THE THREE ASPECTS MODEL – A NEW POINT OF VIEW ON VIRTUAL PROJECT TEAMS IN THE IT INDUSTRY

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Abstract: Information technology companies often have to setup a specific virtual environment in order to develop innovative software products. Software development requires a variety of IT tools to ensure a smooth flow of information and proper organisation of tasks within the project team. The evolution of information and communication technologies has allowed virtual teams to share knowledge online, which became more preferable than traditional meetings of developers. The main objective of this article is to determine how virtual project teams are being formed and what are the key attributes of a virtual team – a conceptual Three Aspects Model of a virtual team was presented that may be used in further research. An overview of supportive project management software solutions for virtual teams has also been conducted. The research results presented in the paper indicate that various IT tools lack support in some aspects of virtual project teams.

Keywords: project management software, IT projects, Virtual Project Team, IT project management tools.

1. Introduction

The Information Technology (IT) industry has evolved from offline development methods to online work spaces. Modern IT companies develop a plethora of new products, including operating systems or individual software in form of sophisticated programs, mobile apps, video games, websites and other types of user-related services. As a result of this productive expansion, many project management methodologies and methods have been invented or adapted to meet the requirements of new development styles. Jim Highsmith indicates that Agile Project Development has revolutionised the current state of the IT industry as a result of adaptation to user requirements, variable project scopes and iterative production cycles (Highsmith, 2004). Enterprises struggle with the high increase of information flow and dynamic changes occurring on the IT market. Efficient and incremental development of software

products with the customer's involvement have become a standard technique in most cases (Papadopoulos, 2015). New product development models were updated and combined with Agile methods and techniques (Cooper, 2014). The evolution of IT networks and technological progress of hardware allowed companies to swiftly and effectively exchange knowledge within whole organisational structures, especially in the case of project teams which are responsible for new software development. Fast communication by such means as Internet or intranets and high availability of virtual supportive tools have encouraged some enterprises to launch new product development (NPD) projects in virtual environments – often referred to as online environments or online (cloud) workspaces. Such virtual environments (or workspaces) require a professional virtual team of developers (Ford, 2017) in order to successfully complete all tasks of the current project.

Reports of Standish Group indicate that only 30% of projects end successfully. Such results concern the IT industry, where projects are often cancelled as a result of insufficient funds or due to lack of human and technological resources, as well as a result of bad management and lack of knowledge about the market (Standish Group: Chaos Reports, 2004 & 2006). Other researchers suggest that the main issue of IT development lies within a lack of proper knowledge transfer in projects' team structures (Reed, Knight, 2010). Similar problems are associated with proper understanding of different cultural aspects in multi-cultural workgroups (Adenfelt, 2010). The Version One Agile report determined that the main barriers which cause IT projects to fail are the following: improper organisational culture and philosophy of development, lack of management support, lack of experience and problems with cultural transitions (13th Annual State of Agile Report, 2019). Such impediments may often derive from lack of knowledge during the selection of a proper IT tool for setting the virtual project workspace. These issues indicate that certain procedures and preparations must be carefully undertaken while creating a Virtual Project Team (VPT). Therefore, the technological layer is not the only important aspect of Virtual Project Teams.

The main objective of this article is to determine how Virtual Project Teams are being formed and to present a general overview of IT tools that may be used to support their workflow – a conceptual Three Aspects Model was presented to characterise all important attributes of an effective and skilled VPT. Empirical research was also conducted to determine whether the aforementioned popular IT tools have the capabilities and features that can support the various aspects of Virtual Project Teams. In this article, these tools are considered as pieces of virtual environment framework software. The latter can be defined as standalone tools or applications which support project management and collaboration among members of VPT.

2. Virtual Project Management, Virtual Project and Virtual Project Team

Virtual Project Management (VPM) can be defined as the ability (of a Virtual Project Team or of an enterprise or organisation) to create and configure a proper virtual collaborative workspace, including its operating principles, and the application of ICT tools, knowledge and techniques to successfully complete virtual project activities in a fixed amount of time. The term VPM is often considered as a system (Aslam, 2010) which enables virtual teams to complete a project's duties. In other scientific papers, it is defined as an effective virtual team which has appropriate competencies to execute a virtual project (Duarte, Snyder, 2001). McMahon (2001) emphasises that virtual collaboration of multiple remote locations and units may grant better productivity than traditional single location endeavours. He also introduced an eight-step plan that can be used as a roadmap to properly set up and execute a virtual project:

- High Level Virtual Project Organisation (Virtual Culture and Virtual Leadership).
- Architecture, Work Split, Tasking.
- Planning.
- Project Rules.
- Lower Level Virtual Project Organisation (Integrated Product's Teams).
- Detailed Planning.
- Test the Operation Concept of the Virtual Organisation.
- Execute.

