How to Better Form Software Development Teams? An Analysis of Different Formation Criteria

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Abstract: In the competitive world of the on-demand software development market, some practices that increase companies' chances of delivering better results turn out to be an essential differentiator. Several studies in the literature discuss numerous criteria used by companies in the formation of teams. This research aims to analyze the criteria and factors in the formation of software teams and their impacts on the value perceived by the customer of the deliveries. We collected 31 project results scores of an R&D organization and performed a quantitative analysis comparing teams formed using two selection criteria: self-selection versus leader selection. We observed a statistical significance in the comparison between the selection criteria when tested with the longevity factor. Our results indicated that the self-selection team formation criteria had impact on value delivered to the customer. We also noticed this impact when, besides being self-selected, the team was also long-lived.

1 INTRODUCTION

Organizations that develop software on-demand need customers to pay their operating costs (Helander & Ulkuniemi, 2012). It is necessary to identify, attract, and make project proposals for customers. If a proposal is accepted, the customer receives the agreed deliveries and makes the expenditure. Therefore, an essential step for these organizations is the process of generating this software project proposal that is tailored to face customer's needs. In order to support the customer's decision-making on contracting the service offered, the proposal should include a project plan at some level of detail. It has to contain information like budget, schedule, resources, and scope. Once the proposal is accepted, the organization must form a development team funded by the project budget (Project Management Institute, 2008). Then the software is built, requirement by requirement, respecting schedule, budget, scope, and quality constraints (Project Management Institute, 2008). The software organization responsible for developing the application must deliver an outstanding result. As a consequence, their customers could become satisfied with the work done, encouraging renewals, and financing more projects with the organization (Mehta et al., 2008).

A following moment in this project proposal process is the formation of an appropriate team for the project execution. This team will build the resulting product to be delivered for the customer, in order to keep their satisfaction on a high level, intending to influence their future relationship with the software organization positively (Helander & Ulkuniemi, 2012). Providing adequate attention at the moment of forming the development team is critical. Previous reports (Standish Group, 2014) show that team conflicts cause 42% of the cases of software failures and also cause 52% of the time on correctly addressing customer demands. Therefore, the software organization also needs to identify which team formation criteria should use to form an appropriate team in order to achieve the software project success from the client's perspective (Evans, 2002). Also, in companies that develop software on demand, where the man-month (people effort during project time) is part of the cost of the project, factors such as team size and percentage of dedication can affect the final price of the project proposal and must be considered (Heričko et al., 2008).

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Thus, our research question is: how to better form software development teams?

This paper investigates if the chosen criteria and factors considered on the formation of software development teams impacts customer satisfaction assessment. Through a quantitative study, we investigated the relationship between team formation and customer evaluation scores. We collected data at an R&D organization with 127 people working on several simultaneous projects. We used data from 31 projects, developed over three years, that had a final score given by the client.

We organized the remainder of the paper as follows. Section 2 presents the theoretical bases for conducting this research. Section 3 describes our research method employed and the data collection. Section 4 describes the main results by comparing the team forming criteria. In Section 5, we discuss the paper findings. Finally, in Section 6, the conclusions are addressed, and we present some final remarks.

2 BACKGROUND

In this section, we describe the context of our study. We describe the resource allocation, forming teams criteria, and forming teams factors. We also briefly describe the Customer Value Perception, which is the way that this study measures Customer Satisfaction with the organization project deliveries.

2.1 Resource Allocation

Allocation is the activity of assigning an activity to be done to a human resource, making him/her responsible for it (Park et al., 2015). This allocation work is a crucial factor for the success of a project (Tsai et al., 2003). Barreto et al. (2008) affirm that the allocation effort in companies is complex. They mention that the combinations of available people and tasks to be done on a given example of ten people and ten tasks reach ten billion possibilities (ten raised to the tenth power). Besides, they also mention that several constraints must be considered, such as organizational needs, maximum monthly team cost, development time, and developers' knowledge of project requirements. So, the task allocation usually has an earlier moment, which is the formation of a team. It would be an extreme effort to think about allocation tasks with all the available people in mind. This way, the alternative is to allocate people in teams, and after that, the team members can be assigned to project tasks. Next, we will present criteria and factors to consider when forming these teams.

