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Virtual Software Development Teams - Their Organizational Structure, Management Mechanism Involved, Problem Resolution and Decision Making

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Abstract:
This paper seeks to analyze different methods in existence to manage software development teams. It will review a number of other papers that suggest different team management methods and organizational structures in order to give a better understanding of all the issues faced by software development teams, and how to tackle them. The aim of this document is to aid software professionals in making better decisions regarding their software development life cycle processes by providing them with relevant information and know-how. Keeping in mind the recent increase in the number of virtual teams in operation in the software development scenario, this paper will devote a large fraction of its attention towards virtual team management, its organizational structure and methods of problem resolution.

Keywords: Global teams, virtual teams, globalization, software planning, project management, project execution, development teams

1. Introduction

As a result of globalization, it is common to manufacture software with development activities taking place in different locations. This allows engineers from across the globe to work together, collaborate and create world class software. It helps bring new talent and varied ideas on the table for discussion and exposes employees to fresh viewpoints. But this process of development scattered across the globe has its own shortcomings too. It poses new challenges in the field of software project management which makes the process more complex especially since research in the field of management methodologies and protocols for virtual teams is still in its fetal stage. Based on an extensive literature review towards an understanding of industrial practice regarding software development processes, authors of this paper conclude that there is still scope for more research in this field and would like to present their findings on the issues faced by virtual software development team managers and the various solutions available.

1.1. Virtual Teams vs. Traditional Teams

Before delving into the solutions suggested for managing virtual teams, it would be wise to reiterate on the characteristics that differentiate virtual teams form traditional close knit ones. Virtual team can be defined as a group of people who use electronic means to communicate with each other more often than having face-to-face meetings. It is the degree of online communication and not the dispersion of the team that characterizes a team as virtual. The main issue that virtual teams face is when it comes to communication. Virtual teams need an efficient means of communication that can facilitate synchronous communication between team members so as to enable them to make well-informed decisions regarding the project and collaborate with each other seamlessly. The processes involved in software lifecycle management need to the altered to make them more appropriate for virtual teams. For example: Daily meetings, that are fundamental to agile development method, will prove to be unfeasible in the case of a virtual team and most means of synchronous communication (video conferencing and phone calls) are inefficient and/or expensive. Therefore, an amalgamation of traditional methods of team management and the modern agile methods is needed. Furthermore, the processes can be modified to standardize the deliverables produced at each development phase so as to reduce the amount of collaboration needed in the review phase and to make work easier for every team member to understand. Care has to be taken to ensure that planning is done appropriate detail. A plan that is sparsely detailed can create discrepancies at a later stage and a plan that is too detailed can become too rigid to be handled by a virtual team where not every member is in constant communication with each other. The communication between different members can also be categorized into two parts: Synchronous and asynchronous. Synchronous communications are expensive and time consuming and sometimes can prove to be infeasible for team members that span across the globe or across

different time zones. Asynchronous communication is less expensive and is feasible with existing email and instant messaging technologies but does not provide the same efficiency as synchronous communications. In the case of virtual teams it is necessary to carefully decide when to have synchronous communications with team members and how to economize the communication.

1.2. Project Management for Virtual Teams
The entire process of software development, from the inception of the project to its completion is called project lifecycle. A project life cycle is a set of project execution activities that may be executed parallel or in an order. All project lifecycles consist of the following four phases of lifecycle management:
- → Project Initiation
- → Planning
- → Execution, and
- → Closing

All of these phases are simultaneously controlled and monitored for performance reviews, error correction and progress monitoring. Every phase is associated with a key deliverable so that it is possible to have a tangible method of monitoring progress.
The software development project is started in the project initiation stage. This stage is very similar to the project initiation stages in traditional software development lifecycles. It consists of setting clear project goals and defining its scope. It requires a high level of collaboration and needs clear, synchronous communication between not just the developers but the client's representative too, since any misunderstanding or ambiguity regarding the project at this point of time in the lifecycle can lead to disastrous results in the end. These communications are expensive and time consuming but projects with such discussions done in the initial phases have less tendency of producing unexpected results. A clear work breakdown structure needs to be drawn out to ensure clarity about the project. It should be noted that this phase only involves an initial discussion about the project and what needs to be done and does not involve and detailed plan about how and when it needs to be executed. The details about the project in this phase are kept at bare minimum so as to give all the developers involved some flexibility.
Project initiation is followed by a set of phases that keep on repeating until the project is finished. Each phase consists of the following processes:
- Iteration planning
- Iteration execution
- Iteration review, and
- Customer review.

