Distributed Project Team
Key Performance Indicators

Natalia Krasnokutska, Tetiana Podoprykhina

National Technical University "Kharkiv Polytechnic Institute", 21 Frunze Str., Kharkiv, Ukraine

Abstract – **Distributed projects provide major benefits in terms of tapping team members' competencies around a globe, but still they represent a significant challenge for coordinating and monitoring teams' performance. This paper investigates distributed projects with a specific focus on performance metrics. As the result of the research, the list of suggested Key Performance Indicators (KPIs) are given to manage distributed project team as well as described the process to define project KPIs and maintain them.**

Keywords – **Project management, distributed project team performance, KPIs, project metrics.**

1. Introduction

While we look at the software development industry, we would like to highlight that today, due to the pandemic; almost all project teams have moved to distributed team organization and work remotely [1], [2], and [3]. It would be beneficial, in our opinion, to investigate the results and effect on team performance by keeping the distributed team setup and evaluate the effectiveness of such project teams.

In general, despite the fact that a number of transformations from the classical type of project team to the distributed team organization in the companies are forced now, otherwise the distributed team organization forms advantage, which allows

responding to the changes in the environment outside of the project rapidly [4]. In fact, even before Covid 19, the software development industry used to grow globally when companies involved employees from subcontractors, third parties or had their own remote developers around world. In practice, distributed projects deal with the same problems as classic project teams, which include problems related to the quality management, project scope, schedule and price. Geographical remoteness of the team members of the distributed team only complicates standard problems that happen in project team [5], [6], [7], and [8]. In our opinion, these problems are of different kind and caused by different reasons. For example, the lack of private / interpersonal communication between team members, as well as no scheduled slots for informal talks inside team, undermines trust and support inside team that is quite natural when there is a distance between team members, and there is a lack of previous experience of interaction, which results that team members' conversations are in one place. As a result, the before-mentioned problems slow down the distributed team performance improvement. Therefore, we believe that the systematic monitoring of the distributed project team performance as well as the project status tracking is especially important. In order to establish the correct processes and practice that lead to project success it is important to define the correct team performance indicators and project metrics. The goal of this article is to find out and provide common distributed project team KPIs in order to manage team and help to make a step forward improving its performance, which is particularly important in the industries such as software development where practitioners are increasingly trying to enhance the measuring process by fine-tuning the measurements and optimizing the internal practices to produce project added value. In addition, in our opinion, team performance KPIs are needed not only by project managers, who need access to high-level and high quality information, but it is also crucial to have them for top managers, whose goal is to optimize the value of their team's activities on strategic level and get support in decision-making process [9].

2. Objectives and Literature Review

An important management tool in any organization is the performance metrics, which allows tracking the correspondence rate in regards to the project or company goals achievement in general or on the level of individual employee. In the context of the study, KPI is defined as a set of information derived from project data and contains of a characteristics condition or results.

Within this study, the emphasis is on the formation of a set of metrics in order to determine the effectiveness of the distributed project team. From implication point of view, the objective is to offer a set of important indicators of the project status and distributed team performance for project managers' usage. Since the KPI manager's work does not have a direct impact on project results, and it is included in the operating costs of the project budget, the process of identifying, collecting and processing KPIs should be optimal and efficient. Thus, the number of metrics will be deliberately limited in order to establish their optimal and sufficient KPIs number. Another criterion that we distinguish which helps us selecting KPIs is the following: if the metric is useful to provide information on the intermediate state of the project to ensure the manager, then it is worth acting upon it. In the following, we propose to use the term KPI (from the Key Performance Indicator) to denote the metrics / performance indicators of the distributed project team.

From the existing literature perspective we are able to sum up that the limited numbers of researches have investigated the distributed project team performance metrics.

One form of them is the performance evaluations findings based on the integrated scorecards by Kaplan and Norton which is purely 'business-oriented' metrics [10], [11]. The authors' concept is based on financial metrics grouped, reflecting on the question, 'By what criteria project owner and related stakeholders will evaluate the project success?'. In this case, the writers apply to the conventional financial ratios approach that, despite their shortcomings, is still commonly used to measure the success of businesses and, as a result, the project success.

Another approach to team performance metrics and the way to measure project status is based on these three constraints (cost, time, and workload) are known as the "iron triangle" in project management [12]. In addition, stakeholder satisfaction can also be an effective indicator of project effectiveness [13].

