Leadership Styles in Agile Teams: An Analysis Based on Experience

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ABSTRACT This study covers the lack of literature analyzing the empirical relationship between leadership styles and self-management in agile frameworks. We have conducted a comprehensive survey in agile teams in order to analyze the relation between the self-management concept and the different types of leadership that occur in such teams. To perform the study we have followed the Goleman's leadership classification and the Marquet's and Kniberg's self-management models. Besides the previous concepts, we also investigate how different leadership styles exert alignment and autonomy within agile teams. The statistical evidence of these results has been validated for the sample at hand using statistical hypothesis tests. The results of the study show that respondents' perception of self-management in their teams remains similar and significant for all leadership patterns. Moreover, we study the effect of the alignment dimension within the concept of self-management, showing that authoritarian leadership styles, when present in agile teams, compensate low levels of autonomy with high levels of alignment.

INDEX TERMS Agile software development, innovation management, engineering management, organizational aspects.

I. INTRODUCTION

In this study we explore the direct relationship between self-management and leadership styles in agile teams. In this context, a misinterpretation of the self-management concept leads in many cases to think of an absence of formal leadership in such teams, see Agile 2 Values and Principles [1]. However, it is a false assumption that if a team has no formal authority, then the team self-organizes as a group of equals. As indicated in [2], leaders emerge naturally, the so-called de-facto leaders, whose distinction from an imposed authority is that de-facto leadership is recognised within the team and not outside. Leaders have an impact on an organization's profitability, productivity, market share, customer satisfaction, efficiency, and the ability to achieve organizational goals, see [3] for a detailed analysis.

In agile teams, leaders are intended to serve the group. In this sense, the figure that fits best is that of the so-called servant leader, see Robert Greenlaf [4]. Servant leaders encourage everyone to participate and help to create a good group atmosphere. They have a solid vision of the goals and inspire team members to develop their talents and skills. An example of an agile framework where the concept of leadership is explicitly introduced is Scrum. The Scrum Guide [5] describes Scrum Masters as leaders that ''serve the Scrum Team and the larger organization''. However, according to Cliff Berg [6] there is a lack of authority in the attributions given to the Scrum Master by the Scrum Guide. Authority is still needed, and a real servant leader should use this authority to give others a reasonable degree of autonomy. This ties in with the natural emergence of de-facto leaders in agile teams, as the key point is the type of authority: an agile leader is not necessarily an appointed authority, but an authority recognised by the team.

In this work we go further: we explore the different types of leadership that appear in agile teams. Moreover, we empirically show that the self-management degree is independent of the type of leadership. In other words, self-management is inherent to agility. We also study, for the different leadership styles, the effect of the alignment dimension, that is, the commitment of the team members to a common objective. In particular, we show that this dimension is essentially

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crucial to achieve self-management in teams managed by authoritarian leaders who usually constrain the autonomy of the team members.

The paper is organised as follows: Section II presents a brief state of the art on self-management, autonomy, alignment and leadership styles. In section III we describe the particular frameworks used to conduct our study. Section IV describes the methodology followed to carry out the study. In section V a descriptive analysis of the survey results is presented, whereas section VI includes a statistical analysis supporting the descriptive results. Finally, section VII resumes the conclusions and outlines further research topics.

II. BACKGROUND

In this section we briefly review some well-known leadership and self-management frameworks. We also introduce the concept of alignment in agile teams. Besides, we will attempt to clarify the dissimilarity between the concepts of autonomy and self-management. It is important to remark that although our analysis has been carried out within the agile framework, these concepts are not exclusive to the field of agility.

The Agile Manifesto [7] explicitly states that ''The best architectures, requirements, and designs emerge from self-organizing teams.'', being self-organization a concept strongly linked to self-management [8]. In agile frameworks, these two concepts are often used interchangeably. We refer to [9] for a discussion about the difference between both terms. Some suggested references that might add additional perspectives are [10], [11]. With regards to the study of self-organization in the agile literature, there exist some works such as the paper that laid the foundations of self-organization in the agile context [12], or the work in [13], a reliable academic study involving 58 agile practitioners from 23 different organizations, in which some spontaneous roles that make agile teams self-organizing are identified. We refer to [13], [14] and references therein for a detailed literature compilation on self-organization in agile teams.

Self-management is defined by the movement of Sociocracy 3.0 [15] as "People who govern themselves within the limitations of a domain. Self-management: People who coordinate work within the limitations defined through governance." A definition of self-managed teams also appears in the Scrum guide [5], where it is stated explicitly that Scrum Teams are "self-managing, meaning they internally decide who does what, when, and how". As stated in [16], self-management teams plan and program their work, which involves a compromise to the team's goal. A self-management working environment implies that individuals decide the objectives to be performed and how to accomplish them, that is, everything is self-conducted and self-handled [17]. David Marquet introduces a framework that presents different levels of self-management, based on the communication between leaders and members of the team [18].