2.2 Forming Teams Criteria

Team forming is an activity to staffing a team to develop a software initiative (Barreto et al., 2008). Among the stages of this construction, we highlight the moment to select the people who will compose this team. In this step, this article will address the leader selection and self-selection criteria, which we will detail in the following sections.

2.2.1 Leader Selected Team (LS)

One of the forming criteria from literature is that a person, usually a project manager, selects experts from a resource pool, which are the organization employees, selected and trained on the technologies of projects that organizations have to develop (Ngo-The & Ruhe, 2009). So, this a top-down selection. With the project plan in place, the project manager assesses which technologies would be involved in the context of the project, checks the pool of human resources with their mapped competencies, and assemble the team choosing the best case for resource-task allocation over time (Abdel-Hamid, 1989; Project Management Institute, 2008). After the project is complete, the team is disbanded to re-compose the human resources pool, which is again available for a new project. Thus, the main idea is forming a temporary team to execute a single software project, with its technological requirements as the director of its formation. In this article, we call this criterion **Leader Selected Teams (LS)**.

The main benefits expected with this approach are: (i) this team has specialists in the project technical requirements; (ii) motivation through job rotation in several projects (Santos et al., 2016). However, this criterion requires stable environments and well-defined scopes. If the scope changes, as well as the technologies involved, a human resource that could be critical at a project may become completely expendable. This criterion still has the problem of specialists synchronizing their work in more than one project. Therefore, this allocation plan, based on technology requirements, should be considered as a type of draft, frequently revised, and its tasks quite detailed (Hendriks et al., 1999).

There is a belief that allocating a team of people with the necessary skills reduces the risk of project delay and failure, achieving a positive outcome (Eskerod, 1998). However, a problem that arises with this type of allocation is that a new team is formed

every time a new project starts. Due to their new staffing, this team would not have a synergy, all team's production is still primarily based on individual work (Tuckman & Jensen, 1977). Moreover, this criterion assumes that a team is the sum of its "task-performing" parts, focusing on individual accomplishment and the success of the resource allocated to the task, not considering the collaboration, the synergy, and the productivity of a team (Katzenbach & Smith, 1993).

Choosing the best resources to form a team is also an optimization challenge. Some authors suggest tackle the allocation problem using optimization techniques commonly used in SBSE (Search-Based Software Engineering) such as fuzzy logic (Britto et al., 2012) or particle swarm algorithms (Gerasimou et al., 2012). Another alternative is to use genetic algorithms and linear programming to try to optimize the process of selecting a group of people who have the right skills that can solve the problems that the activities bring (Ngo-The & Ruhe, 2009; Park et al., 2015; Shan et al., 2010) Despite these support tools, it still much depends on the intuition and experience of the project manager, and ultimately he/she can make the wrong choices and not allocate the best resources to the project team (Barreto et al., 2008).

2.2.2 Self-Selected Teams (SS)

A non-predictive criterion for forming a team is through self-allocation (Potosky & Duck, 2007). In this case of team formation called **Self-Selected Team (SS)**, team members choose their components through a pre-established method. Thus, instead of a Project Manager choosing the resources to assemble a team, the members have the autonomy to organize themselves into teams, choosing by personal or technical affinity (Scott & Pollock, 2017). This self-allocation can follow certain constraints established by the organization that would be some factors to consider, for example, size, essential roles and dedication percentage. It can also be temporary, running this self-selection from time to time (Mamoli & Mole, 2015), or can be used to form stable teams.