One more opinion still exists, saying that it is mandatory to measure individual team member's performance in order to have a good grasp on distributed team performance. It has been shown that the implementation of measures in human activity shows rapid improvements in communication, negotiation skills, dispute resolution and general effectiveness of the team [14].

Ultimately, conversations between researchers and practitioners may result in a series of recommendations to enhance the distributed team performance metrics at both organizational and strategic levels. Despite authors opinion, each project is unique, thus to arrange the proper KPI identification process and setup the valid KPIs, the knowledge (technical and methodological) is required from project managers. As an example, the project manager has to understand the procedure and stages of the specific project, product maintenance plan after release, the relationship between project activities, understands the roles and qualifications of team members and more other things.

3. Discussion and Results

In order to formulate a basic list of KPIs on projects using distributed commands, we propose to carry out the phasing of KPI identification on the project, which can be used as an auxiliary instruction to project managers. In addition, to minimize the processing time and manual interventions, part of the analysis according to the proposed sequence of steps should be automated.

According to the certain case study in the field of software project management and management operations, which is related to the recommendations for project managers on the selection of project KPIs we suggest a new one [15]. The proposed sequence of stages is based on an alternative view on the KPIs identification process and combines metrics formation processes, which includes regular work on them, encourage the monitoring of factors affect project's KPI and distributed team performance.

The KPI formation stages are grounded on the need to form metrics to reflect distributed team performance parameters taking into account business requirements from the customer to the project metrics, i.e. those criteria by which the client will assess the status of the project and team work.

As the next, we define project KPIs formation stages distinguished into three stages including KPIs list creation and maintaining phases that are shown in Figure 1.
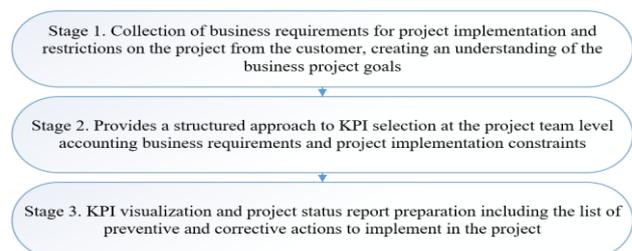

Figure 1. The main stages of project KPIs formation

One disclaimer here, before making an attempt to introduce and follow the recommended project KPIs formation process, we would suggest companies to make sure their project manager and team have sufficient experience. It is also mandatory that distributed team manager understands the feasibility of implementing KPIs according to the level of project maturity, which will further determine the initial KPIs list. In addition, Stages 1 and Stage 2 require the customer's representative participation as well as key team members, while Stage 3 could only be performed by the project manager on his/her own. Figure 2, in addition to the previously discussed project KPIs formation process, also represents the regular process of working with KPIs and KPI-reporting components in the project. Thus, we can consider each process of working with KPIs. Firstly, in order to get up-to-date project metrics that will later be part of KPI report shared with team and customer, project manager should pay attention to the following steps:

1. Data extraction and collection of the project information. This phase aims to identify the mandatory data for analysis and cleanup / organize raw data. For example, we recommend project managers to define patterns in the format of key terms / phrases, specify names of entities, actions as well as to clean up information that does not bring value. Once the data is extracted, there is a period of data storage structuring in case this is just a beginning of working with KPIs. The process itself can take quite a long time, as information can be stored in separate databases in different formats. However, in order to speed up and automate the data collection process, as well as to increase the reliability of their storage and avoid information loss, this distributed data has to be integrated from different sources and then combined, i.e. stored in a centralized software database;
2. The analysis of the project status. In particular, it would be quiet sufficient when the project manager involves key team members to provide their expert opinion at this stage.

Next, once the project information has been collected and analyzed correctly, the project manager forms a list of corrective and preventive decisions to stabilize the indicators or avoid possible negative deviations from the planned project indicators. It is a regular practice that the analyzed KPIs with explanations reach project status reports, which later are to be sent to the interested parties of the project.