At this point, it is important to note the difference between self-management and the concept of autonomy, as it is very
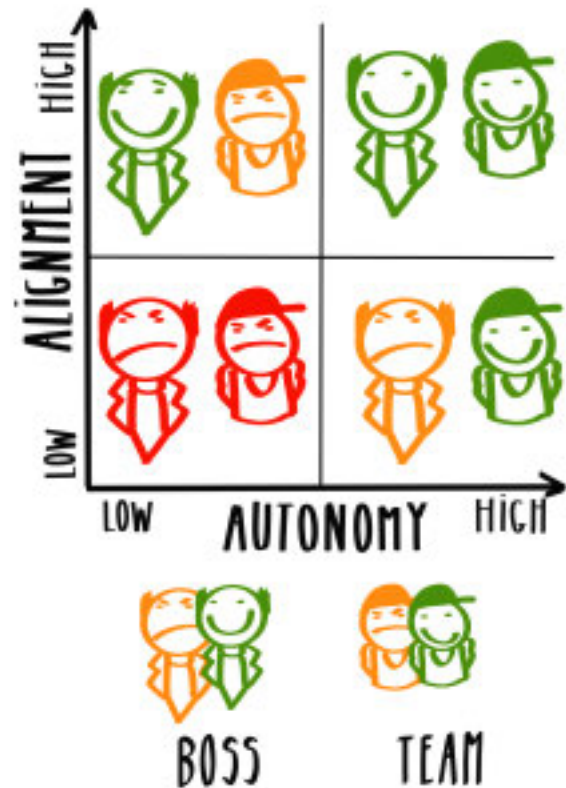

FIGURE 1. Henrik Kniberg's two-dimensional self-management model.

typical to confuse their meaning and interpretation. Autonomy is a more bounded concept. An autonomous working context implies that there are objectives previously defined for the employee, but the employee decides how to achieve them, that is, there exists an entity or body providing strategic directions. The well-known Hackman's model [19] defines autonomy as a level of self-management. According to Hackman, the probability of being a high-performance self-organized team increases with the ability of its members to identify their type of leadership, autonomy, goals, structure, supporting context, coaching capacities and guidance available. Other works [8], [20] define autonomy as independence in the development of the tasks that will be realized. More recently, a model that clearly differentiates these concepts was proposed by Kniberg [21], whose framework has been implemented in Spotify, a company dedicated to music streaming. Kniberg proposes a simple model to measure self-management. He analyzes two dimensions, specifically: i) the team's autonomy and ii) the team's alignment to accomplish the objectives. Then, an autonomy versus alignment matrix is built to compare these dimensions. Fig. 1 shows a matrix representation of Kniberg's model. In Kniberg's model, autonomy is a dimension within self-management, but not the only one. In this paper we will follow the models of Marquet and Kniberg to construct a measurement scale for these concepts.

Concerning the alignment concept, it is defined in [22] as the ''proper or desirable coordination or relation of components and a condition of close cooperation''. This definition

fits with the above mentioned commitment of the team members to a common objective. This is coherent with the conditions that lead to a good alignment, particularly: A shared purpose, transparency, feedback loops to reinforce alignment, making priorities clear and organizational learning (for instance, sharing of good and bad practices) [21]. Nevertheless, most studies focus its results on autonomy [19], being alignment a less studied concept. For instance, in [23] it is empirically shown that there is a positive correlation between autonomy and self-management, that is, the greater the autonomy, the higher the levels of self-management in the teams. In addition, the authors also show that flexible leadership styles foster autonomy, while authoritarian styles tend to constraint it. According to Kniberg's model, intermediate levels of self-management could be reached through a high alignment of the team and a lower level of autonomy, although there is no literature empirically studying this fact. In [10], a seven months study through different ethnographic groups is carried out, showing that highly specialized skills promote individual autonomy but may interfere with self-management. However, in these works, with autonomy being the main thread, a study of the straight relationship between the types of leadership and self-management is not carried out. This study covers the lack of literature that analyzes such a relationship.

Regarding leadership styles, Lewin, Lippitt and White [24] defined three basic types, namely: Authoritarian, Democratic and Laissez-faire, and different extensions of such classification have been presented in the literature, see for instance [25] among others. In this study, we will follow Goleman's approach [26], who considers six styles of leadership: Democratic, Affiliative, Visionary, Coaching, Pacesetting and Commanding leaders. We will review such styles in the Models and frameworks section.

III. MODELS AND FRAMEWORKS

Next we present the particular models and frameworks chosen to design the survey and develop the subsequent analyses.

A. LEADERSHIP STYLES FRAMEWORK

As already mentioned in this study we will follow Daniel Goleman's framework [26]. Such a model introduces leadership from an emotional intelligence point of view, distinguishing the following styles:

- Democratic leader: considers the opinions of the entire team to reach a goal. She/he encourages everyone to participate.
- Affiliative leader: tries to establish a good environment in the team and promotes the bonding of the team members. She/he helps to create a good group atmosphere.
- Visionary leader: has a solid vision of the goal and tries to involve the team to reach it. She/he listens and encourages improvement.
- Coaching leader: focuses on inspiring team members to develop their talents and skills. She/he inspires belief in the team's members to achieve a common goal.