The organizations expected some benefits with this approach: (i) this team bets on a sense of teamwork rather than individual work, with the same support commitment and fast learning; (ii) agility regarding changes in scope; and, (iii) autonomy when allocating to tasks. An additional expected benefit of this type of allocation would be a reduced number of conflicts in the team (Tuckman & Jensen, 1977). As the members chose each other, it makes sense to think that they would strive to seek conflict outputs more constructively, preserving the foundations of the team, thereby advancing its maturity stage.

However, this team may not have some technical skills needed to solve some technical challenges required by the project they will be carrying out, different from the Leader Selected Tem of Specialists. Besides, another problem would be that this team would also have low synergy and still need to discover how to work efficiently together (Tuckman & Jensen, 1977).

In our review of the literature, we found few papers that cite self-selected teams, most of them student choices to form teams for schoolwork (Bacon et al., 2001; Caglayan et al., 2013; Potosky & Duck, 2007). Nevertheless, we find a book (Mamoli & Mole, 2015) that speaks widely about the subject and even describes a method to facilitate this formation.

2.3 Forming Teams Factors

Some factors that can impact the performance of software teams, such as autonomy, team size, turn-over, communication, among others (Dutra et al., 2015). In this section, we will consider and detail some factors that exist in the context of the organization and assess their impact on the customer perceived value of team deliverables, which will be team longevity (resulting in stable or temporary teams), resource dedication profile and project dispersion factor.

2.3.1 Stable Teams – ST

The idea of maintaining a **Stable Team (ST)** is that a group that has spent the entire life of a project together would lead the team to a better performance stage (Tuckman & Jensen, 1977). It would be more productive because of its longevity (Katz, 2006). Additionally, a report from CA Technologies mentions that stable teams' productivity would reach 60% more when compared to temporary teams' productivity (CA Technologies, 2013). So, even if there is some technological gap in the team, teamwork would prevail over individual results, generating support, quick learning, and, consequently, the success of the project (Katzenbach & Smith, 1993). With this repeatedly learning, this approach generates more generalist teams.

2.3.2 Temporary Teams – TT

We will call **Temporary Teams (TT)**, groups of people who have not necessarily worked together before but have been joined to form a team over the life of a project. Prikladnicki et al. (2017) show how

selecting people who have never worked together to form teams, can be better for a company. Prikladnicki et al. (2017) cite the work of Uzzi and Spiro (2005) and argue that forming new teams, based on the dissolution of other teams, increase the members' network of connections and their soft-interaction skills. That would contribute more to the project success than relationships with people within a long-lived group that are part. They studied a large company of projects of different types and duration and even found that teams of people who have never worked together are better, depending on the duration. They conclude that it is generally better to mix members who have worked and never worked together because these new members bring knowledge, norms, and processes from previous projects, but new ones would bring new ideas.

2.3.3 Other Factors

Hendriks (1999) cites two factors about using one specialist resource among projects: (i) the project dispersion factor and (ii) the resource dedication profile. The dispersion factor is described as the division of projects into technically defined modules for the allocation of one or more specialists in these tasks. The more different technical tasks, the more different specialists, the bigger the team, the higher the coordination and synchronization effort. The author suggests that the dispersion factor, along with the dedication profile, has a profound impact on allocation complexity.

The resource dedication profile is how much that resource is dedicated to a project and its objectives and not just to the tasks, i.e., how much the resource is allocated and committed entirely to a single project (Hendriks et al., 1999). The lower the resource dedication per project, the more complex the allocation. Additionally, this dedication profile also affects productivity. Software teams with dedicated resources at allocation percentages of 95% or more can double their productivity than teams with allocation percentages of less than 50% (CA Technologies, 2013).

Therefore, it is better to keep the resource entirely allocated in only one project, and if it is not possible, lessen the impact of the scatter factor by not allocating the resource in too many projects.

2.4 CVP – Customer Value Perception

In order to get project feedback and validate the customer value perceived on project deliveries, the organization collects the CVP (Customer Value Perception) score.

