

# A Decade of Research on Autonomous Agile Teams: A Summary of the Third International Workshop

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**Abstract.** Ever since the agile manifesto was created in 2001, the research community has devoted attention to autonomous teams. This article first examines publications on autonomous agile teams to illustrate how the research has progressed in the last ten years and next summarizes the result of the Third International Workshop on Autonomous Agile Teams. The workshop's goal was to capture what practitioners and researchers in the field of agile software development believe are emergent research themes and update the research agenda. We found that the top-rated research questions are related to autonomy in large-scale agile software development. Further, the number of relevant scientific publications is increasing, and there is widespread interest in the topic at various conferences.

**Keywords:** Autonomous teams · Agile software development · Team design · Self-organizing teams · Self-managing teams · Coordination · Large-scale frameworks

## 1 Introduction

To succeed in solving complex projects, agile organizations have to find ways to support and regulate teams' autonomy according to environmental demands. Furthermore, agile organizations have to take into consideration the degree of change and uncertainty and that there is no one-size-fits-all autonomy approach [1]. The process of forming and implementing autonomous teams, as well as the effective coordination of such teams, are not yet adequately addressed or understood [2]. Common barriers for such teams are 1) too much dependence on others, 2) lack of trust, and 3) part-time resources [3]. In large-scale agile development, autonomous teams struggle to handle organizational dependencies, set and communicate goals, establish a shared direction [4], and implementing tools like Slack to increase team awareness [5]. Further, even in the same large-scale agile projects, teams have individual needs for coordination with experts and other teams [6]. Thus, there is a need for new knowledge on how organizations should organize for the right level of team autonomy and utilize autonomous teams to attain better performance, productivity, innovation, and value creation.

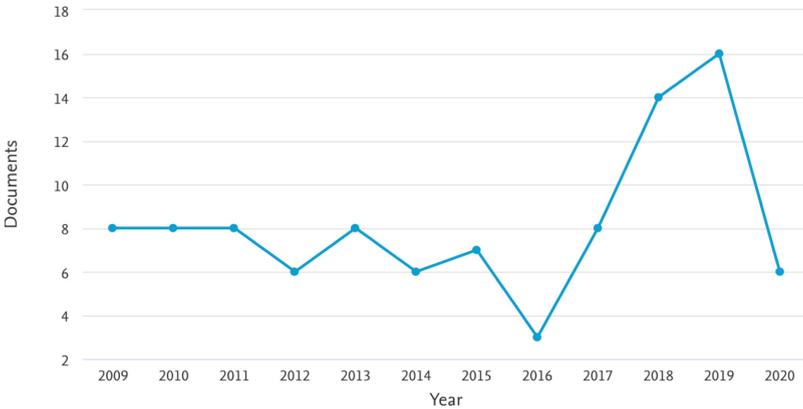
Next, we introduce research on autonomous teams and present findings from a literature search in the Scopus database. Then, we introduce the papers and results from the workshop. Finally, we present the updated research agenda.

## 2 Research on Autonomous Teams

Autonomy refers to control over the way a task is carried out [7] and can simultaneously reside at the team level and the individual level [8, 9]. While autonomy can have a positive impact on a team, an important question to answer is when—and how much—autonomy is appropriate under the specific conditions the team and organizations are facing. Hackman [10 p.92] discusses the relationship between self-management and autonomy, where the self-managing team has *a certain but limited amount of autonomy*. More precisely, the self-managing team is given responsibility for executing its tasks and monitoring and management of its work processes. As autonomy increases, the team is given responsibility for both designing the team and setting the overall direction. When a software development company maintains or develops a product or service, the work is assigned to several teams, and each team needs to align many decisions regarding the tasks and process with the rest of the unit. As a result, the team’s autonomy will be reduced in large-scale agile software development.

First-generation large-scale agile methods combine agile methodology, such as Scrum, with project management frameworks, such as Prince2. Today, many second-generation large-scale frameworks, such as the Scaled Agile Framework (SAFe) and the Large-Scale Scrum (LeSS) have been implemented. The SAFe is a comprehensive framework that requires the introduction of many predefined roles and processes, and the goal is establishing stable processes. Stable roles and processes provide control but reduce the flexibility required to solve complex tasks and experiment with ideas. The SAFe is based on daily team meetings and cross-team meetings as well as planning ahead with “big room planning.” Empirical studies suggest that these practices are insufficient when coordination is complex and changes over time [11]. The LeSS is based on the principles in Scrum related to product queue and defined sprints (time-boxing). Although the LeSS is more flexible than the SAFe, it does not support the need for team members with a high degree of autonomy and high responsibility to make decisions on a continuous basis when solving problems. The Spotify model is inspired by the Nordic model with a high degree of autonomy. However, the model is designed for a born digital company, built on an entirely separate platform without legacy systems and with many thousands of developers.