In addition, we advise as a good practice to visualize the obtained KPIs using interactive visualization tools such as Business Intelligence tools, which will allow the customer and team members to conveniently view, receive, compare and share information. In practice, some KPI recipients may have different information needs depending on their role and experience. In order to meet their information needs, it is recommended by us to take into account personal knowledge and needs and address them by personalizing access to the interactive KPIs visualization.
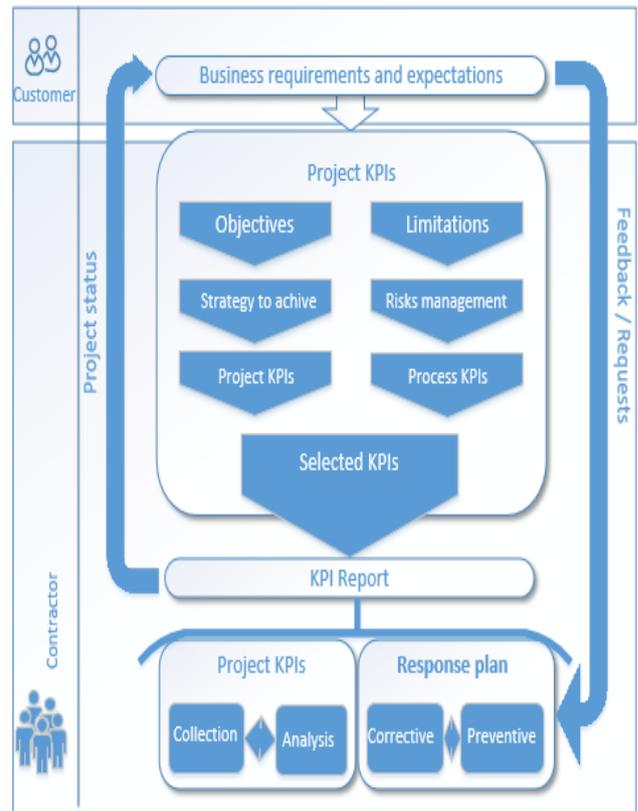

Figure 2. Formation and adaptation of project KPIs

In turn, the customer, depending on the agreements and the degree of his/her involvement into project implementation process, cannot only share feedback and views on the project status and metrics, but also make their own recommendations on the action plan, shown in Figure 2. Based on the project metrics, in the case of non-fixed contractual obligations between the parties, the contractor has an opportunity to influence the business requirements as well. For instance, contractor namely is able to propose changes to the initial agreements, expectations and restrictions on the project in accordance with status indicators. We can share one example to deep dive into this topic. Talking about software development project, the assumption about the structure of the client database and the optimal way of integration with it did not work. As far as the initial assumption was determined and estimated, the time required to perform integration with client systems, the contractor is able to propose to review the client's expectations regarding the budget, execution time and update the arrangements. Or,

when it comes to the customer himself, if he has his own team, they can technologically eliminate the difference from the initial assumption of the contractor and real situation, but not to change the primary business constraints with the contractor.

An important step in the proposed sequence of the work with project KPI is the selection and monitoring process according to which one keeps track on the distributed team performance.

Although software companies may assess project status differently using different parameters to assess team performance it should still be evaluated by financial results, i.e. according to the agreed project budget, schedule, volume and declared quality [16]. Thus, based on the already developed provisions, we recommend using the following 4 categories of metrics to measure the effectiveness of the project team, which, in turn, are indicators of the project status:

1. Financial indicators; comprising adherence to the defined project budget.
2. Execution schedule; comprising compliance with the project implementation deadline.
3. Scope of work / quality of work; comprising compliance with the requirements and objectives of the project.
4. Satisfaction of stakeholders; comprising the level of customer satisfaction.

In our opinion, the success of the project or the compliance of the project status indicators with certain parameters, if we eliminate external factors, is correlated the most with the team performance. Constantly measuring the project team performance can be a challenge, but it is the best way to build a productive team to achieve project goals.

Given the specifics of this study which is linked to the distributed project teams management, in our opinion, the KPIs needed to track the effectiveness of such team setup which will differ from those that should be used to assess the effectiveness of the classic project team. The main characteristics that distinguish the KPI of a distributed team from the classic, in our opinion, are:

▪ Higher risk of misunderstandings in distributed teams due to the lack of private personal communication and more complex process of knowledge exchange between team members, which leads to an increase in the number of defects in the system;

▪ Lack of clear and consistent processes in the project using distributed teams, which requires more effort from the project manager to implement and establish them. The result is an increase in the indirect project costs, i.e. communication time increase, etc.;

▪ Commitment to the project, loyalty to the organization among the members of the distributed team is lower, which can lead to the increased staff turnover, as a result - the productivity of the team decreases. The reason for this is also the fact of remote cooperation in a team, not in one place. To mitigate the impact of negative factors, the project manager should regularly monitor the mood and satisfaction of the team members.

▪ As a driver of the whole team efficiency, non-technical skills of the distributed project team members, their independence, communication skills, responsibility, time management skills, etc. come to the fore.