Some companies mention about delivering value but do not provide a method to collect and measure it (Mehta et al., 2008). Some cite that some companies make use of surveys to do it (Evans, 2002). The selected organization sends a survey to the customer in which the customer gives a score from 1 to 5 to the project delivery, followed by an optional comment after delivery is done.

With this information received from the customer, the team receives feedback about their work and stores this value in the portfolio management tool to analyze whether it is improving concerning effectiveness. This score became the most important metric for the organization because the company keeps the focus on fulfilling the customer's desire in order to enable more projects with him.

3 METHOD

This research is a case study with a holistic view of the context of an R&D organization where its software development teams are studied (Wohlin et al., 2012). The method employed comprises the following tasks: data collection, data treatment, and quantitative analysis. Next, we describe the organization context and explain when the selection criterion has changed and how it affected the teams formed. Then, the following sections detail the tasks mentioned above:

3.1 Organization Context

The selected organization is an R&D (Research and Development) institute that develops on-demand projects in a service delivery model. In order to conduct this research, we needed to collect several organizational data about the projects developed in the portfolio management tool.

The candidate projects happened from 2016 to 2018/2019 (started in 2018 but ended in 2019) after the organization became an independent institute and had to become more competitive. New knowledge was necessary, and among them, how to form software teams in order to retain customers and employees.

The criterion formerly used was forming temporary teams specializing in the technological challenges of the demands that arose, but the organization glimpsed other ways of improving team forming activity. The new idea was to assemble more generalist teams, so they could be able to execute

projects with different challenges. Also, betting on criteria and factors that could increase members' autonomy, the company aimed to form more motivated and productive teams. An organizational change in these proportions could be very disruptive, so it must take some caution to avoid economic problems, but the benefits could overwhelm the problems that could arise (Bider & Söderberg, 2016).

In February 2017, the organization tested an alternative team formation criterion. In addition to the criterion, it was also necessary to define some constraints that teams should follow in this formation:

Selection Criteria: People would choose whom to work with by affinity. Thus, it is expected that the team will go through the initial moments of conflict faster and gain rapport and synergy by learning to work together soon, as they chose to form the team by their affinity. The method was based on Mamoli and Mole's book (Mamoli & Mole, 2015);

Team Basis: The first role of the new team would be the Product Owner role. He/she would explain what types of projects they would like to work on and that they would bring to the team;

Size: Each team would have a base size of 6 people and would consist of 1 PO (Product Owner), one designer, three developers, and 1 test developer, entirely dedicated to a single project. According to (Rubin, 2012), there are several benefits of keeping small teams: (i) in small teams there is less social loafing, people who exert less effort because they believe others will take over the job, which is called Ringelmann Effect (Ingham et al., 1974); (ii) constructive interactions are more likely to occur in a small team (Project Management Institute, 2008); (iii) less times in is spent coordinating efforts; (iv) small teams are more satisfactory to their members; and, (v) harmful overspecialization is less likely to occur.

Dedication: Each member would have full dedication without dividing between other projects. The rationale behind this chosen factor: (i) the dedicated Product Owner would have only one product in mind and focus on its success; (ii) a dedicated designer can do more than only generate UI specs. He/She can help in conducting product specification sessions, helping to define and improve project products, as well as performing usability tests; (iii) three developers help to implement software best practices, such as code review (this number considers absence that could occur among the 3, such as vacation or illness); and, (iv) a dedicated tester can do manual testing as well as design automated tests and even help to develop features.

Longevity: These teams would continue together after the project end and may become a stable team (at least 60% of the team members).

This action of changing the way teams was formerly formed in the organization generated three teams with these characteristics that ran nine projects between February 2017 until August 2018; Along with the other projects from 2016 to 2019, they compose the database analyzed in this research.

