Study on Influencing Factors of Multiple SCRUM Software Development Project Performance Based on Team Difference

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Abstract. From the perspective of team difference, combined with multiple SCRUM software development project features, studied the impacts of team communication, team trust, team innovation, team reaction speed and team conflict on the performance of multiple SCRUM software development project. The data was collected by means of electronic questionnaire, then performed multiple regression analysis. Results show that team communication and team reaction speed have significant influence on the performance of multiple SCRUM project. Team trust, team innovation and team conflict have no obvious effect on team performance.

Introduction

SCRUM is an iterative process of software development, which is a framework to solve the problem of software development. In recent years, the SCRUM method is becoming more and more widely used in the field of software development. Agility development of software by SCRUM method is comparatively mature and extensively used. With the rapid growth of economy and economic globalization, software development teams begin to distribute in different geographic locations. Software development is evolving toward the trend of geographically distributed development. In the process, the SCRUM approach also began to adapt to the different distribution in the direction of development, which has formed the multiple SCRUM project. Multiple SCRUM projects are developed with multiple SCRUM software development teams. All teams use the SCRUM method to complete their own software development tasks. Therefore, the elements of team are extremely important during the development process.

In multiple SCRUM software development project, team is an important part. As agile software development project, compared with the traditional software development, SCRUM project has its own unique characteristics, like large number of teams and wide distribution. Increasing with the number of team, the difference among Scrum teams is becoming bigger and bigger, which is bound to affect the performance of multiple SCRUM project. Therefore, how to make use of the team difference to enhance project performance has become an urgent problem. This paper studies influencing factors of the performance in multiple SCRUM project from the perspective of team difference. Trying to improve the customer satisfaction of software development products and achieve the goal of enhancing the performance of multiple SCRUM project.

Literature Review

Scholars [2] pointed out that the size of team is very small and a team can work various tasks in SCRUM. Stephens and Carmeli [3] pointed out that the performance of agile software development team has a close connection with the negative emotions. Soomro and Salleh [4] said that the performance of agile software development is affected by team member’s individual traits. Acuña and
Gómez [5] had studied the influence of team climate to the performance of software development and suggested that team climate should be created for team performance. Houts C R and Rahael [6] put forward that team process have different influence on team performance among distinct types of teams. Carsten and De Dreu [7] proposed that team conflict plays an important role in the process of team innovation. Scholars [8] pointed out that team communication is a vital factor to team performance. Butchibabu and Sparano-Huiban [9] found that ways of team communication have lots of things to the level of team performance, and during communication, actual needs of team members should get more concern instead of simple exchange of information. Yang [10] pointed out that team trust is a vital factor in team performance, but whether it could be used in multiple SCRUM project still remain to be confirmed. Peltokorpi and Hasu [11] suggest that the impact of team innovation on team performance is increasing.

**Problem Description and Hypotheses**

Completed by various SCRUM teams, the projects whose distributions are in different regions, the allocation of different tasks, and their different characteristics of the team, so the difference is also very large. Compared with traditional software development project, team difference for the impact of multi-SCRUM project is more intense. Generally speaking, in the field of traditional software development methods, the research on influencing factors of team project performance has become more and more mature. However, there are few researches on team difference in SCRUM method, which is scarce when it involves multiple SCRUM projects. The research problem in this paper is how the team difference affects the performance of multiple SCRUM project. The research model is shown in Figure 1.

Based on the analysis of team differences and the characteristics of multiple SCRUM projects, this paper analyzes the impact of team differences on performance from the five dimensions of team communication, team trust, team innovation, team reaction speed and team conflict, and made the following assumptions.

*Team Communication.* In the multi-SCRUM project, the team's goal is to meet the needs of customers. In this process, the team member closer communication is necessary, timely questions and comments is better to complete the task. Therefore, it is assumed that H1: Team communication has a significant impact on the performance of multiple SCRUM projects.

*Team Trust.* In the teamwork, each member needs to work together with other members to complete the task. In this process, mutual trust among members is critical to the efficiency and quality of the work performed. The level of trust between the different teams is different, and the team's performance will also be affected. Therefore, it is assumed that H2: Team trust has a significant impact on the performance of multiple SCRUM projects.