- Pacesetting leader: demands the whole team to act like her/him and does not allow each member to develop their skills. She/he creates a competitive environment.
- Commanding leader: has full control over the team members work and they have no decision-making capacity. She/he dictates the steps to follow in everything.

These styles can be grouped into: i) Flexible styles: Democratic, Affiliative, Visionary and Coaching leaders; and ii) Authoritarian styles: Pacesetting and Commanding leaders. Notice that the flexible styles include characteristics that define servant leaders.

B. SELF-MANAGEMENT FRAMEWORK

David Marquet, derived from his work as a commander in a military submarine, proposes a framework that allows measuring self-management at different levels [18]. The lowest level of the ladder is the least self-organizing. In his model, it is crucial the importance of the language used to determine the tasks, that is, how the team members and their leader communicate with each other. The levels relate the language used by the leader while defining the tasks, and the viewpoints of the team members while executing their works. The Marquet's degrees of self-management are categorized in three levels, namely:

High degree of self-management:

- The boss says. . . : "What have you been doing?", "What have you done?"
- You say…: "I have been doing…", "I've done…"
Intermediate degree of self-management:
- The boss says. . . : "What do you intend to do?", "What would you like to do?", "What do you think?", "What do you see?"
- You says . . : "I intend to do …", "I would like to do…", "I think that…", "I see that…"

Low degree of self-management:

- The boss says. . . : "I'll tell you what you have to do?"
- You say…: "Tell me what I have to do."

One of the characteristics that make this model interesting is that it defines different levels, both for the team and for the leader, designating them in a very clear way with the phrases that they propose to identify them. Therefore, this model constitutes a perfect basis for the design of questionnaires.

C. AUTONOMY AND ALIGNMENT MODEL

Henrik Kniberg was an Agile/Lean Coach in Spotify, who co-created a business organization model [21]. His model describes self-management as a two-dimensional concept whose dimensions are alignment and autonomy. This model provides a simple framework to measure in a binary way (yes/no) the concepts of autonomy and alignment in a company. As already mentioned, see 1, the model crosses the team's autonomy (to what extent how to solve the things) and the clearness of the organization making objectives explicit (to what extent is it comprehensible what needs to be resolved). The purest degree of self-management is achieved

Country	Percentage
Spain	57.1%
Colombia	9.0%
Peru	6.5%
Chile	6.1%
Argentina	4.9%
Mexico	4.9%
Costa Rica	1.6%
Uruguay	1.2%
Cuba	0.9%
Germany	0.9%
Other	6.9%

with simultaneous high levels of alignment and autonomy, whereas the poorest degree of self-management is reached when low levels of alignment and autonomy take place, being these scenarios, respectively, the most and least positive ones for the organization. At intermediate levels, either the team works autonomously but not aligned with the goals proposed by the organization or the team knows the objectives but does not have the ability to decide how to do the work (when low levels of autonomy are present). As a consequence, the model states that a good alignment should consists of:

- A shared purpose: why are we working on X?
- Transparency.
- Feedback loops, to frequently reinforce alignment, within the team and between several teams.
- Make priorities clear.
- Organizational learning, that is, good and bad practices are shared among teams.

IV. METHODOLOGY

In this work we carry out an analysis of the data obtained from a survey focused on the experiences of members of agile teams within the software industry. The sample of respondents was built up from people who belong to active agility groups in social networks. Data were collected from December 2017 to March 2018. The questionnaire was completely answered by 247 out of 248 participants (drop out rate of 0.0004%). Missing data account for less than 5% of the responses and have been eliminated. Concerning the geographical distribution of the respondents, 22 countries were represented, shown in table 1. In this regard, it is important to point out that most respondents belong to groups of agile developers from Spain and Latin American countries. In particular, 57.1% of the answers come from Spanish professionals, followed by wide groups from Latin America.

The survey was voluntary and anonymous, with no reward to the participants. No ethical approvals were needed. The survey was designed following the Pfleeger and Kitchenham model [27], which provides guidelines for the design of surveys in the software engineering field. In addition, we have followed the Stavru recommendations [28] for the design of reliable agile surveys, especially those concerning the survey method and design, the conceptual model, target population, sampling frame and method, questionnaire design, response rate and assessment of trustworthiness. In fact, the survey

instrument has been designed so that it could be applied within any agile context. All this considerations were taken into account during the preliminary planning phase of the survey.

