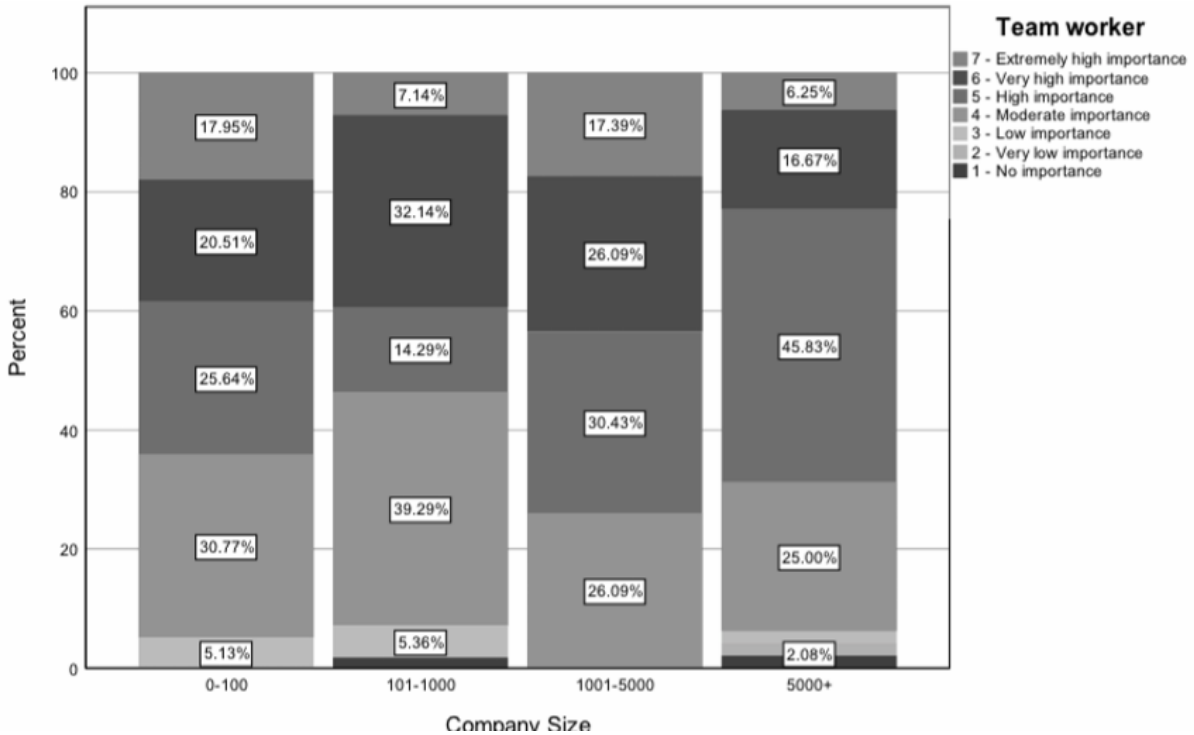


Technical lead





Team worker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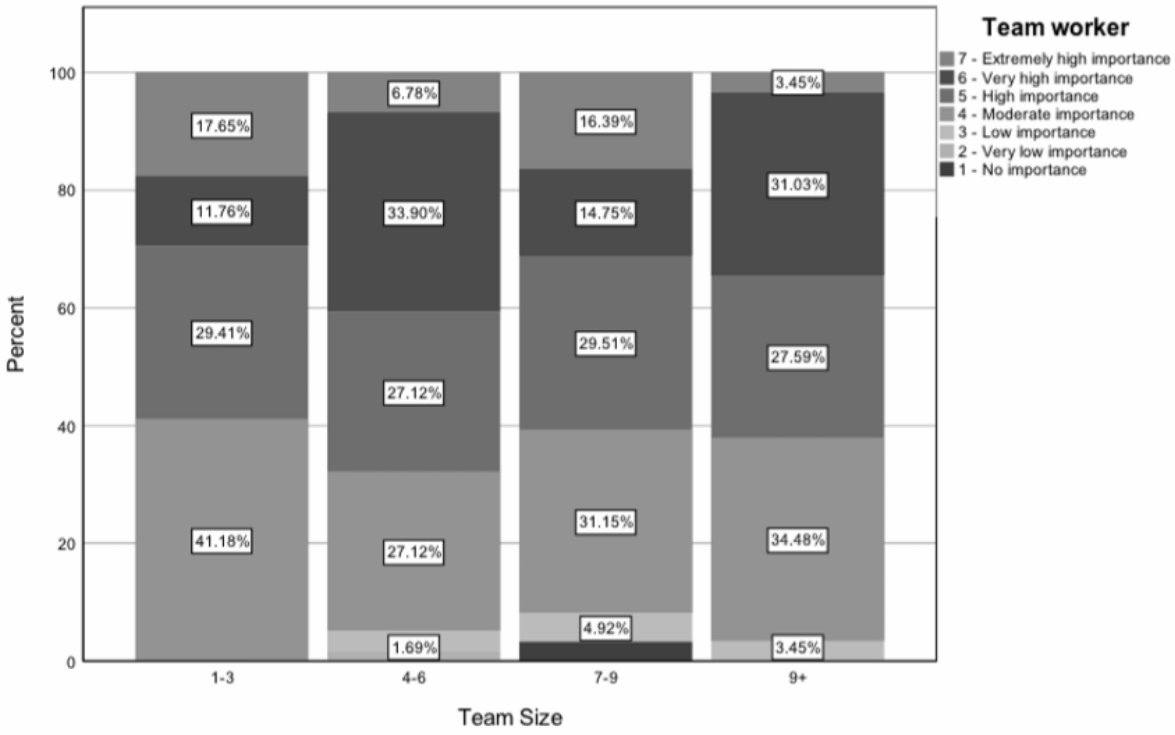
Company Size