One should also bear in mind that we have intentionally removed product metrics that relate to the product, system, program, etc., and are the subject of the project managers' decision to include them or not. Given the above, Figure 3 and Table 1 present generalized performance indicators that we propose for use in order to monitor the performance of a distributed project team.
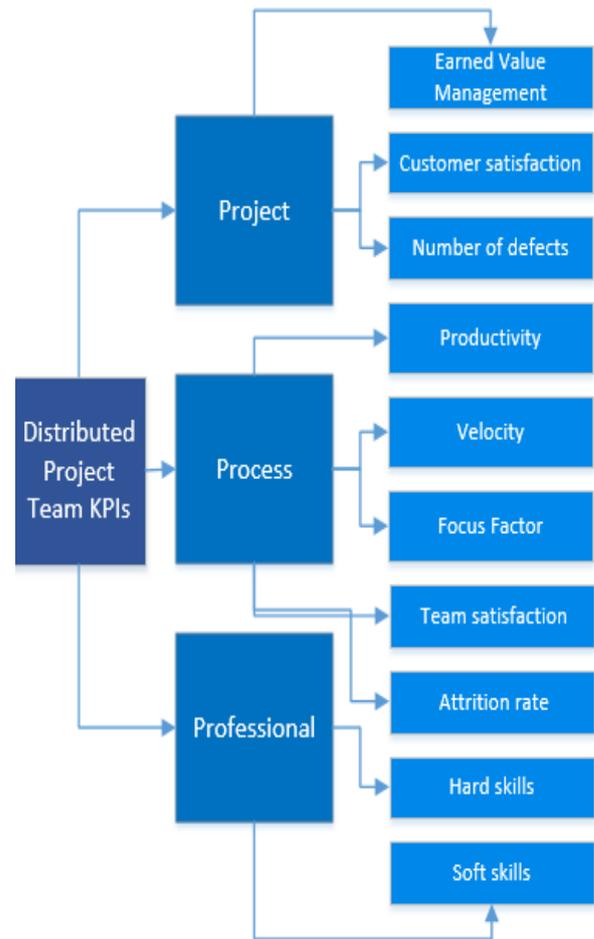

Figure 3. Distributed Project Team KPIs

Table 1. KPIs for assessing the status of the project using distributed teams

KPI	Calculation	Terminology	Description
1	2	3	4
Earned Value Management	Cost Variance, CV CV = EV – AC Schedule Variance, SV SV = EV – PV Cost Performance Index, CPI – indicator of measuring the volume of work performed in comparison with the actual cost of the project (efficiency of the actions performed) CPI = EV/AC Schedule Performance Index, SPI – indicator of measuring the achieved volumes of project implementation in comparison with the planned volume SPI = EV/PV	PV (Planned Value) - planned volume, agreed project budget EV (Earned Value) - mastered volume, used to indicate the percentage of actual work done AC (Actual Cost) - the actual cost of the designed work, funds spent to achieve the mastered volume	Methodology for managing the integration of volume, schedule and resources, as well as objective measurement of project performance and progress. Cost Variance: CV < 1 – exceeded the budget CV > 1 – haven't fulfilled the budget Schedule Variance: SV < 1 – behind schedule SV > 1 – ahead of schedule Cost Performance Index: CPI < 1 – the cost of project work is higher than planned (budget overruns) CPI > 1 – the cost of project work is lower than planned Schedule Performance Index: SPI < 1 – the amount of the implemented scope is less than planned SPI > 1 – the amount of the implemented scope is more than planned
Customer Satisfaction	Customer Satisfaction Score, CSAT – customer loyalty indicator used by companies to assess the level of satisfaction with the team / performer service. Customer satisfaction is calculated as the percentage of satisfied customers from the total number of respondents.	CSAT is rated on a scale of 1 to 5, or 1 to 10. Scale for assessing customer satisfaction from 1 to 5 as example: 5 - Completely satisfied 4 - Partially satisfied 3 - Neither satisfied nor disappointed 2 - Partially dissatisfied 1 - Absolutely dissatisfied	Customer satisfaction of 70% or higher is considered good for business. Highly depends on the industry.
Number of defects	Defects per unit, DPU – the average number of defects per unit / system functionality DPU = total number of defects / number of functional units in the system	DPU considers a unit of functionality defective if any of its characteristics fails. A defect is a result that does not meet the customer's requirements.	An indicator that expresses the effectiveness of the team in creating a product or system based on the number of defects. DPU metric is used to measure the quality and to improve the quality of business processes by identifying and reducing defects.
1	2	3	4
Productivity	Team Productivity index, PI – indicator of measuring the actual cost of work compared to the actual cost of work of the same level of complexity in the past PI = Cost of works / Cost of works in the past	An indicator that indicates an increase in the economic efficiency of the team after the intervention or time and can compare the situation "before" and "after".	Team Productivity index: PI <1 - the productivity of the team to perform work of the same complexity has increased PI> 1 - the productivity of the team to perform work of the same complexity decreased
Velocity	Velocity – indicator of the	During the iteration, the	Velocity is the average amount of