The team members were asked to answer a survey about four fundamental aspects in agility: leadership style, autonomy, alignment and self-management. In particular, the specific questions analysed in the current work have been designed from the following two hypotheses: i) there exist different leadership styles; and ii) the degree of self-management is different for each leadership style. Respondents were asked to provide answers based on their experience working as members of agile software development teams. The responses to the survey allow us to quantify both the extent to which each type of leadership comes into view in agile teams and the level of self-management that is perceived for each leadership style. To quantify the responses, Likert-type scales have been used. The survey is structured into four parts (general data, leadership styles, self-management, autonomy and alignment). Next we give a detailed description of each section of the questionnaire:

1) General data. Collection of the respondents descriptive data, in particular: *Country, company name, work in the company (management, technical works), role in the team (scrum master, product owner, development team, agile Coach, others), team size (1-4, 5-9, 10-20, > 20)*

2) Leadership styles.
   For each leadership style, the respondents are asked whether they perceive such a style in their agile teams. Respondents are allowed to choose more than one leadership option, since they may recognize characteristics of various leadership styles within their teams. We avoid asking respondents about the agile role of the person exercising leadership, as in agile teams de-facto leadership is independent of the role in the team (scrum master, product owner, project manager, agile coach, etc.). Therefore, in this study we are interested in the concept of perceived leadership, that is, the perception of leadership that the team members have. The concept of perceived leadership is intangible and takes into account both the workers' experiences with the leader and their knowledge about him. Based on Goleman's framework, the concrete leadership question appearing in the questionnaire is:
   Choose the definition that best suits your boss/leader (Always, Quite often, Occasionally, Only occasionally, At a point in time, Never):
   - *Encourage everyone to participate*
   - *Helps create a good group atmosphere*
   - *Listen and encourage improvement*
   - *Inspire belief in us to achieve a common goal*
   - *Create competitive environment*
   - *It dictates the steps to follow in everything*
   Notice that each bullet identifies a type of leadership, respectively Democratic, Affiliative, Visionary,
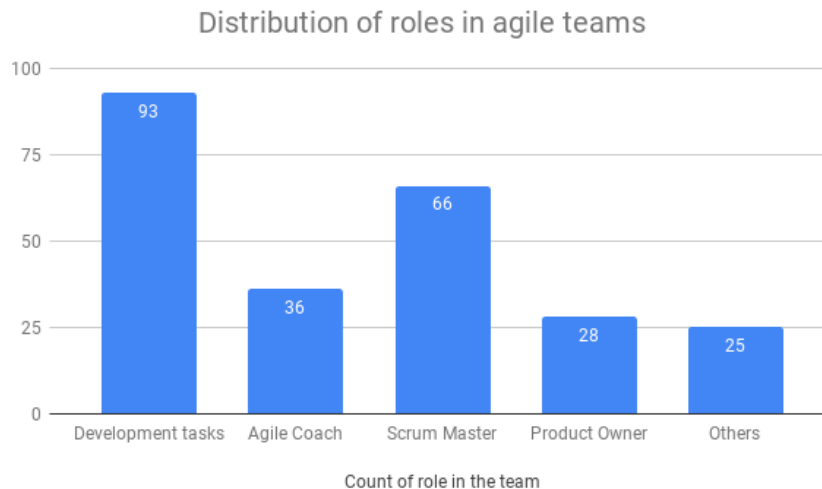
Distribution of roles in agile teams

FIGURE 2. Distribution of roles in agile teams: number of participants within each roles.

Coaching, Pacesetting, Commanding, without explicitly mentioning it.

3) Self-management.

Regarding self-management, the questionnaire is based on Marquet's model. The respondents are asked whether they perceive self-management in their agile teams both, from the point of view of the person in charge and from the employee's point of view. In particular, the questions appearing in the survey are:

i) From the point of view of the person in charge (Always, Quite often, Occasionally, Only occasionally, At a point in time, Never): When your manager talks to you about the tasks that need to be done, how does he talk to you?

- *What tasks have you been doing or have you done?*
- *What tasks do you intend to do?*
- *What task would you like to do?*
- *What do you think about the task assigned to you?*
- *You have to do the task X*

ii) From the employee's point of view (Always, Quite often, Occasionally, Only occasionally, At a point in time, Never): When I talk to my manager about the tasks to be done, I answer type sentences . . .

- *I tell you what I have done*
- *I would like to do*
- *Regarding the task you have assigned me, I think that*
- *I do not think (tells me what I have to do)*

4) Autonomy and alignment.

We have used the Kniberg's model to ask respondents about the autonomy and alignment in their organization. The questions asked are:

Do the following situations occur in your team? (Yes/No):

- *The leader explains clearly the objectives, what to achieve and why (alignment)*
- *The team has autonomy to decide how to work*

V. RESULTS
In this section we provide a descriptive analysis of the survey results for each section of the questionnaire.