Team worker
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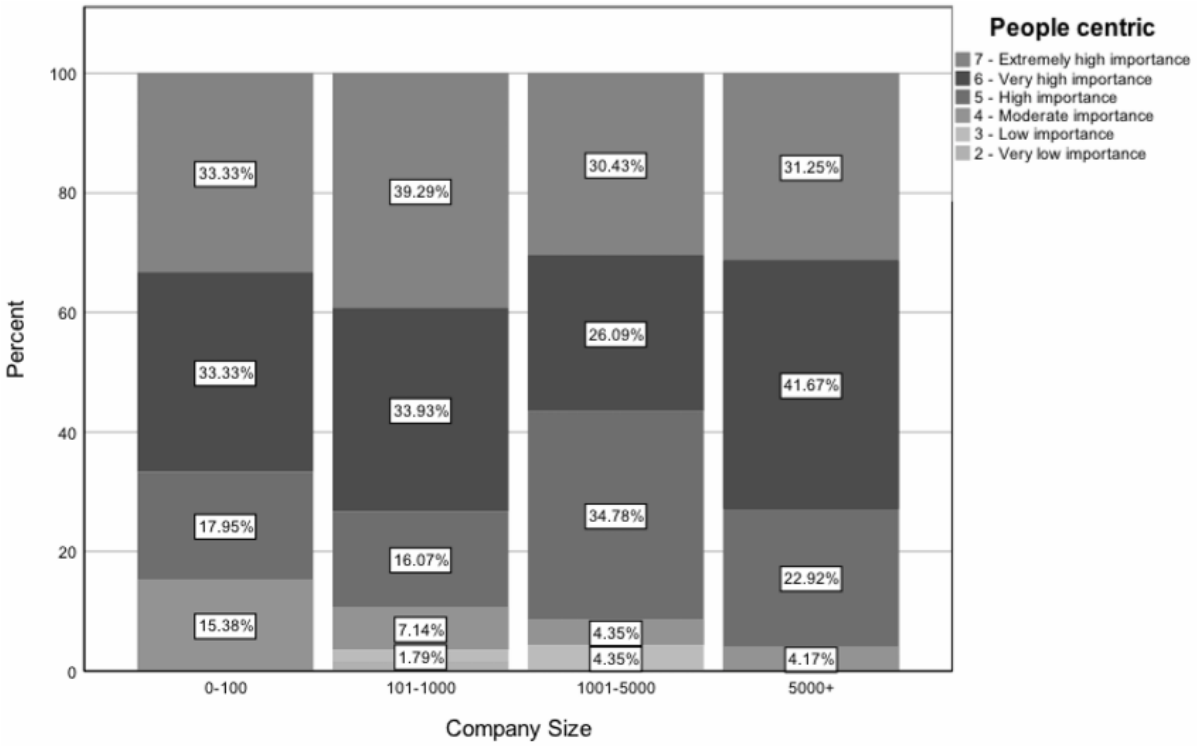
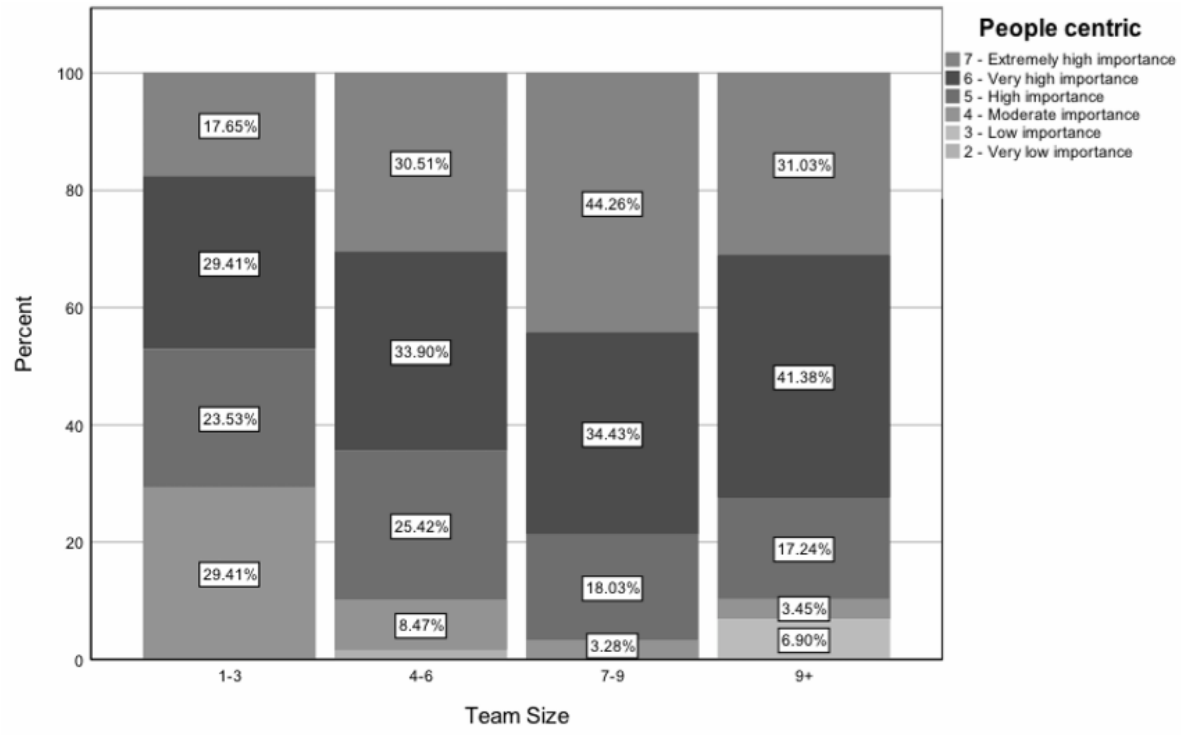
Team Size