In Iteration planning, the current arrangement is further expounded, altered or affirmed, contingent upon the level of planning and points of interest identified in the Project initiation phase and the previous planning cycles, that impacted further course of the undertaking. The deliverable of the Iteration planning is a period plan sufficiently detailed with the goal that particular duties can be doled out to every developer. A few exercises must be executed as collective work, i.e., including more than one developer. In spite of the fact that developers work simultaneously to execute such exercises, certain duties must be unambiguously allotted to every developer. Every process execution must have its inputs and yield a key deliverable. These planning activities require synchronous communication and must be taken seriously by all developers who are part of the project.
After Iteration planning is done, the work on creating tangible deliverables begins, and project management specific activities are performed. Forms and additional related inputs, yields and intermediates ought to be generalized however much as could reasonably be expected to diminish the requirement for successive synchronous communications. These systems must empower every developer to have knowledge of all the activities that are left undone and what goals need to achieved by the group and to give others data about his or her status. Towards the start of a workday, every developer analyses the project progress to acquire the latest data about task status. In light of that data, he/she must perform or modify his or her exercises, and as indicated by the work done, redesign his or her schedule with respect to the status of the project.
In the Iteration review, client is not specifically included for few reasons. Since virtual project management situations convey more serious risks, the created deliverables first ought to be audited and approved inside the group. On account of shorter emphases, it is not generally important to include the customer, as client representatives would be reluctant to waste their time looking after every small error or discrepancy. Besides, the time allotted for face-to-face meetings with clients should be judiciously used as it is very expensive. To adjust to these conditions, client assessment is a part of Customer audit that may, or may not take after the Iteration review. In the Customer review, just a part of the task group may partake, and whatever remains of the group is educated about the outcomes later. If there are some very huge flaws, the process may be repeated from the iteration planning stage. When all deliverables are finished and affirmed by client, the Project close-out phase begins.
At the point when brain storming exercises must be done, Project close-out is not altogether different from those in other methodologies. All the lessons and experience gained from the project must be documented for future references. Video meetings could likewise be a decent and cost sparing decision for all inclusive appropriated virtual groups. Putting away project information in the knowledge base for future reference ought to get focused consideration in virtual group situations. In the event that the with virtual teams and the factors apparatuses and innovations utilized are not appropriately set up, gathering and throwing away of the project information can be very troublesome. Data can be dispersed among various employees and different information storehouses. Project closing stages in a wide range of projects regularly get limited consideration. On the off chance that extra intricacy is presented by virtual environment, much conceivably valuable data might be excluded. To keep that in mind, a focal archive must exist and extra

instruments must be designed and coordinated to store all task data seriously and naturally. In the event that formation of information base turns into a by-result of the project life cycle itself, endeavors in this stage can be fundamentally diminished in contrast with the other task situations. In spite of the fact that the proposed methodological structure abuses lithe standards, this doesn't avoid use of project administration forms. Dexterous project administration ought to incorporate determination of project administration procedures and utilization of industry standards on the chosen process areas.

1.3. Analyses of Papers and Methods
The first paper we analyzed is MANAGING VIRTUAL PROJECT TEAMS by Bryan Rolf Trautsch. The paper deals virtual teams and the factors that affect the functioning of virtual teams. The paper particularly looks into communication among team members and its effects on efficiency.
The method of research used in the paper was in the form of a questionnaire that was send to various project managers across united states.
The questions were:
1 What are the main reasons your organization uses virtual project teams?
2 Does your organization have different techniques for managing virtual project teams compared with traditional project teams? If yes, what are the main differences?
3 Please list in order of usefulness up to 3 tools (technology, software) that you personally have found most useful in managing virtual project teams. Please briefly explain how you personally use each tool to manage virtual teams.
4 What impact do virtual teams have on virtual team members' morale? On in-house team members' morale?
5 What are the 3 most common communication problems you have encountered with virtual project teams?
6 What are the 3 most common control issues you have encountered with virtual project teams?

The responses were analyzed quantitatively for the research and the answers were used to bring about some conclusions. The paper first deals with the problems faced by virtual teams as opposed to traditional teams and the impact it can have on an organization. It then answers the questions regarding the impact of the method.
The conclusion is that the managing of teams is similar in both virtual and traditional teams even if it should be different. The team leader has a few more responsibilities in terms of leadership and management. The paper concludes by raising the issue of whether the virtual teams require any more training to manage.

1.4. Training to Virtual Teams
-extra training regarding cross cultural education must be imparted to the team members. If a person from China, India or USA are interacting with one another they must be aware of the basics of the cultural factors involved in communication i.e. what is appropriate etc. This would sensitize and create awareness among the members for each other culture, religion and traditions.
-extra communication must be enabled to solve communication related issues that compensate for the distance.

2. Conclusion
Despite the fact that various task management strategies exist, none of them is totally sufficient for overseeing projects running in virtual situations. Consequently, by joining the studies and research by different papers this paper proposes an amalgamation of an iterative and conventional methodology joined by serious usage of devices and technologies, and a methodological system custom fitted for management of projects including virtual groups. The proposed approach diminishes the requirement for successive synchronous collaboration, while expanding of the project mindfulness and thus brings about a more effective project execution.

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