*Team Innovation.* SCRUM project is very different from the traditional software development project, agility is the core of the SCRUM project, once the team encountered in the difficulties can’t
solve by past methods, the progress of software development will be affected, greatly reduced the agility of team. At this time the team needs to have the spirit of innovation, to find new methods, new technologies to improve teamwork. Therefore, it is assumed that H3: Team innovation has a significant impact on the performance of multiple SCRUM projects.

**Team Reaction-Speed.** In the multi-SCRUM project development, customer demand is not static, with the environment and time changes, customer needs are constantly updated, that team’s response to customer demand will affect the speed of teamwork progress. In addition, when the team has unreasonable procedures and methods, if it could be timely detected and correct treatment, teamwork efficiency will be greatly improved. Therefore, it is assumed that H4: team reaction rate has a significant impact on the performance of multiple SCRUM projects.

**Team Conflict.** In the field of team performance, team conflict has always been a very controversial part [12]. As the team members of the different characteristics of individual, SCRUM work within the team will have a variety of conflicts, some conflicts can play an active role in promoting, and some conflicts will seriously hamper the team work. Therefore, it is assumed that H5: Team conflict on the performance of multiple SCRUM project has a significant impact.

**Data Analysis**

In this paper, the data samples come from a software development company, and use the method of questionnaire survey to collect data, and the questionnaire is designed with the help of mature measurable tables from home and abroad. It contains 24 issues, reflecting the proposed five variables and the performance of multiple SCRUM software development project as the dependent variable. The questionnaire uses Likert-five-scale, from 1-5 representing "strongly disagree", "disagree", "uncertain", "agree" and "strongly agree". A total of 170 copies of electronic questionnaires are issued, 121 are recovered, and the recovery rate is 71.2%, including 13 invalid questionnaires and 108 valid questionnaires.

Before the regression analysis, the reliability and validity of the questionnaire need to be analyzed to test the reliability of the questionnaire and the rationality of the questionnaire. The Cronbach's α of the questionnaire is 0.915, which indicates that the reliability of the questionnaire is very good, and the Cronbach's α of each factor of the questionnaire is more than 0.7, as Table 1 shows, which suggests that the internal consistency of the questionnaire is pretty fine and the reliability of the questionnaire comes to greatly high.

<table>
<thead>
<tr>
<th>Factor</th>
<th>Standard Deviation</th>
</tr>
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<tbody>
<tr>
<td>Y</td>
<td>0.771</td>
</tr>
<tr>
<td>H1</td>
<td>0.857</td>
</tr>
<tr>
<td>H2</td>
<td>0.824</td>
</tr>
<tr>
<td>H3</td>
<td>0.956</td>
</tr>
<tr>
<td>H4</td>
<td>0.833</td>
</tr>
<tr>
<td>H5</td>
<td>0.836</td>
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</tbody>
</table>

The KMO value of the questionnaire reaches to 0.854, and the Barrett spherical test result is significant, indicating that the validity of the questionnaire is very good.

| Kaiser-Meyer-Olkin Measure of Sampling Adequacy | 0.854 |
| Bartlett’s Test of Sphericity Approx. Chi-Square | 252.130 |
| df      | 15    |
| Sig.    | 0.000 |

Five factors, as independent variables, are used for regression analysis. The results are shown in Table 3 and Table 4. The value of R is 0.847, R² is 0.717, and the adjusted R² is 0.687, indicating that the model is a good fit with a high significant level.
Table 3. ANOVA.

<table>
<thead>
<tr>
<th>Model</th>
<th>Sum of Squares</th>
<th>df</th>
<th>Mean Square</th>
<th>F</th>
<th>Sig</th>
</tr>
</thead>
<tbody>
<tr>
<td>Regression</td>
<td>22.153</td>
<td>5</td>
<td>4.431</td>
<td>23.857</td>
<td>0.000</td>
</tr>
<tr>
<td>Residual</td>
<td>8.729</td>
<td>102</td>
<td>0.186</td>
<td></td>
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<tr>
<td>Total</td>
<td>30.882</td>
<td>107</td>
<td></td>
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</tbody>
</table>

Table 4. Model Summary.