	speed with which the team performs the planned tasks Velocity = the number of units of the developed functionality per iteration	entire team performs tasks or units of the planned functionality. At the end of the iteration (a week or two weeks or any other period) the team will perform a certain number of units of functionality, which will be considered as the speed of the team.	work that a team performs in one of the iterations, i.e. for a fixed period of time and is measured in units of developed system functionality or hours and is used by the manager to predict the work schedule of the team.
Focus Factor	Focus Factor – percentage of team concentration on the implementation of the project volume Focus Factor = Velocity / Capacity	Velocity - speed of planned tasks execution Capacity - available efforts of the team in iteration	The percentage of team members' available time that will focus on developing a unit of system functionality, ie excluding time for communication, research, project review, knowledge sharing, and so on. The Focus Factor is the ratio between the speed at which a team performs planned tasks and the available time of the entire team in the iteration.
Team Satisfaction	Team Satisfaction Score, CSAT – team satisfaction indicator used by project managers to assess the level of job satisfaction in the project team / team member. Team satisfaction is calculated as the percentage of satisfied team members of the total number of respondents.	TSAT is rated on a scale of 1 to 5, or 1 to 10. Scale for assessing the satisfaction of a team member from 1 to 5 as an example: 5 - Completely satisfied 4 - Partially satisfied 3 - Neither satisfied nor disappointed 2 - Partially dissatisfied 1 - Absolutely dissatisfied	Team satisfaction of 80% or higher is considered as a good indicator for the project.
Attrition	Attrition rate – Indicator shows the percentage of the number of team members who left it to the number of people in the team when calculating for a certain period. Attrition rate = Number of dismissed / total number of team members x 100%	The Attrition rate itself and its deviation from the norm for the industry or within the company only serves as a signal of the problem, but does not speak directly about the costs incurred by the team due to this phenomenon.	The Attrition rate speaks to the internal problems with the teams, which lead to a loss of speed and knowledge over time because of the team members' change. Finding the reasons for team members' turnover and defining the way to fix problem can significantly increase work efficiency and improve productivity of the team.
1	2	3-4	
Hard skills	Hard skills – it is the special knowledge and skills required to perform work tasks, i.e. the skills to use the methods, technologies and equipment required to perform specific functions.	Professional skills increase employee productivity and efficiency. Because such skills are stable, easy to see, measure, and compare to specific constructions, they are included in the list of requirements set forth in job descriptions.	
Soft skills	Soft skills — a set of non-specialized, supra-professional skills that are responsible for successful participation in the work process, high productivity and, unlike specialized skills, not related to a specific area	Non-technical skills are a set of productive personality traits that characterize relationships in the environment. These skills may include communication skills, language skills, personal habits, cognitive or emotional empathy, time management, teamwork, and leadership.	

4. Conclusion

Finally, we consider it is necessary to comment on a few important opinions that are part of Table 1. Firstly, the whole list of metrics is universal, because changes in the distributed team will be manifested in accordance with the proposed metrics. Depending on the client's needs business objectives, and etc., including the changes to the list of metrics for monitoring the effectiveness of the distributed project team, as well as the status of the project itself, it is necessary to implement and critically consider which KPIs really matter to the project. Secondly, all the components that need to be tracked on the project by project manager, analyzing project budget state, schedule and volume / quality, are gathered in one KPIs recommended list to measure distributed project team performance and project state. For example, the metrics in the 'Managed Volume Management' group are directly correlated with the need to understand the budget, schedule and volume according to the parameters agreed with the customer. In addition, the metric of the number of defects in the developed system shows the level of quality of custom software development. Thirdly, we believe that the success of a project using distributed teams is particularly influenced by the performance of team members, whose technical and non-technical skills will be especially noticeable when everyone is working remotely. That is why, paying attention to this, we have separated certain KPIs into a group of professional skills as an important factor that has an impact on the efficiency of the distributed project team.

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