People centric





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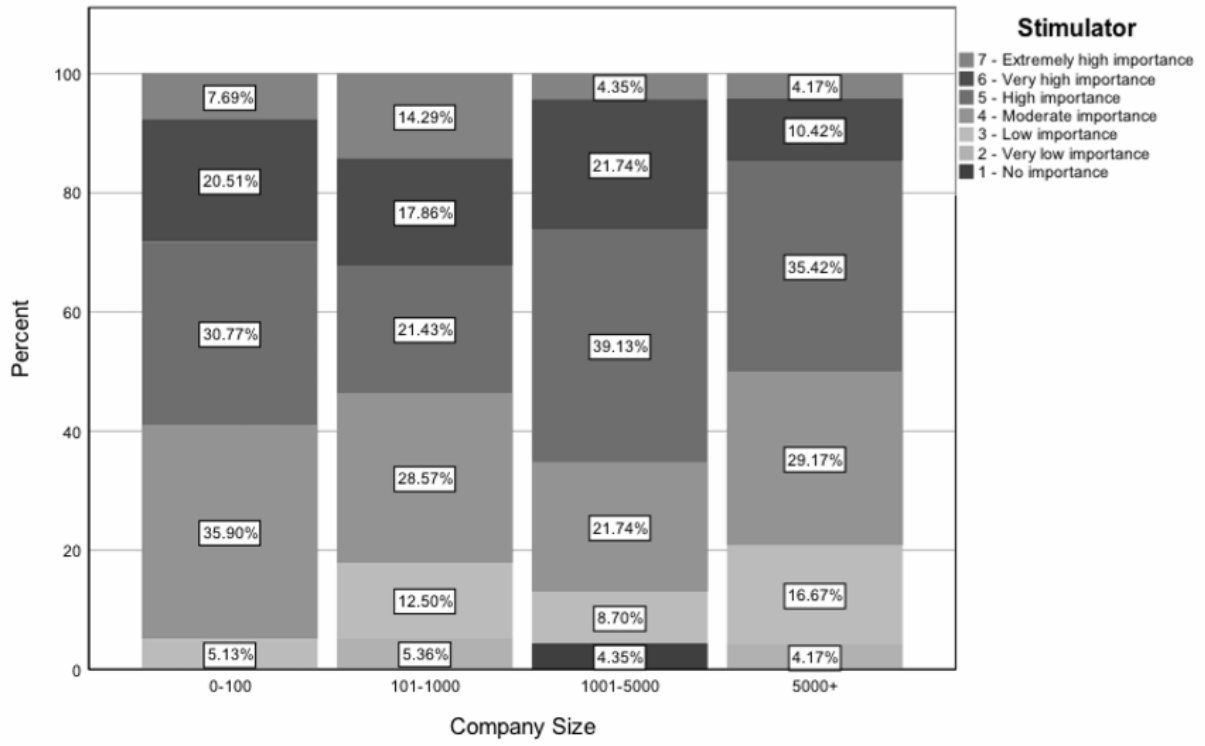
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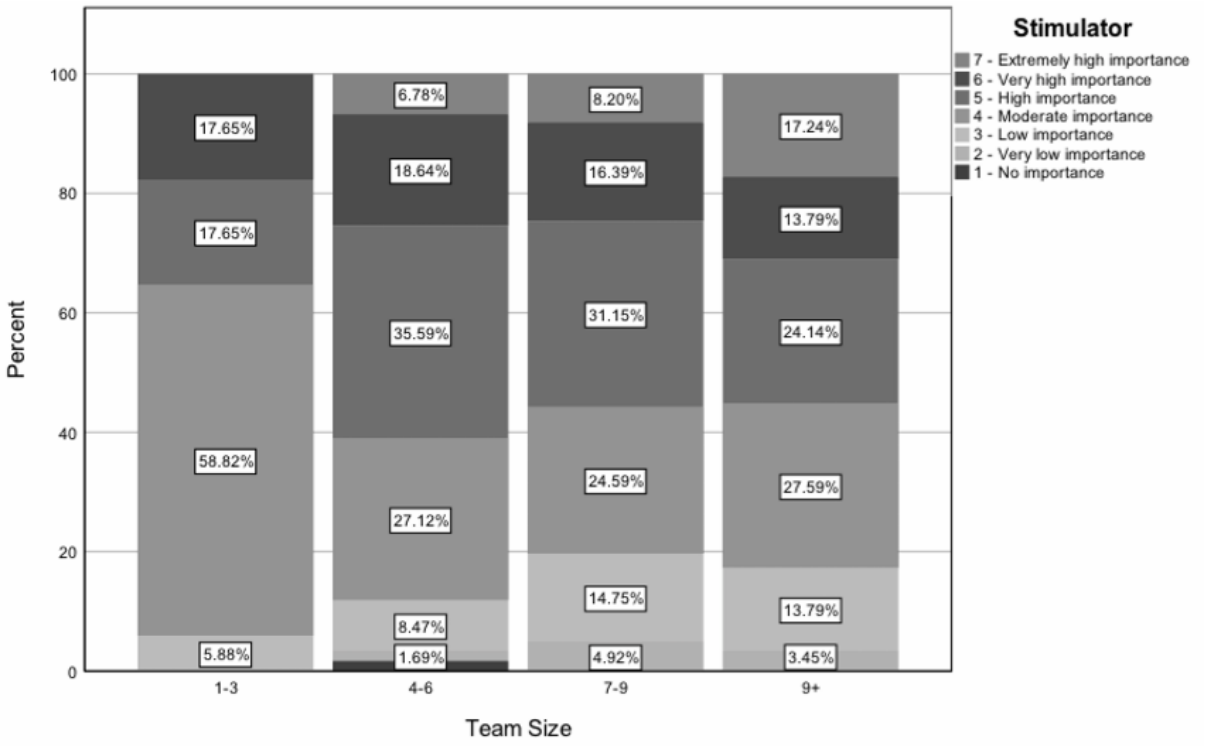
Company Size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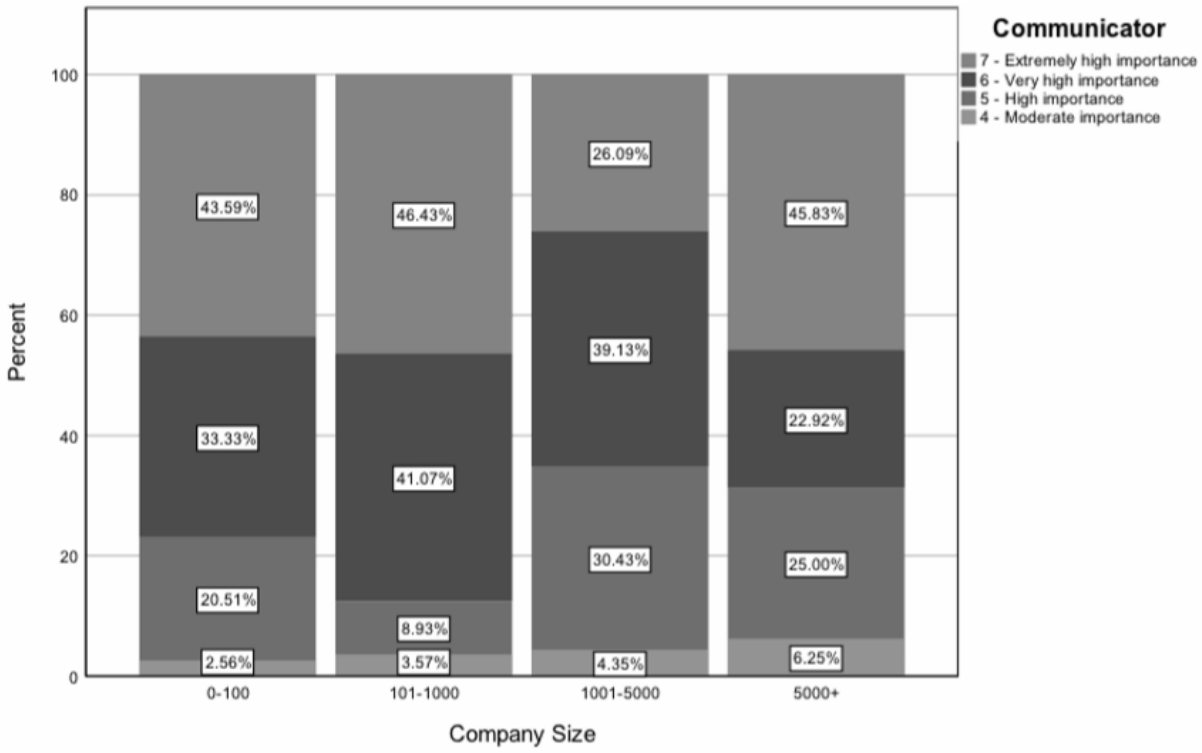
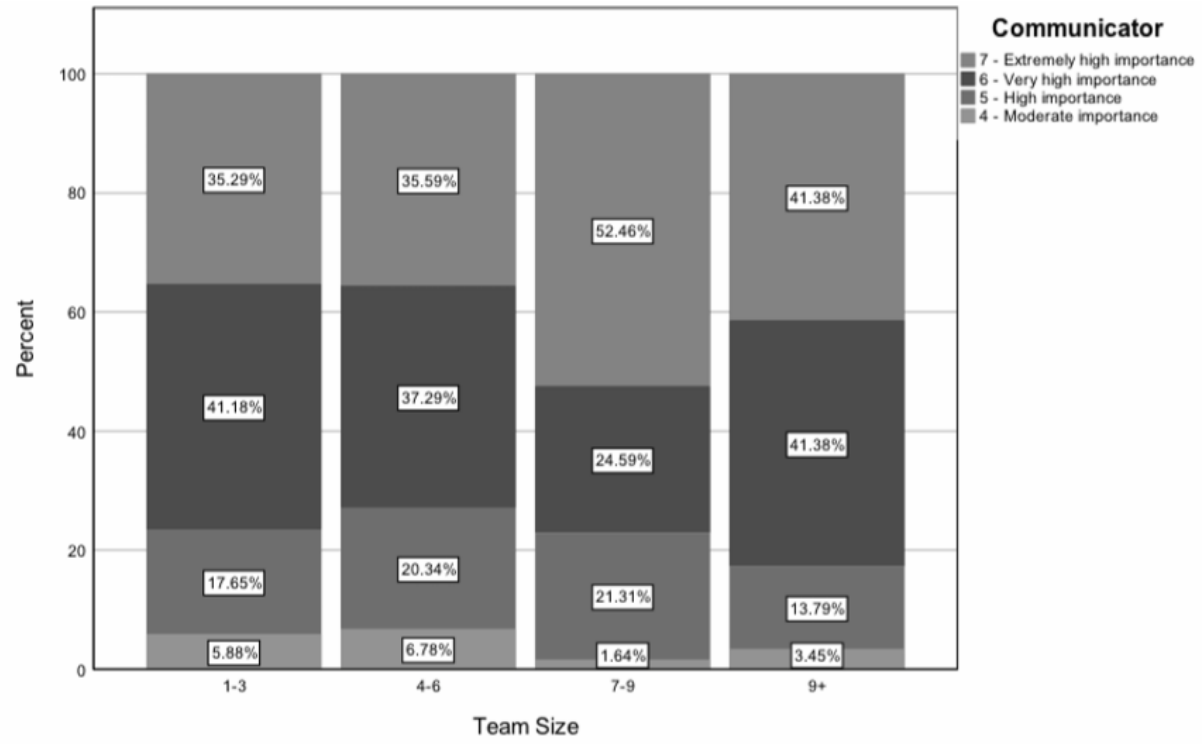
Team Size