3.2 Data Collect

Data related to executed projects were extracted and tabulated through the organizational portfolio management tool. Table 1 presents the consolidated list of project data that could potentially be relevant for analysis. We selected the following data from the Portfolio Management tool:

• **Team Forming Criterion:** Choice Criterion (Self-Selected team by affinity (SS) or Leader Selected team of specialists (LS) and Longevity: Stable Team (ST) or Temporary Team (TT).

• **Results:** CVP final delivery scores, collected from the customer, as explained in Section 2.4;

• **Project Data:** Project ID, start, and end dates.

Additionally, we validated the legitimacy of this data individually with at least one member of each of these projects

3.3 Data Treatment

It was necessary to treat the data used only to consider the relevant info to this research. The criteria employed to select the data were:

• Exclusion of 2015 data - We considered only projects executed from 2016 until 2018/2019. We used this filter by the fact that, even though we had data available from 2015, in this year the previous "maintainer" (an associated company that financially guaranteed the operations of the Institute) left, leaving the company with many people dislocated, requiring dismissals to avoid expenses with people without projects to pay them;

• Exclusion of basic research projects, primarily hardware projects, process engineering and validation projects (only tests) because they have no software development as their main context;

• We excluded external projects because the organization only made people available to these initiatives from partner organizations;

• Projects that did not need a full team, and only one expert who is out of the objective of this research scope;

• Self-funded projects, where the client is the organization itself, were maintained because they were software projects.

• Third parties were disregarded as part of the team as they do not even work within the company and perform particular and timely tasks such as software integration with legacy systems;

• Managers and Agile Coaches were disregarded as part of the development team. Managers are usually not part of the team's daily life, taking care of more bureaucratic things like the financial and legal aspects.

3.4 Quantitative Analysis

After data collection and processing, leaving 31 projects, following our method, we performed a quantitative analysis of project data to assess whether there is a significant difference between team forming criteria. For this, the dependent variable observed was the CVP score.

We made three comparisons, combining the selection criteria and longevity factor, to verify if there would be statistical relevance:

• **Stable Teams (ST) and Temporary Teams (TT) -** Comparing only the "Longevity" factor; There were already actions in the organization of not forming new teams and merely taking advantage of keeping teams stable and bringing projects to the team as we can see in Table1. As we mentioned in section 2, stable teams seem to be more productive, so it might be relevant to show the comparison of the result of those projects where the factor was longevity.

• **Self Selected Teams (SS) and Leader Selected Teams (LS) -** Comparing the selection criterion in the context of the organization. We aimed to verify if the autonomy given to the teams form themselves by affinity would impact the customer perception of the project deliverables;

• **Self Selected Stable Teams (STT) and Temporary Specialist Teams (TET) -** Combining the selection criteria and longevity factor to verify if this combination had an impact on customer perception of project deliverables.

A fourth possible combination, which would be **Self-Selected Temporary Team** versus **Leader Selected Stable Team**, was not made because the sample of the **Self-Selected Temporary Team** is too small, with only one project.

We performed a normality test for each comparison to support the choice of the method of statistical analysis. We performed all statistical tests, both normality and auxiliary graph plotting using the statistical tool SPSS (Statistical Package for the Social Sciences)[1]. We also used Boxplot analysis to visualize possible differences between groups and variables better.

4 RESULTS

Table 1 shows the final CVP scores of the 31 projects analyzed in the descending order of CVP score, the forming team selection criteria, and the longevity factor for each project. We can see that CVP scores range from 3 to 5.

Table 1: Project List.