To better understand current research on autonomous agile teams, we conducted a literature search in the Scopus database. This search identified 170 research papers from journals and conferences that were published in the last ten years—between 2009 and 2019 (Fig. 1). After conducting the initial search, we added 2020 (until July 1) to check if the trend continued. We used the following search string: TITLE-ABS-KEY = (“autonomous team\*” OR “self-managing team\*” OR “empowered team\*” OR “team autonomy” OR “self-organizing team\*”) AND (computer science). We carefully read all titles and excluded articles that were not about teamwork. When in doubt, we read abstracts to make the decision. Seventy-four papers were excluded, and 96 were kept.

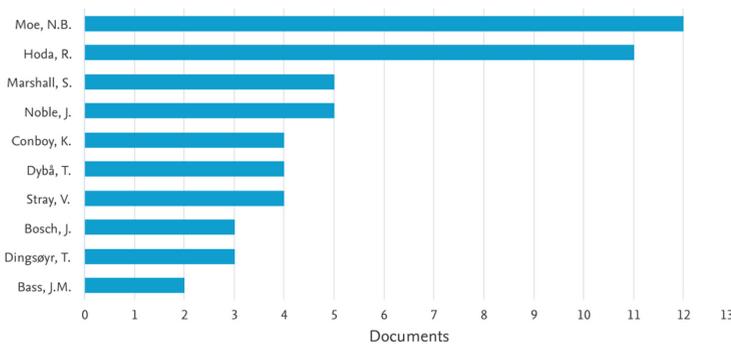


**Fig. 1.** Publication per year on autonomous teams in the field of computer science until July 1 2020

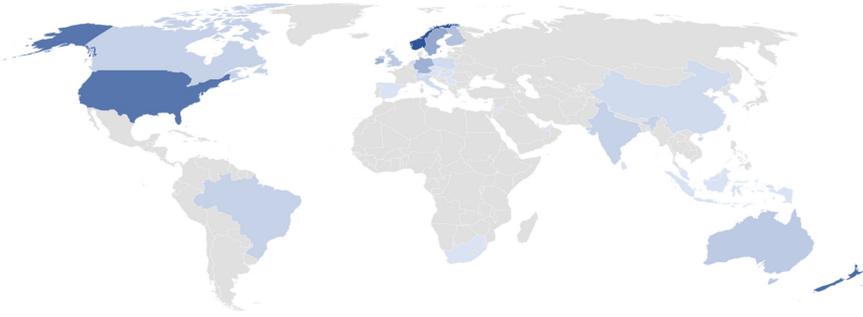
Most were conference articles (66%); however, 30% were journal articles, indicating the field is maturing. The ten most productive authors on the topic are shown in Fig. 2, and the four most productive institutions are SINTEF (Norway), University of Auckland (New Zealand), University of Oslo (Norway) and Victoria University of Wellington (New Zealand). However, as many as 33 countries are represented (Fig. 3). The top conference for research on autonomous teams is the XP conference, and many articles can be found in Springer proceedings.

Fig. 1 shows that the number of publications per year is increasing, and one reason for this is the XP conferences and the International Workshop on Autonomous Teams. There are a low number of publications recorded for 2020 because the search was conducted July 1. We estimate that 2020 will have more publications on autonomous teams than the previous years. The post-conference workshop proceedings from XP 2020 include five articles and will be summarized in Section 3.

We investigated the use of theories and the construction of theories in the articles included in the literature review by adding “AND (\*theory OR \*theories)” to the search



**Fig. 2.** Publication per authors on autonomous teams in the field of computer science



**Fig. 3.** Publication per authors on autonomous teams in the field of computer science

string earlier presented. We found a total of 12 articles (13%) and these articles reported using Agile Matching Theory, Modern Sociotechnical Theory, Control Theory, Complex Adaptive Systems Theory, Big Five Teamwork Theory, and Grounded Theory.

### 3 Summary of the Workshop

The 2020 workshop was an online event (because of COVID-19) as part of XP2020. The main conference had 900 registered participants, and the workshop on autonomous agile teams had 120 participants attending via Zoom. The workshop included five presentations by researchers who had had their papers peer-reviewed. After each presentation, the workshop participants gave feedback and asked questions. Finally, there were two interactive sessions.