Communicator





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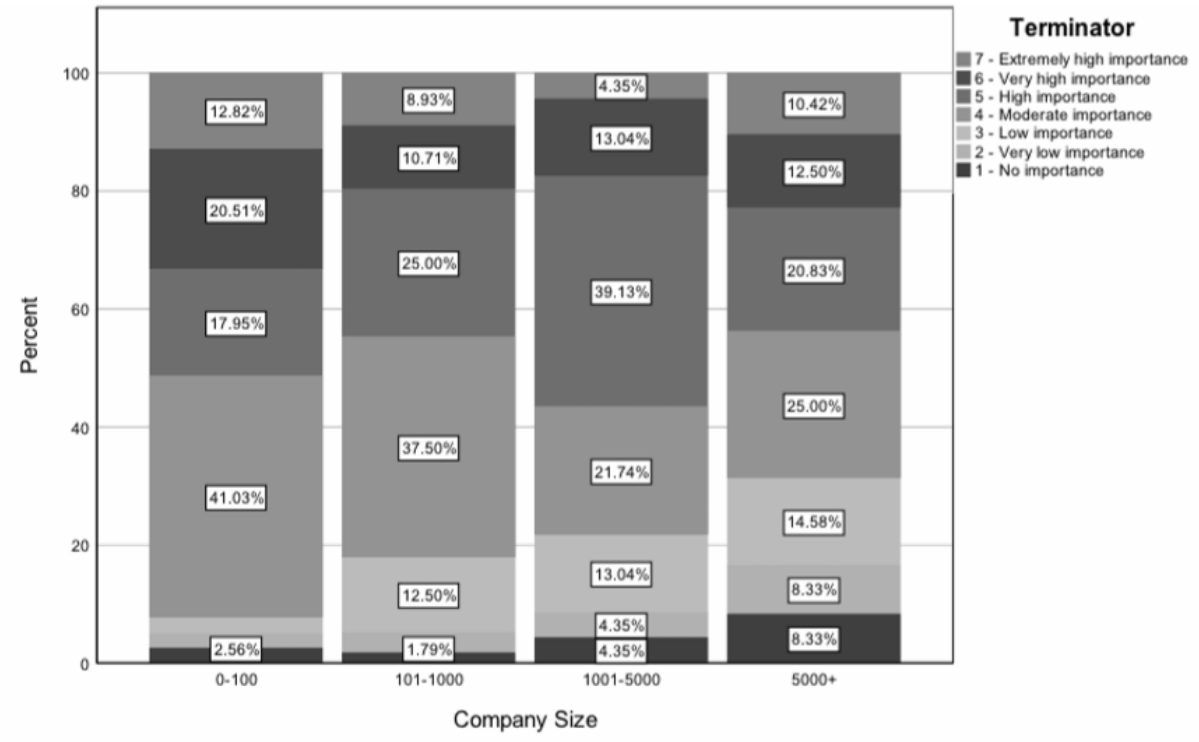
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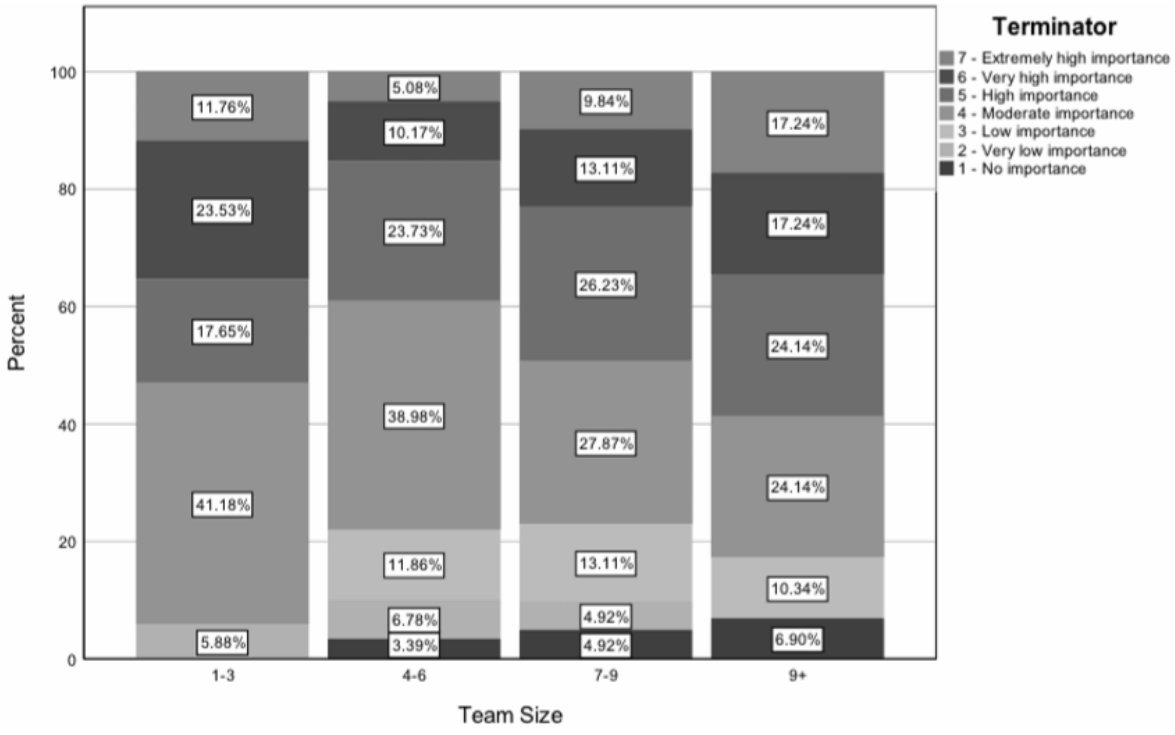
Company Size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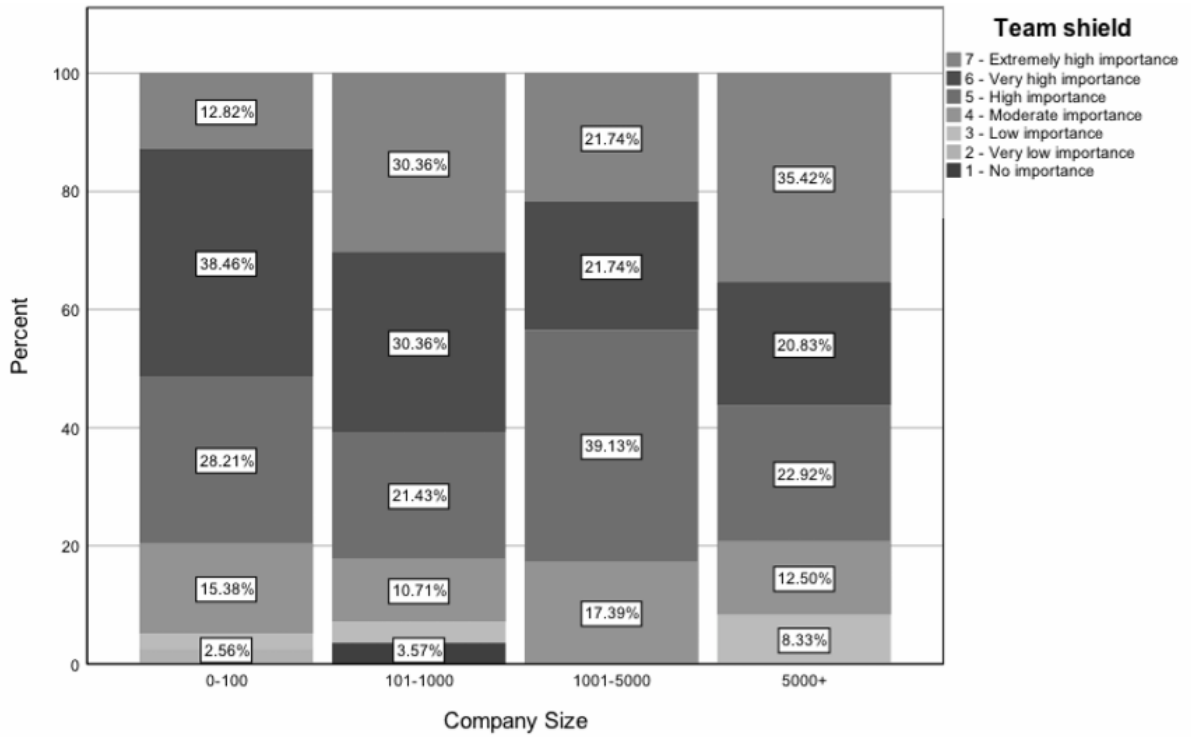
Team Size