<table>
<thead>
<tr>
<th>Model</th>
<th>R</th>
<th>R Square</th>
<th>Adjusted R Square</th>
<th>Std.Error of the Estimate</th>
<th>Change Statistics</th>
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</table>

Table 5. Coefficients.

<table>
<thead>
<tr>
<th>Model</th>
<th>Unstandardized Coefficients</th>
<th>Standardized Coefficients</th>
<th>t</th>
<th>Sig.</th>
<th>Collinearity Statistics</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>B</td>
<td>Std.Error</td>
<td>Beta</td>
<td></td>
<td>Tolerance</td>
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<tr>
<td>H1</td>
<td>0.332</td>
<td>0.119</td>
<td>0.369</td>
<td>2.790</td>
<td>0.008</td>
</tr>
<tr>
<td>H2</td>
<td>0.183</td>
<td>0.172</td>
<td>0.196</td>
<td>1.065</td>
<td>0.293</td>
</tr>
<tr>
<td>H3</td>
<td>0.020</td>
<td>0.024</td>
<td>0.024</td>
<td>0.150</td>
<td>0.882</td>
</tr>
<tr>
<td>H4</td>
<td>0.330</td>
<td>0.147</td>
<td>0.357</td>
<td>2.242</td>
<td>0.030</td>
</tr>
<tr>
<td>H5</td>
<td>0.038</td>
<td>0.085</td>
<td>0.041</td>
<td>0.446</td>
<td>0.658</td>
</tr>
</tbody>
</table>

The result of T-test of the model is shown in Table 5, with a confidence interval of 95%, $\alpha = 0.05$. As can be seen from the table 5, the standard regression coefficient $\beta$ of team communication as H1 is 0.369, and the value of $p$, which represents significant level, is 0.008, less than 0.05, which means that it does not reject hypothesis H1, that is, team communication has significant influence on the performance of multiple SCRUM software development project; The standard regression coefficient $\beta$ of team trust is 0.169, the value of $p$ is 0.293, which is more than the 0.05, so reject the hypothesis H2, that is, the team trust has no significant effect on the performance of multi-SCRUM software development project; the standard regression coefficient of team innovation as H3 is 0.024, the value of $p$ is 0.882, more than 0.05, so there is no obvious influence between team innovation and team performance in the multiple SCRUM software development project. The standard regression coefficient $\beta$ of team response rate is 0.357 and the $p$-value is 0.030, less than 0.05, so it does not reject hypothesis H4. That is to say, the team reaction rate has a significant effect on the performance of multiple SCRUM projects. Team conflict, H5, its standard regression coefficient $\beta$ is 0.041, the value of $p$ is 0.658, which is more than 0.05, it rejects the hypothesis H5, so the team conflict has no significant impact on the performance of multiple SCRUM project.

From the above results, we can see that team communication and the speed of team reaction have significant impacts on the performance of SCRUM projects, but the factors such as team trust, team innovation and team conflict are relatively insignificant.

**Conclusions**

Through the analysis of above results, the study shows that team communication is particularly important in a multiple SCRUM project, mainly because the multiple SCRUM project team located in different regions, the degree of communication with each other has a certain gap comparing with traditional software development project. In software development, the exchange of information is essential, so the software development team has to pay more attention to information exchange and communication among team members and teams. And in order to make sure that information can be shared in real time, the team should make out the team communication in the software development process as an important role.
In addition, the team’s response speed is also an important factor in the performance of a multiple
SCRUM project. For the software development team, meeting customer’s needs is the primary goal.
And in a multiple SCRUM project, the changing of customer demands is more frequent than
traditional software development project, which requires the SCRUM team to respond customer’s
needs timely, and add customer's requests to the software product quickly. This also suggests that
multiple SCRUM project teams should pay more attention to the SCRUM process of the task review
and feedback meetings, including team member’s recommendations and opinions. The team should
promptly improve the inappropriate methods or techniques to avoid affecting team performance. In
the case of team conflict and team trust, the impact on multiple SCRUM project is not significant.

In this paper, the performance of multiple SCRUM project is studied from the perspective of team
difference, but only at the team level, not from the individual point of view. This is a weakness and
also the direction of future research.

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