In the first interactive session, attendees were divided into breakout rooms using Zoom, with 4–5 participants in each room (a total of 24 rooms), to discuss two questions: “What are the real-world problems that need to be solved (for autonomous teams)?” and “What are the research questions that should be answered?” In the second session, a silent writing session was conducted using Metro Retro to collect ideas. Forty-two ideas were posted on the virtual board and synthesized into a list of research questions by the organizers of the workshop. Because XP 2020 and the workshops were held online, the timeslots for all sessions and workshop were reduced. As a consequence, there was no time to discuss the identified research questions. The day after the workshop, the research questions were posted on the conference’s Slack channel for the workshop participants to vote on the most important questions.

#### 3.1 Research Themes on Autonomous Agile Teams

All of the papers presented at the workshop were based on investigations of autonomous teams in the context of large-scale agile frameworks. In the workshop, Gren [12] presented a paper using two popular theories from social psychology to better understand team autonomy in a large-scale setting: Group Socialization Theory and Social

Identity. Gren argues that the two social theories can be useful in explaining complexities to help one gain a better understanding when building autonomous agile teams, such as the social-psychological components of the team-based workplace or group dynamics. Group Socialization Theory explains patterns of behavior in retrospective meetings, and the Social Identity Theory explains why stand-up meetings within cross-functional teams decrease intergroup bias.

Salameh and Bass [13] explored how architectural governance increases team autonomy in a case study of a multinational fintech organization. The authors identified tailored practices that promote effectiveness in autonomous teams using the Spotify model. One important practice was introducing new roles and responsibilities within the team, such as the architect with a focus on facilitating decision-making regarding the architectural aspect and sharing architectural knowledge among teams.

Theobald and Schmitt [14] highlighted some challenges faced by agile teams when working on large, complex projects; in such projects, agile teams are often required to collaborate with other organizational branches, such as marketing and human resources. Moreover, safety-critical products still utilize traditional system engineering processes and mindsets, which may cause issues in collaboration between teams and their surrounding environments. In their study on the SAFe, the authors found that the framework does not provide enough details on how an efficient collaboration should be set up.

Mohagheghi et al. [15] highlighted challenges of autonomous teams within the governmental sector, such as inexperience with agile methods, large and complex projects, and reliance on traditional approaches. The authors examined a team in the Norwegian Labor and Welfare Administration that adopted agile methods while back-sourcing. Defining a clear product boundary, reducing dependencies on other teams, and developing necessary skills were critical factors for team autonomy. Furthermore, changes such as adding product owners to the team; abandoning a stage-based software development process with handovers between business, IT, and vendors; and having the team refine its portfolio for better cohesion supported agile adoption.

Doležel [16] collaborated with a global antivirus company to provide more clarity on the coined term “TestOps.” The author analyzed a set of practitioner videos on YouTube using thematic analysis and found that TestOps was understood as either a collaborative behavior associated with a shift in test personnel’s mindset or as a technology-intensive set of software practices. The first perspective is a people-centric view that binds with culture and sharing elements in DevOps, while the second is a technical view denoting TestOps as new tools, workflows, and processes supporting DevOps teams, highlighting automation and measurement elements. Doležel argued that both perspectives should be combined.

## 4 Revised Research Agenda

During the 2019 workshop, we asked participants about the best team size for autonomous agile teams; 23% answered four to five members, 23% answered eight to nine members, and 54% answered six to seven members. In the 2020 workshop, 9%

answered two to three members, 18% answered four to five members, 55% answered six to seven members, and 18% eight to nine members.

The actual performance of an autonomous agile team depends not only on the competence of the team itself in managing and executing its work but also on the organizational context of the teams. In the 2018 workshop, eight barriers to team autonomy were identified [2], and in 2019, these eight barriers were rated on a scale from 1 to 10. “Too much dependence on others” was rated as the main barrier [3]. One explanation could be that agile methods are applied increasingly often in a large-scale context.

The 120 participants of the 2020 workshop generated 42 ideas for research questions and these questions were synthesized into a list of eight questions. The workshop participants were then invited to rate these questions on a scale from 1-10. The top two questions are related to the challenges of autonomy in large-scale agile frameworks. Below is the ranked list:

1. How can autonomy and alignment be balanced?
2. How does a top-down approach to agile (e.g., SAFe) affect autonomy?
3. How can relationships and good communication habits be established?
4. How can teams be autonomous within a hierarchy?
5. What are the limits to the level of autonomy?
6. How can the dependencies between teams be reduced?
7. How can autonomous BizDevOps teams be implemented?
8. How can autonomy be measured?

## 5 Conclusion

It should be apparent from this introductory article that the research community is paying greater attention to issues related to autonomous teams in software development. There is an increasing number of scientific publications and widespread interest in the topic at various conferences; in addition, many countries (33) have engaged in research on autonomous teams in the field of computer science. This paper presents an overview of what practitioners and researchers in the field of agile software development believe are emergent research themes for autonomous teams. Top-rated research questions are related to autonomy in large-scale agile frameworks.

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