Team shield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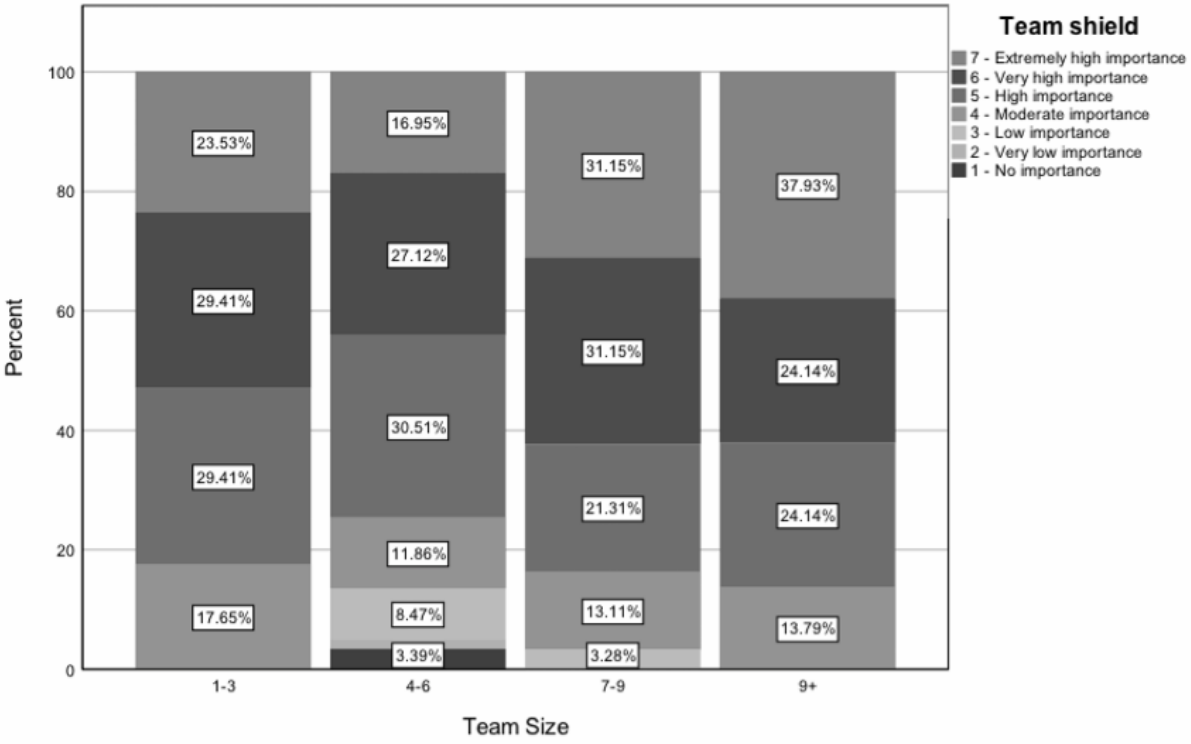
Team shield
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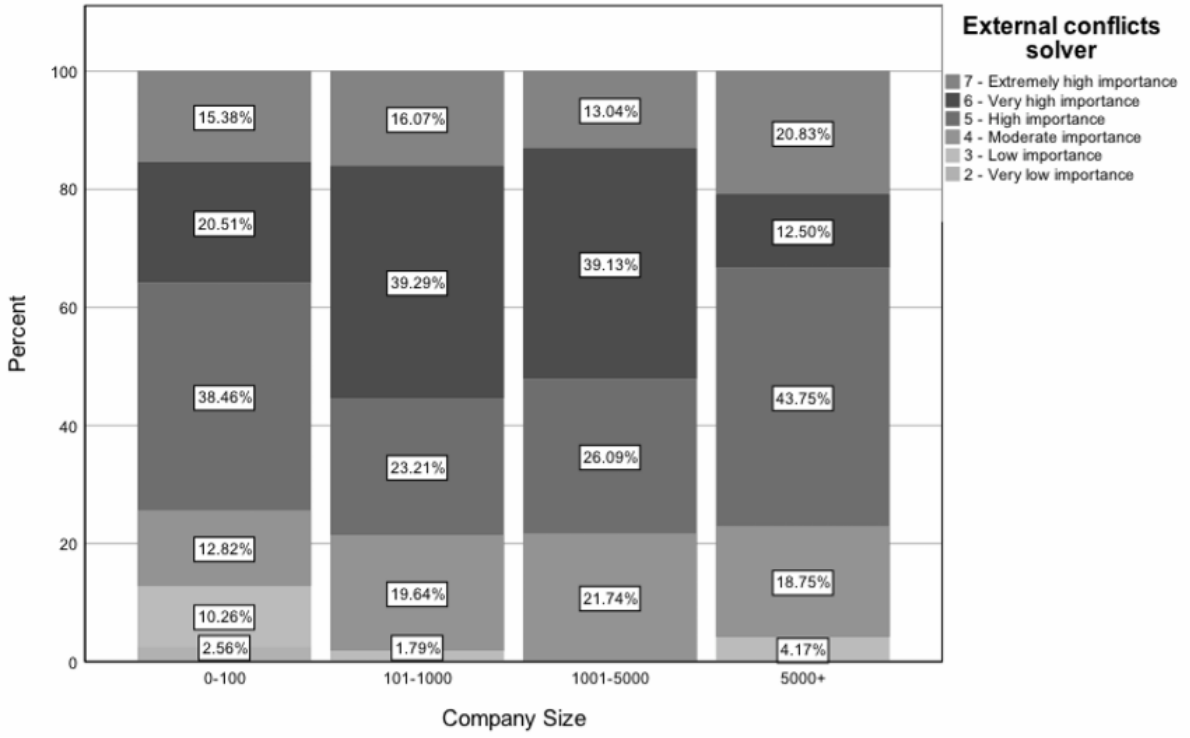
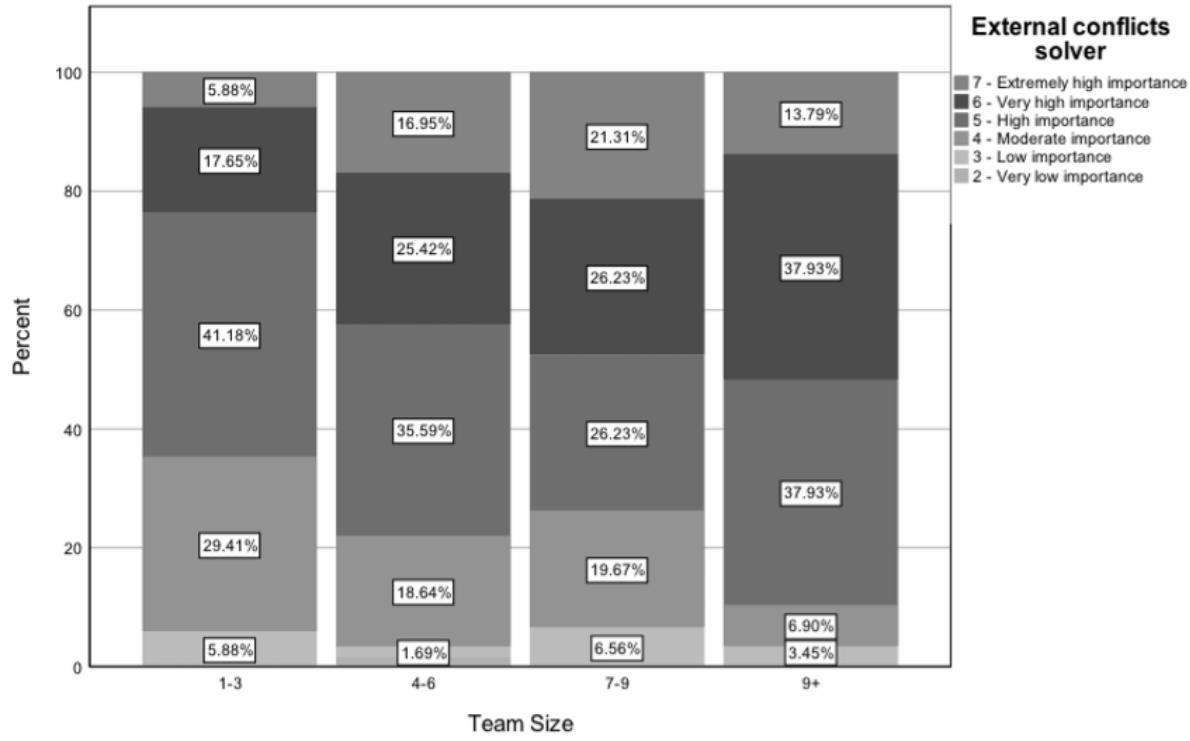
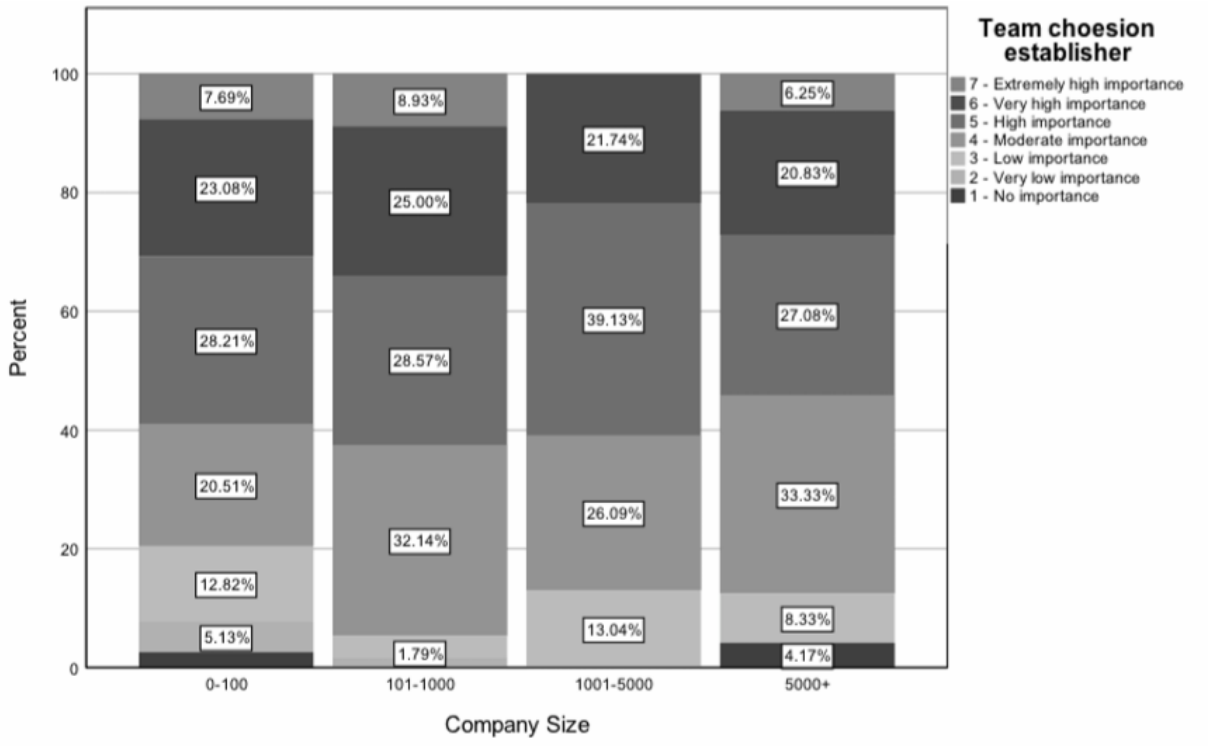
Team Size