A. SUMMARY STATISTICS
The survey responses show a diverse mix of roles within the organization teams. Most participants, 93 people, take care of development tasks, 66 achieve the Scrum Master category, 35 correspond to Agile Coaches and 28 are Product Owners. This distribution of roles is shown in fig. 2.
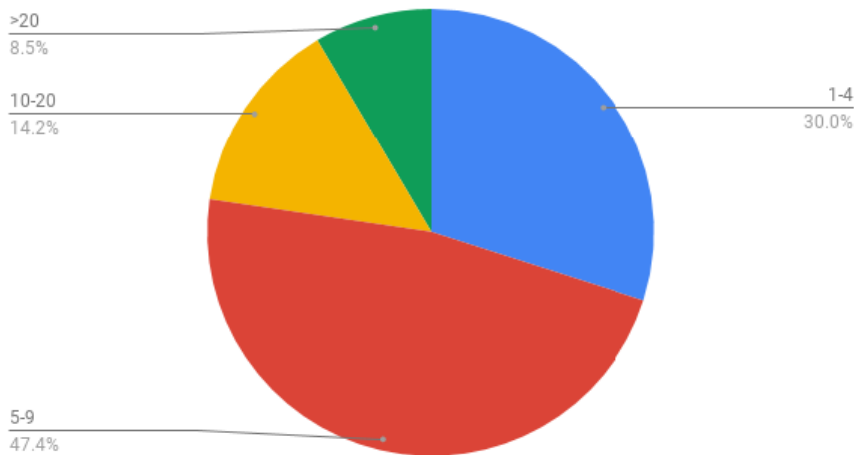
Fig. 3 shows a size comparison of the participants' agile teams. Most participants, 47%, work in teams with 5 to 9 members, the considered ideal size for an agile team [29], 30% in smaller teams with one to four members, and 23% in teams with more than 10 members.

B. QUANTIFYING LEADERSHIP STYLES IN AGILE TEAMS
Fig. 4 presents a summary of the results regarding the leadership style perceived by the respondents within the agile teams they belong to. As already mentioned, the leadership styles correspond to those in the Goleman's framework. A first result is that all leadership styles are perceived to occur in agile teams. Authoritarian styles, Pacesetting and Commanding, are perceived respectively by 22% and 30% of the respondents; whereas flexible styles, Democratic, Affiliative, Visionary and Coaching are recognized by 58%, 58%, 54% and 51% of the respondents respectively.

Fig. 5 shows aggregated results regarding the types of leadership: 45% of the respondents perceived their leaders having only features corresponding to flexible styles, 16% of the respondents observed only authoritarian features in their leaders, 25% of the respondents perceived both kinds of leadership styles in their agile teams and the remaining 14% of the respondents did not identify any leadership style or did not respond. This result is consistent with the fact that flexible styles embody features typical of servant leaders, more suitable in general for agile frameworks, see for example [5] and [6].

FIGURE 3. Size of participants' agile teams.
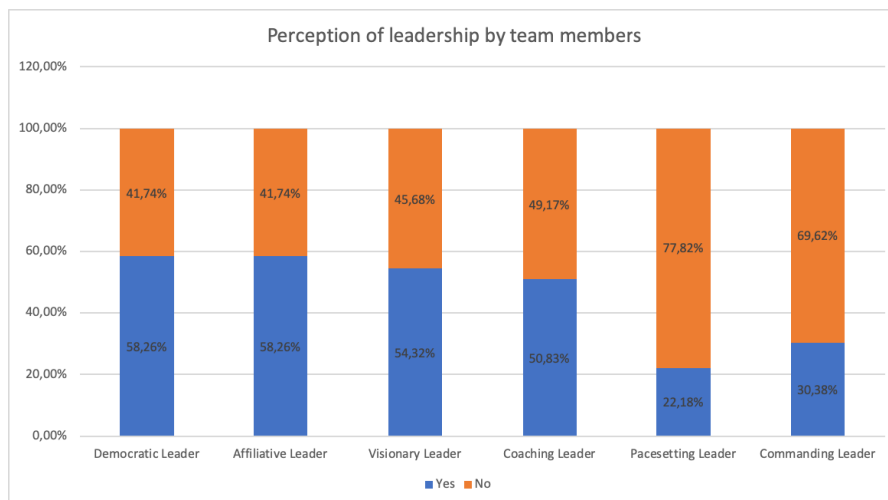
FIGURE 4. Leadership styles perceived by the respondents.

In summary, it can be concluded that, in agile teams: i) all leadership styles occur, being flexible styles the most frequent ones; and ii) a quarter of the sample perceives in their leaders both, flexible and authoritarian features at the same time, showing that different leadership styles may take place simultaneously.

C. QUANTIFYING THE DEGREE OF SELF-MANAGEMENT FOR EACH LEADERSHIP STYLE

Fig. 6 presents a summary of the results for agile teams regarding the degree of self-management within each leadership style perceived by the respondents. Again, the leadership styles are those in the Goleman's framework. As previously commented, the respondents are asked whether they perceive self-management in their agile teams, and then the answers are crossed with the leadership style perceived by them. According to the results, we observe that the perception of self-management that respondents have is comparable regardless of the type of leadership. The maximum level of self-management is attained by the Visionary leader (61%),

whereas the minimum level of self-management is achieved by the Commanding leader (54,8%).