Project	Selection	Longevity	CVP
Prj1	LS	ST	5
Prj2	SS	ST	5
Prj3	SS	ST	5
Prj4	SS	TT	5
Prj5	LS	TT	5
Prj6	SS	ST	5
Prj7	SS	ST	5
Prj8	SS	ST	5
Prj9	LS	TT	5
Prj10	LS	ST	5
Prj11	LS	TT	4.5
Prj12	LS	ST	4.4
Prj13	LS	ST	4.05
Prj14	LS	ST	4
Prj15	SS	ST	4
Prj16	LS	TT	4
Prj17	LS	ST	3.85
Prj18	LS	TT	3.55
Prj19	LS	ST	3.5
Prj20	SS	ST	3.5
Prj21	SS	ST	3.5
Prj22	LS	TT	3
Prj23	LS	TT	3
Prj24	LS	TT	3
Prj25	LS	ST	3
Prj26	LS	ST	3
Prj27	LS	TT	3
Prj28	LS	TT	3
Prj29	LS	TT	3
Prj30	LS	TT	3
Prj31	LS	TT	3

[1] https://www.ibm.com/products/spss-statistics

4.1 Stable Teams (ST) versus Temporary Teams (TT)

Hypotheses of the first comparison:

- H0 - There is no statistically significant difference between the Stable Teams versus Temporary Teams scores.
- H1 - There is a statistically significant difference between the Stable Teams versus Temporary Teams scores.

In addition to the statistical tests, we used Boxplot analysis to visualize better data distribution and possible differences between groups and variables, as we can see in Figure 1. We can see that most Stable Teams scores are in the range of 3.5 to 5, with 4 being the median — otherwise, most Temporary Teams scores between 3 and 4.5, with 3 being the median. The variations of the two groups are of similar sizes.

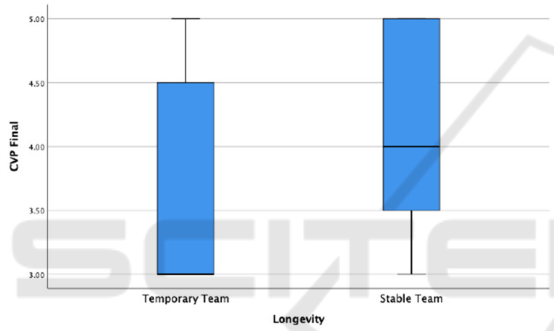

Figure 1: ST versus TT.

First, we performed the normality test. Using Shapiro-Wilk, one can observe that the p-value of both sample groups is less than 0.05, suggesting that there is evidence that the data tested are not normally distributed, as Table 2 shows.

Table 2: Normality Test ST versus TT.

Shapiro-Wilk		
Longevity	df	Sig.
Temporary Team	14	0.001
Stable Team	17	0.013

Therefore, according to the sample size (31 projects), we should use the non-parametric Mann Whitney statistical test, where the desired confidence interval is 0.05.

When comparing the two sets to the CVP obtained by the experimental study using the "Mann-Whitney" statistical test, no statistical we found difference between the groups (p-value = 0.095) as Table 3 shows. Nevertheless, the p-value had a result of less than 0.10, so, with the p-value result close to the alpha chosen alpha = 0.05, further studies are needed to investigate this issue further.

Table 3: Mann U Whitney ST x TE.

CVP	
Mann-Whitney U	78.500
Wilcoxon W	183.500
Z	-1.668
Asymp. Sig. (2-Tailed)	.095
Exact Sig. [2*(1-tailed Sig.)]	.109b

4.2 Self-Selected Teams (SS) versus Leader Selected Teams (LS)

Hypotheses of the second comparison:

- H0 - There is no statistically significant difference between the scores of Self-Selected Teams versus Leader Selected Teams.
- H1 - There is a statistically significant difference between the Self-Selected Teams versus Leader Selected Teams scores.

Again, in addition to the statistical tests, we used Boxplot analysis to visualize better data distribution and possible differences between groups and variables, as we can see in Figure 2. We can see that most Self-Selected Teams scores are in the range of 4 to 5, with 4.5 being the median — otherwise, most Leader Selected Teams scores between 3 and 4, with 3.25 being the median. The variations of the two groups also are of similar sizes.