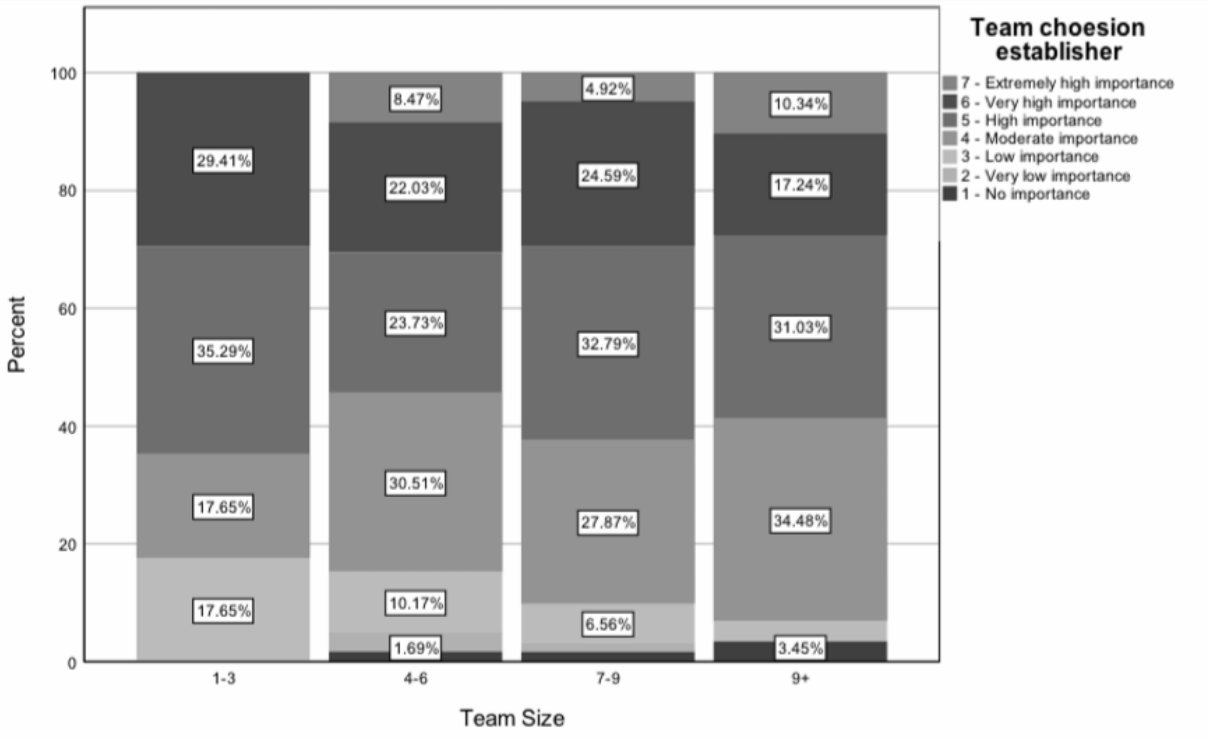
External conflicts solver



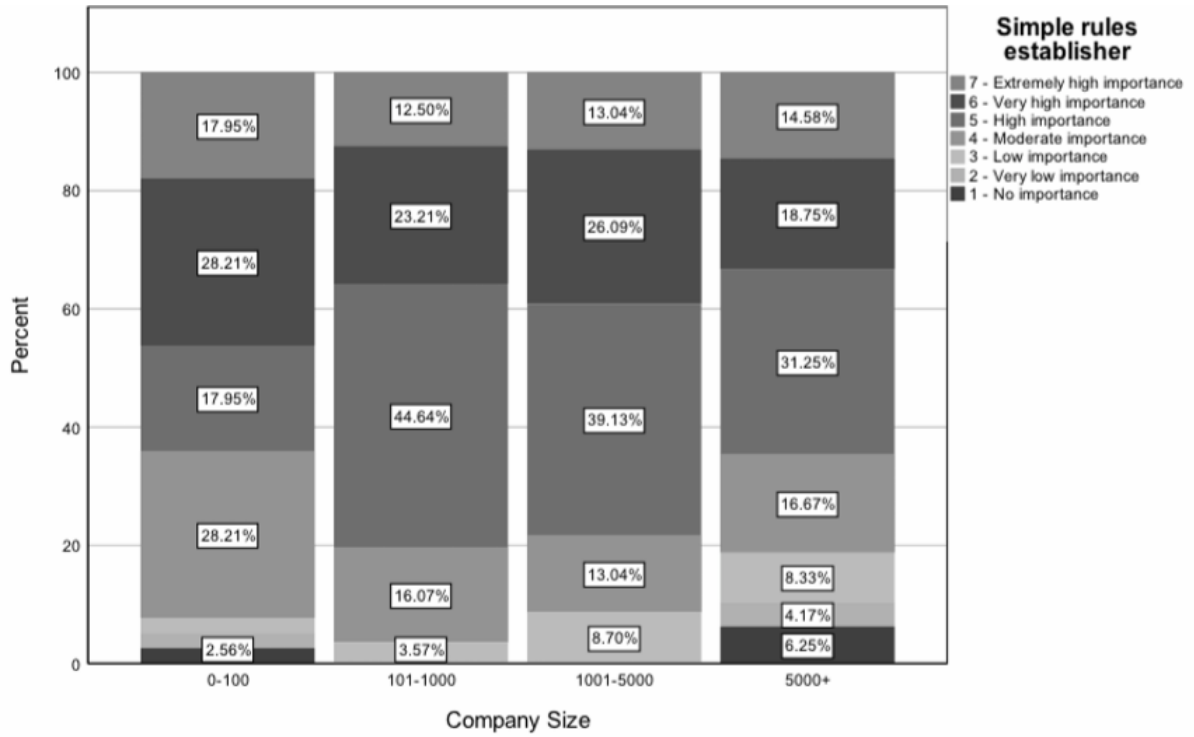


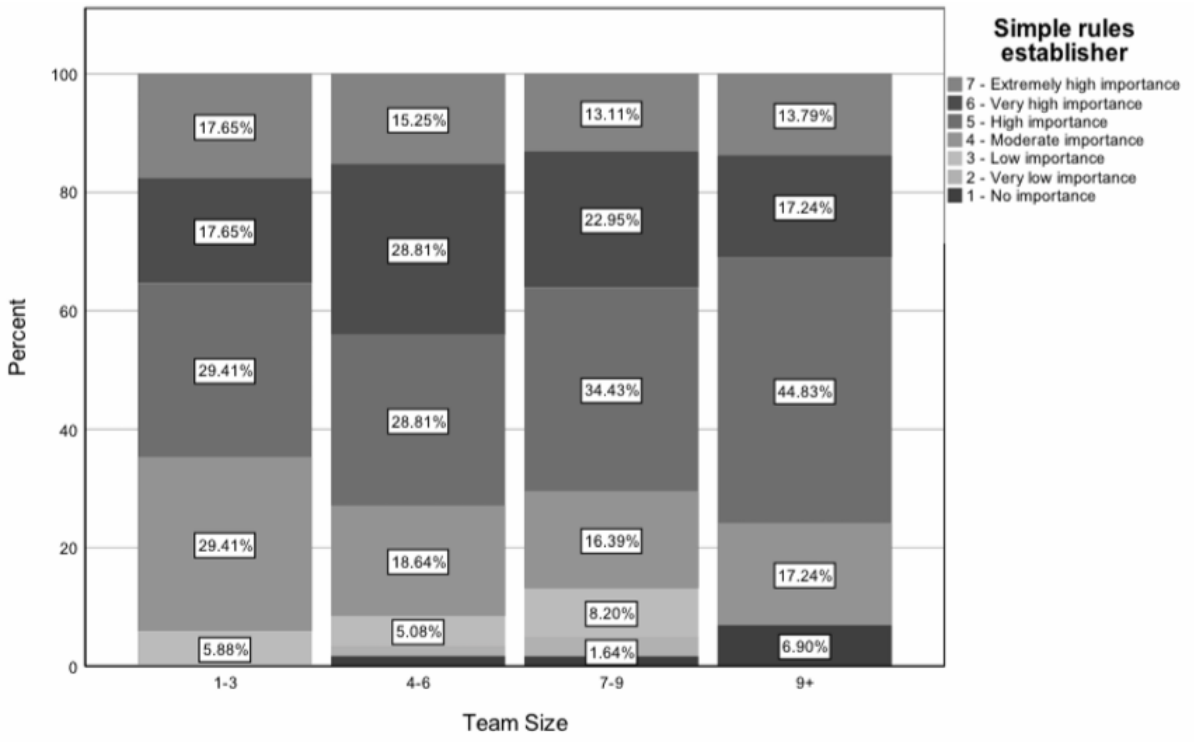
Team cohesion establisher



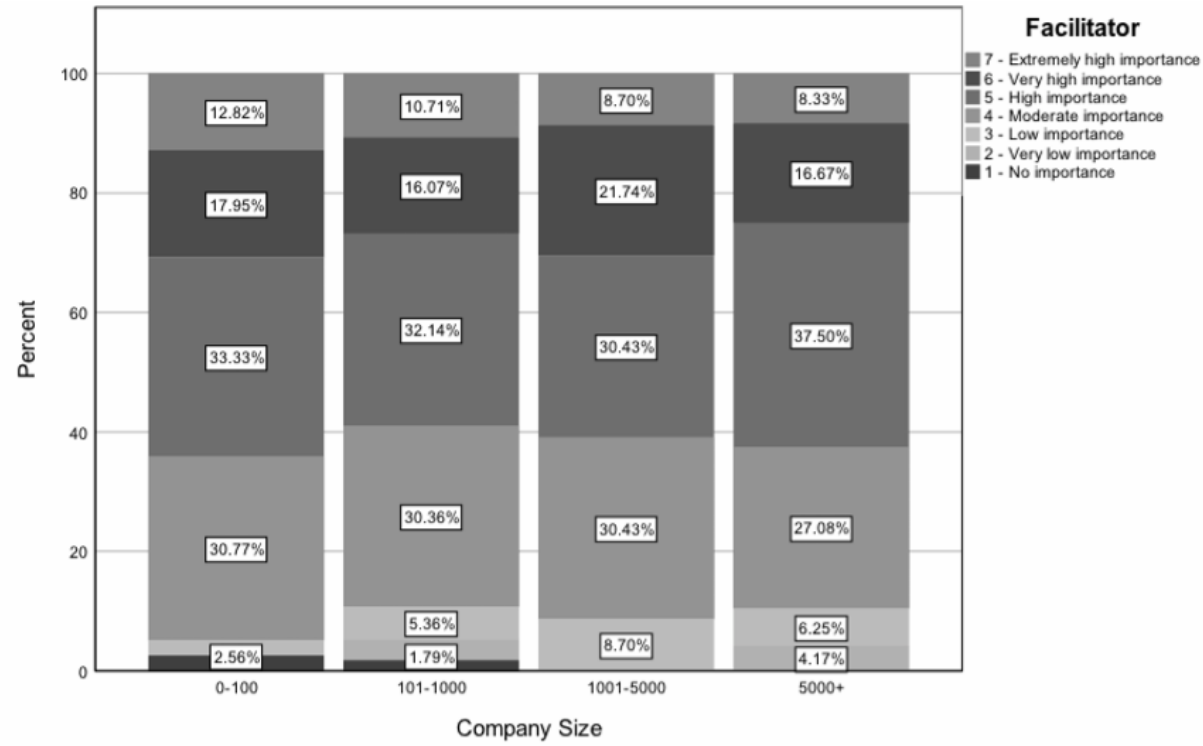


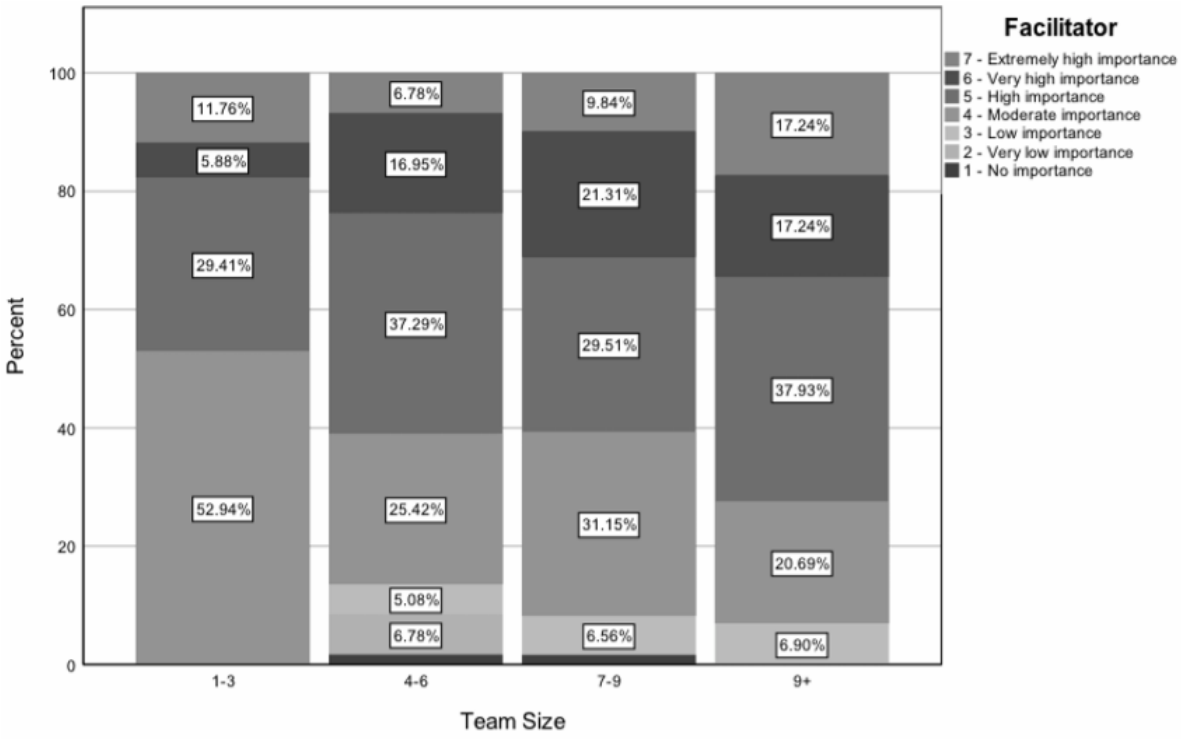
Simple rules establisher



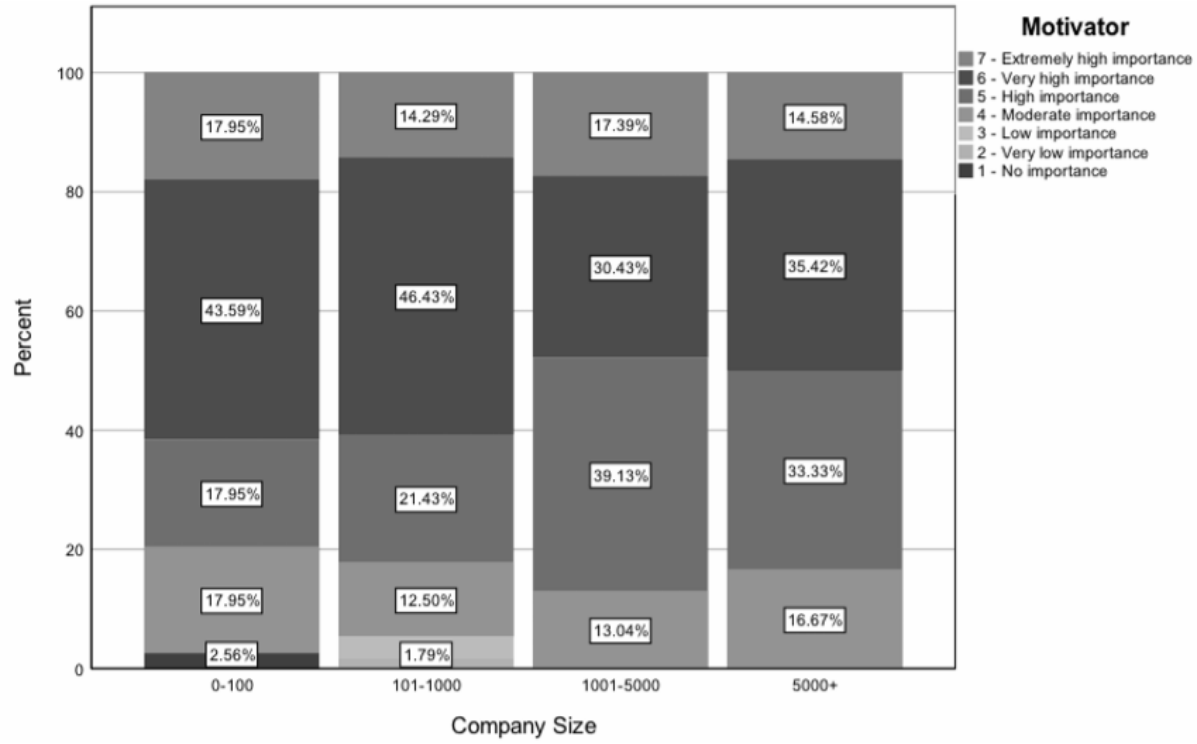


Facilitator





Motivator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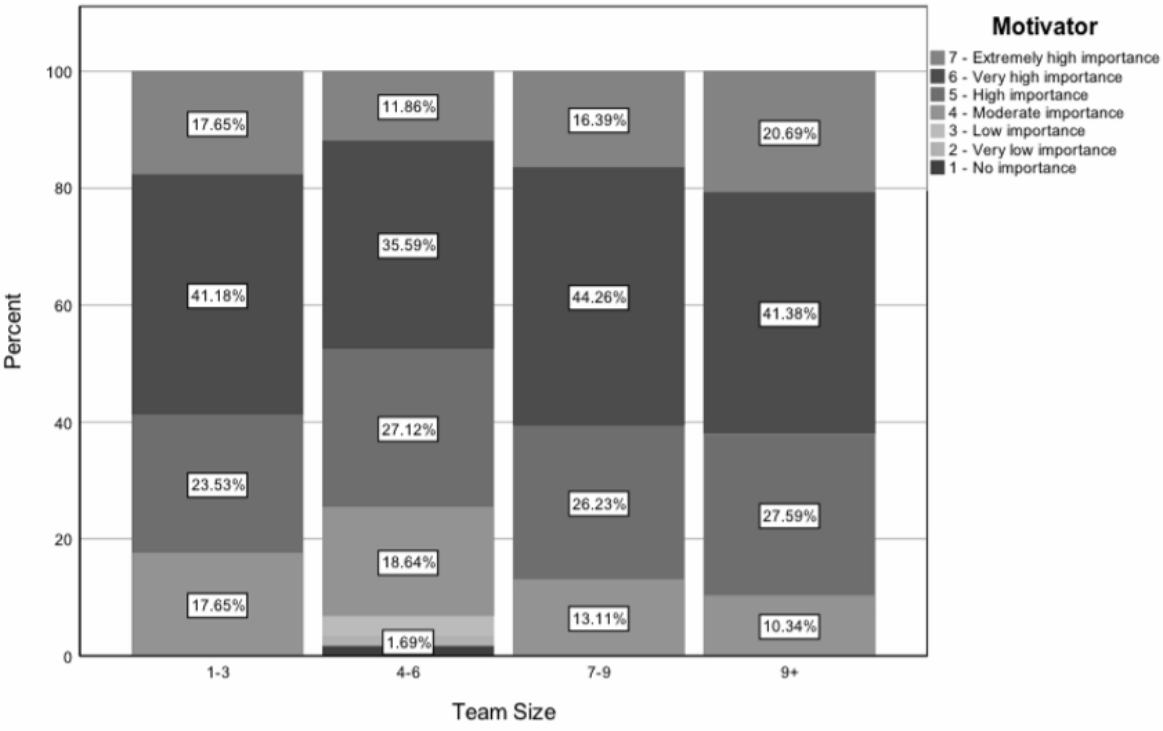
Company Size


Motivator
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Team Size

Appendix C – Reflection Document

How does your study correspond to the goals of the thesis course? Why? Focus on the goals that were achieved especially well and those that were not well achieved.

I think my study covers the goals of this course very well. Indeed, I learnt a lot during this half a year; I have never written a real scientific article in my life, I have never done literature review and have never applied reviewed applicability of statistical tests. One of the requirements set out by the University is to be able to contribute to the development of a research area. I think in this aspect this study was successful; even if the results are not something that would revolutionise a whole industry, I think it adds to a field that is very little researched. I think not limiting the scope of the research to a certain team, company or even country was a good idea, as like this it could generate a basic overview of the Agile community's thinking.