D. QUANTIFYING THE IMPORTANCE OF ALIGNMENT IN AGILE TEAMS

Fig. 7 shows the categorization by leadership styles of answers from those participants who only perceive alignment in their agile teams. This categorization helps to guess which leadership frameworks promote the alignment concept as a key basis within their usual performance. It is clear that, according to the participants' perception, Pacesetting and Commanding leaders, the so-called authoritarian styles, are the ones with the highest perception of alignment in their teams (with more than 50% of their members supporting this statement), whereas Democratic, Affiliative, Visionary and Coaching leaders, that is, the flexible leadership styles, show a lower level of alignment (less than 40% of their members support this statement). It is important to remark that this result is restricted to the perception of alignment as an isolated concept. These descriptive findings complement
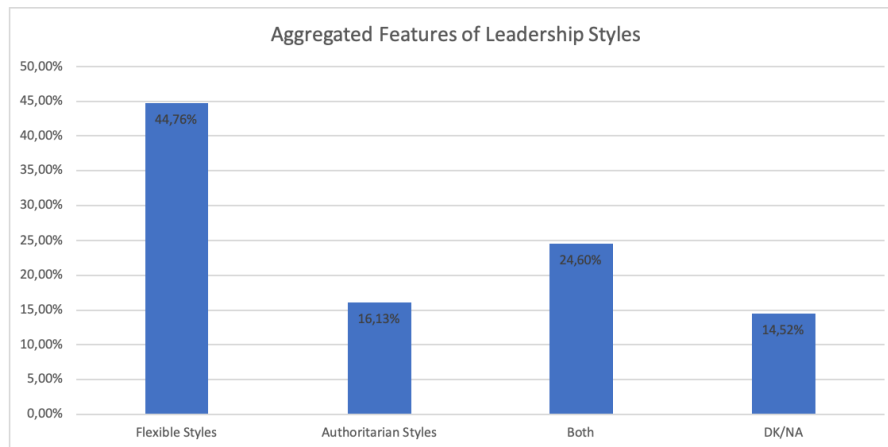
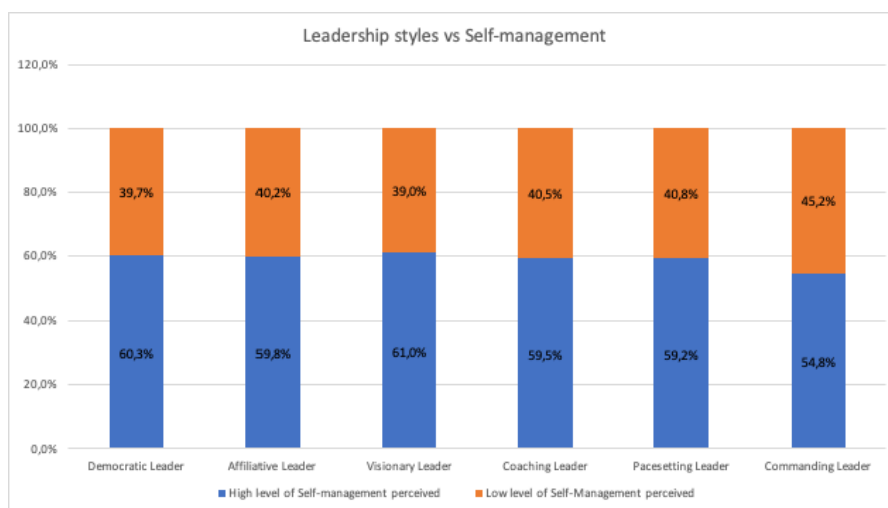**FIGURE 5.** Aggregated features of leadership styles.

FIGURE 6. Leadership styles vs self-management perception.

the results in [23], where it is shown that flexible styles incorporate high levels of autonomy in contraposition to authoritarian styles, and support the hypothesis that authoritarian leadership styles compensate for the lack of autonomy by strongly promoting alignment in their teams.

VI. STATISTICAL EVIDENCE OF THE RESULTS

In this section we use well known hypothesis tests to provide statistical evidence of the descriptive results shown in section 5.