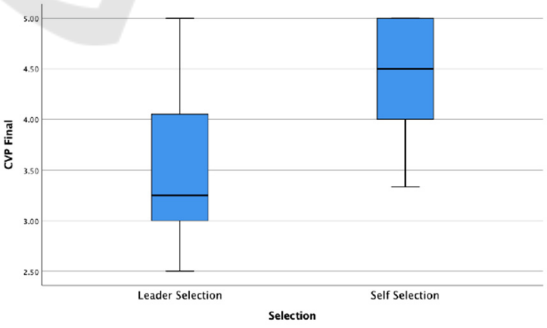

Figure 2: LS versus SS.

We applied the normality test, and by performing the Shapiro-Wilk test, we also observed in Table 4 that the p-value of one of the sample groups is less than 0.05, suggesting that there is evidence that this group data tested is not normally distributed even though p-value from the other group is higher than

0.05. The null hypothesis that the data came from a normally distributed population cannot be rejected. Therefore, according to the sample size (31 projects), we applied the non-parametric Mann Whitney statistical test, where the desired confidence interval is 0.05.

Table 4: Normality Test SS versus LS.

Shapiro-Wilk		
Selection	df	Sig.
Leader Selected	22	0.003
Self-Selected	9	0.057

The test results suggest statistical significance that the Self-Selection criterion results in better scores on customer value perception of deliverables than a team of specialists selected by a leader criterion, as shown in Table 5.

Table 5: Mann U Whitney SS x LS.

CVP	
Mann-Whitney U	43.500
Wilcoxon W	296.500
Z	-2.474
Asymp. Sig. (2-Tailed)	.013
Exact Sig. [2*(1-tailed Sig.)]	.014b

4.3 Self-Selected Stable Teams (STT) versus Leader Selected Temporary Teams (TET)

Hypotheses of the third comparison:

- H0 - There is no statistically significant difference between the scores of Self-Selected Stable Teams versus the Leader Selected Temporary Teams.
- H1 - There is a statistically significant difference between the Self-Selected Stable Teams (STT) scores versus the Leader Selected Temporary Teams (TET).

We used Boxplot analysis to visualize better data distribution and possible differences between groups and variables, as we can see in Figure 3. We can see that most Self-Selected Stable Teams scores are in the range of 3.75 to 5, with 4.5 being the median — otherwise, most Leader Selected Temporary Teams scores between 3 and 4.5, with 3 being the median. The variations of the two groups also are of similar sizes.

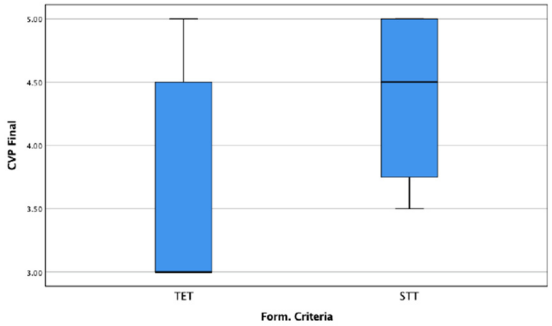

Figure 3: STT versus TET.

Using Shapiro-Wilk, one can observe in Table 6 that the p-value of both sample groups is less than 0.05, suggesting that the data tested are not normally distributed.

Table 6: Normality Test: STT versus TET.

Shapiro-Wilk		
Selection/Longevity	df	Sig.
Leader Sel. Temporary	14	0.001
Self-Sel. Stable	8	0.014

Therefore, according to the sample size (31 projects), we employed the non-parametric Mann Whitney statistical test, where the desired confidence interval is 0.05.

The test result showed statistical significance between the two groups, as shown in Table 7. Thus, this result indicates that modifying the selection criteria for Self-Selection along with the longevity factor (Stable Team) suggests better scores in customer value perception of deliverables than a temporary team selected by a leader.

Table 7: Mann U Whitney STT x TET.