Some further efforts into this research could generate even more insights and could turn results into generally applicable action plans.

How did the planning of your study work? What could you have done better?

Planning was more or less alright. As per earlier discussions with my supervisor I have started writing my thesis before Christmas, so that time gave me a bit of buffer. One thing, however, I did not realise was how underdeveloped my statistics skills were. I could not figure out for a very long time how my questionnaire could generate valid responses, what statistical tests I can and which ones I can't use. Looking back, that buffer time could have been better spent on studying those concepts instead of trying to come up with a first chapter of the thesis.

I think what went well is writing itself. When I had the data to work with I could deliver longer pieces of work in limited amount of time. Of course, many times those texts had to be seriously revised (sometimes replaced) but writing continuously gave me a sense of making progress.

How does the thesis work relate to your education? Which courses and areas have been most relevant for your thesis work?

As I am undergoing and MSc course in IT project management, I feel that the thesis and the course material are very well aligned. We had a number of courses on Agile software development methodologies, as well as two semesters in leadership. Those courses, as well as my own practical experience helped me deliver this research.

How valuable is the thesis for your future work and/or studies?

I am currently working as a development manager of an Agile team, so these results will be of particular interest to me in my future career. I think I will be able to use a good portion of the findings in my day by day work and will be able to help my team go faster and deliver better results.

How satisfied are you with your thesis work?

After half a year, and countless efforts put into delivering this work I can say that I am very happy with my text. It's not only about finishing something of this magnitude, but the extreme amount of information I managed to get acquainted with during this semester proved to be very useful.

Of course, this work has its own limitation, and as I wrote earlier, will not revolutionise the industry. However, it will revolutionise my thinking about leading Agile teams, so it definitely achieved its goal to be a great source of learning to me.