A. LEADERSHIP STYLES AND SELF-MANAGEMENT

In this subsection, we will show that, according to the survey, the type of leadership does not have a significant influence on the degree of self-management in agile teams, that is, agile teams tend to self-manage independently of the leadership style perceived by the members of the team. This finding seems to support that the type of leadership does not divert agile teams from the principle of self-management. To validate this fact empirically, we conducted hypothesis tests to check whether the correlation between levels of self-management and different leadership styles is

significant. This will be done by building two-dimensional matrices crossing the leadership styles with the perception of self-management (high, low). From these matrices, we will check whether the leadership styles are correlated to the self-management perception of the respondents. We make use of the well-known Kendall's tau-b rank correlation coefficient [30], [31]. The Kendall's tau-b coefficient is bounded below by -1 and above by 1. The closer the correlation value is to the bounds, the more correlated the variables under study are. Moreover, we make a hypothesis test to check the statistical significance of the tau-b coefficient. We provide the p values corresponding to each hypothesis test carried out. Roughly speaking, large p values (greater than 0.1) indicate that there is no statistical evidence that the correlation values are significantly different from 0, that is, there is no evidence of correlation between the variables under study. We have applied the Benjamini–Yekutieli correction [32] to the p values as multiple comparisons have been accomplished.

Table 2 shows the results obtained for the crossed matrix of the two self-management levels with the six leadership styles. The Kendall's tau-b correlation coefficients obtained range between -0.0348 and 0.168, which apparently are small
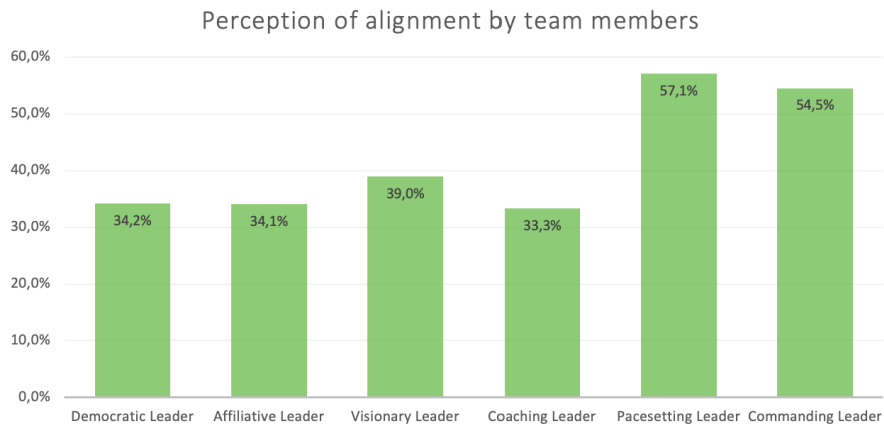
Perception of alignment by team members

FIGURE 7. Perception of alignment by team members in agile teams.

TABLE 2. Kendall's Tau-b correlation coefficient and adjusted p values with the Benjamini–Yekutieli correction in parentheses.

	High Level of Self-management	Low Level of Self-management
Democratic leader	0.150 (p=0.244)	0.130 (p=0.404)
Affiliative leader	0.165 (p=0.186)	0.168 (p=0.186)
Visionary leader	0.095 (p=0.867)	-0.0348 (p =1)
Coaching leader	-0.028 (p = 1)	-0.021 (p = 1)
Pacessetting leader	-0.039 (p = 1)	0.032 (p = 1)
Commanding leader	0.030 (p = 1)	0.109 (p=0.701)

correlation values around 0. All the p values obtained are greater than 0.1. In fact, six out of twelve hypothesis tests provide p values close to 1, their maximum achievable value. The smallest p value is equal to 0.186, also greater than 0.1. As a consequence, there is no statistical evidence of neither positive nor negative correlation between the leadership styles and the self-management levels. This absence of evidence is coherent with the graphical results in fig. 6, in which it is observed that respondents have the perception that the levels of self-management are similar regardless of the leadership style.

B. LEADERSHIP STYLES AND ALIGNMENT

To analyze the relation between leadership and alignment, we have carried out the Wilcoxon-Mann-Whitney test, a non-parametric statistical hypothesis test [33], [34]. The test is used to compare values at different levels of a process. In this case, we have two levels (flexible leadership and authoritarian leadership) and the values corresponding to the percetage of respondents perceiving each of these two levels of leadership. So, we will compare whether there is a significant difference between the percentage of respondents perceiving alignment in flexible leadership environments and the percentage of respondents perceiving alignment within authoritarian leadership environments. Again, as a result of the test, a p value is obtained. A large p value (greater than 0.1) wil indicate that there is no statistical evidence of a difference between the magnitudes of both percentages of respondents, whereas a small p value would demonstrate statistical evidence of such a difference. The p value obtained amounts to 0.067, that is, there seems to be statistical evidence of a

TABLE 3. Kendall'sTau-b correlation coefficient (p values in parentheses)between leadership frameworks and alignment.

	Alignment
Flexible styles	-0.123 (p=0.27)
Authoritarian styles	0.233 (p=0.037)

significant difference between the two percentages, showing that alignment is majorly perceived within teams with authoritarian leadership styles. In addition to the Wilcoxon-Mann-Whitney test, we have measured the correlation level between alignment and leadership styles. This is done by building a two-dimensional matrix crossing the two general leadership frameworks, namely flexible and authoritarian, with the perception of alignment of the participants. In this way, we will check whether the leadership styles are correlated to the alignment perception of the respondents. To this aim, we use again the Kendall's tau-b rank correlation coefficient. Furthermore, we make hypothesis tests to check the statistical significance of the tau-b coefficient, providing the p values corresponding to each hypothesis test performed. Small p values (lower than 0.1) indicate that there is statistical evidence that the correlation values are significantly different from 0, that is, there is evidence of a correlation between the variables under study. Table 3 shows the results obtained for the crossed matrix of the alignment perception with the two general leadership styles.