CVP	
Mann-Whitney U	27.000
Wilcoxon W	132.000
Z	-2.066
Asymp. Sig. (2-Tailed)	.039
Exact Sig. [2*(1-tailed Sig.)]	.050b

5 DISCUSSION

This study compared team formation in an organization using selection criterion and longevity factor, employing the CVP score for project deliveries. We found quantitative results which suggest that Self-Selected Teams tend to score better than the Leader-Selected Teams, especially if

combined with the longevity factor. Nevertheless, regarding the longevity factor by itself, no matter how much the Stable Teams scored better on average than the Temporary Teams, the result did not reach statistical significance, although p-level was below 0.10, suggesting that other studies may lead to significant results.

These results may indicate that for a team perform better, the criterion of selection presented in this study could impact more than just the longevity factor since whenever it was tested, it proved to be statistically significant. About longevity factor, a possible explanation is that a leader may form a team where people may not empathize with others, so a Stable Team would not necessarily help the team to have a better performance; on the other hand, keeping a Self-Selected Team by affinity stable seems to be a good idea, maybe because the autonomy of those who selected themselves as a team and could choose to keep working together is respected. Separating these teams can even harm member motivation. One of the most relevant characteristics found in high-performance teams is precisely having autonomy at work (Dutra et al., 2015), suggesting that it is a likely factor that could generate a superior performance. So, providing autonomy at the moment of forming teams, giving to the members a choice based on affinity, could contribute to a higher performance of these new teams later.

Other factors also could impact the obtained results. Therefore, we would suggest as future work to investigate other possible factors that also may impact these results.

Regarding the other works found, much has been written and researched on how to form teams using various methods, algorithmic tools, always trying to meet the criteria of leader choice of specialists (Karduck & Sienou, 2004; Kaiafa & Chassiakos, 2015; Kang et al., 2011; Ngo-The & Ruhe, 2009; Park et al., 2015; Shan et al., 2010; Yoshimura et al., 2006). However, fewer studies explored the self-selection idea and those who did, conducted on universities, and few in the industry (Bacon et al., 2001; Scott & Pollock, 2017).

The main threat to the validity of this study is the generalization of our results for all organizations. We collected these data from a single R&D organization in a single city that develops software on demand. So, the results may apply only to similar organizations.

Another threat is the measure used for the score, the CVP. At times it may mean a real score or merely a grade that is eventually given by the client's degree of relationship with the team, not expressing the truth by not being anonymous (Evans, 2002; Helander & Ulkuniemi, 2012). However, by sampling 31 scores, it is possible to understand that it is a sampling that can demonstrate some relevance. Besides, to reduce this threat, this score is requested by the QA (Quality Assurance) department of the organization.

6 CONCLUSIONS

In this study, we examined the scores given by the customers of the projects regarding their perceptions of the value of project deliverables, built by software teams formed using different criteria and factors to evaluate better ways to form them. After examining 31 projects results in an R&D organization, the results of our statistical analysis indicate that using the self-selection criteria resulted in better project scores, mainly combining this criterion with the longevity factor. Although other studies focused more on showing better ways for a leader to form teams of specialists (Karduck & Sienou, 2004; Kaiafa & Chassiakos, 2015; Kang et al., 2011; Ngo-The & Ruhe, 2009; Park et al., 2015; Shan et al., 2010; Yoshimura et al., 2006)), our study aimed at showing an alternative selection criterion based on autonomy results, using a case from the industry.

It is possible that these results found in this context could be reflected in similar organizations, so future researchers should consider trying this in other types of organizations. It is worth mentioning that the results found reflect only a quantitative analysis in only one organization. A qualitative study would better enrich both the results and the discussion. Conducting the same experience in other organizations in other contexts would also help to support more understanding.

We did not test other forming criteria, such as personality, random, among others, because the organization did not make use of it. However, they would be interesting to explore on future work in other contexts. Regardless, our results point out to the opportunity of exploring more the self-selection team forming criterion in the industry, combining with other factors.

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