The Kendall's tau-b correlation coefficient between alignment and the flexible leadership styles is -0.123 (with a p-value greater than 0.1), whereas the tau-b correlation coefficient between alignment and the authoritarian leadership styles amounts to 0.233 (with a p-value lower than 0.1). As a consequence, there seems to be statistical evidence of a significant positive correlation between authoritarian leadership styles and the alignment concept, whereas there is no statistical evidence of such a correlation between flexible leadership styles and alignment. These results are coherent with the ones obtained from the Wilcoxon-Mann-Whitney test and those graphically observed in Figure 8, supporting that levels of alignment are higher in teams with authoritarian leadership styles.

VII. CONCLUSION AND FURTHER RESEARCH

In this article, we have defined a survey with results that seem to show empirically that the type of leadership in agile teams does not have a substantial influence on the levels of self-management perceived by the members of those teams.

A first result is that all leadership styles may occur in agile teams, although authoritarian styles, Pacesetting and Commanding leaders, are less frequently perceived than flexible styles, Democratic, Affiliative, Visionary and Coaching. In particular, according to the survey results, in agile teams the widespread leadership style is the Democratic one. This result is in line with previous qualitative findings from the research environment at the Open University in the UK [35] who found that agile methods derive in very different organisational contexts. A second a priori unexpected result is that there is no statistical evidence of correlation between the leadership styles and the self-management levels, that is, within agile teams, self-management is equality promoted by the different types of leadership.

Regarding the influence of the alignment concept within agile teams, we have shown that there is a positive correlation between the implementation of alignment and the presence of authoritarian styles of leadership in agile teams. These leadership styles seem to compensate for a lack of autonomy with high levels of alignment. These findings have been statistically validated for the sample of participants at hand through statistical hypothesis tests. The results in this study are also coherent with those in [23], where it is shown that autonomy presents different levels depending on the leadership style. Most agile teams are not led by authoritarian leaders. However, in the presence of this type of leadership, the alignment of goals and visions is more evident and sand could be understood as a necessary condition. Consequently, given that decisions are primarily leader-driven, this fact suggests that in these agile environments autonomy is mainly provided at the micro (individual) level, although this evidence should be verified in future analyses. Thus, the findings in this work jointly with those in [23] seem to indicate that, in agile teams, leadership styles directly influence the levels of autonomy and alignment, whereas self-management, a deeply-rooted concept in the agile culture, is not affected by the type of leadership.

Given the importance of the topic, the scientific findings of this study should be considered by senior managers to build better agile teams and subsequently transfer this knowledge at a practical level in their companies. Managers at the policy level should be aware that the agile culture is suitable for any kind of leadership. In practice, if you want to promote a context of self-management with high levels of autonomy, flexible leadership styles are more advisable. However, in settings where the predominant leadership styles are the authoritarian ones, focusing on a strong promotion of alignment in the team is an option to compensate for the usual low level of autonomy in these leadership environments.

A promising research topic is the one focused on the effect that personal skills and spontaneous roles [14], [36] have on self-management and leadership in agile teams. This is in line with the concepts of varying leadership and situational leadership styles. Moreover, since 25% of the respondents perceived both kinds of leadership styles, authoritarian and flexible, in their agile teams, it might be valuable studying this type of mixed leadership and its correlation with the personalities of the team. Another interesting further research area is the introduction in Kniberg's model of a scale in the autonomy and alignment dimensions, instead of the current dichotomous versions. These scales would allow to create a richer Kniberg's matrix analysing the influence of autonomy and alignment within self-management. As a final comment regarding future works, quality of the results could be improved through the application of a a suited model for agile development such as the Grounded Theory approach [37]–[39], as a complement to the Pleeger and Kitchenham model [27] and the Stavru recommendations [28] followed to design this study.

Concerning the threats to the validity of this work, the geographical distribution of the participants may imply the existence of some cultural tendency of the conclusions. instance, according to [40], there seems to be greater cultural resistance to the implementation of agile environments in Latin American countries than in Nordic European countries. In the future, in order to verify the general validity of the results, it would be advisable to perform similar studies considering a wider geographical sampling. Moreover, the use of Structural Equation Modelling [41] could assist with the modelling and validation of the proposed models as well as with the testing of the hypotheses.

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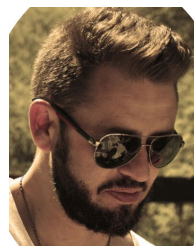
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