Other scientists indicate that Virtual Project Management consists of three major areas, namely – virtual leadership, virtual communication and cyberculture (Nozari et al., 2016). A clear definition of objectives, continuous feedback, shared vision, trust, motivation, development of collaboration and knowledge sharing – all these factors have a significant impact on a virtual project's outcome (Nozari et al., 2016). Some virtually-driven projects still require traditional face-to-face meetings during selected phases of its schedule (Lebedieva, 2011). Enterprises often conduct specific stages of the project by using VPM as a result of a product's complexity. Some project tasks may also require additional computing power and distinctive software features, which are only achievable through virtual environment collaboration. Therefore, a **Virtual Project** is a collaborative effort undertaken by a virtual team which uses a specific online environment and IT technologies to perform all project activities remotely or even in the cloud without the need of any traditional meetings (Krill, Juell, 1997). Virtual projects have various benefits in comparison to the traditional approach, as virtual teams may improve decision-making activities, reduce overhead costs and reduce project scheduling (Tastoglou, Milious, 2005).

Numerous scientific papers define a **Virtual Project Team** (VPT) as a group of people who interactively cooperate to achieve a project's goal, where at least one of the team members works in a different geographical location, time zone or organisation, and as a result, all communication and decision making is performed by the use of digital means, such as online

software, e-mails, phones, video conferences, live streams and other available means (Hertel, 2015; Gibson, Cohen, 2003; Kirkman, Mathieu, 2004; Dulebohn, Hoch, 2017). There are a few conditions which have to be meet in order to form a virtual team (Cantu, 1997):

- Telecommunication or online network connections are being established between team members located in distant geographical locations.
- Collaboration is being formed by members of different organisations or various members of one organisation in order to complete specific project activities, and their headquarters are situated in remote places.
- The time involvement of a specific member in a particular project is very dynamic and differentiates according to the project's scope, goals and unique characteristics.
- Proper IT tools and virtual collaboration software are being used for project management support (Jones, et. al., 2005).

The above-mentioned elements are crucial for setting up an effective Virtual Project Team. Building potent and well-organised virtual teams is a very difficult and challenging process. Scientists have proven that different time zones, business practices and unknown cultural habits may hinder knowledge sharing and often have a negative impact on the creation of virtual teams (Dube, Pare, 2001; Kelley-Lee, Sankey, 2008). Some articles also point out that a trustworthy leadership style plays a crucial role in building successful Virtual Project Teams (Lee, 2009; Iorio, Taylor, 2015). A more detailed overview of all attributes, aspects and characteristics of Virtual Project Teams has been prepared in the next subchapter of this paper.

3. Main attributes of Virtual Project Teams – The Three Aspects Model

The stages of a virtual project's life cycle have some similarities to a traditional project's life cycle. A virtual project may be divided into the following stages (Schumacher, 2011):

1. Project initiation – definition of main goal, virtual workspace and final effect.
2. Planning – searching for experts and resources, defining all task of the project.
3. Estimation – appointment of team members and their role assessment in the virtual environment.
4. Scheduling – defining time limitations for all tasks.
5. Organising – division of responsibility and resources for all tasks.
6. Virtual Project Team Management – role of the Virtual Project Manager.
7. Controlling and monitoring of the project – checking the progress of the project in its full time scale.
8. Finalisation of the project including creation of a knowledge sharing model for future undertakings.

Each stage or phase presented above may vary in practice, as most companies use diverse approaches to virtual project management. The role of a virtual project manager is crucial to

maintain high morale in a VPT. Traditional methods of team supervision are not as effective when managing virtual teams, and virtual project managers have to find other ways to induce trust in team members. Rapid trust from the beginning of the project is commonly used as a typical solution in virtual teams to elicit more commitment (Nandhakumar, Baskerville, 2006). Virtual team leaders must ensure that all team members have a sense of identity and belonging. Developers have to feel that their work is required for further development of the product (Haines, 2014). Members of a VPT are often portrayed as role players, where the project coordinator represents the main leader of development team (Eubanks, et. al., 2016). The virtual project coordinator is usually identified as a procedural task manager (Misiolek, Heckman, 2005), lead visionary of the project (Yoo, Alavi, 2004) and scheduler who deals with task assignment duties (Majchrzak, et. al., 2006). Team leaders often have to delegate leadership functions and responsibilities to team members (Bell, Kozlowski, 2002) – in such cases, project managers have a more supportive than supervising role.

The structure of a VPT is often divided into smaller groups which consist of experts and developers assigned to specific tasks (Chen, et. al., 2008). This practice is usually used in companies which run complex virtual projects and when their headquarters are distant from each other. Members of individual VPTs may interact with one another freely and instantly (Figure 1). Virtual team developers are often empowered by companies or project leaders to self-manage their duties. This empowerment can be considered as a VPT member's authority in decision making, which grants him/her higher awareness of a greater responsibility, satisfaction in accomplishments and especially a sense of ownership. This approach may resemble a holacracy – an approach where no hierarchical structures are used in organisation, but instead all developers are self-organised and assign themselves to particular roles (Robertson, 2015).

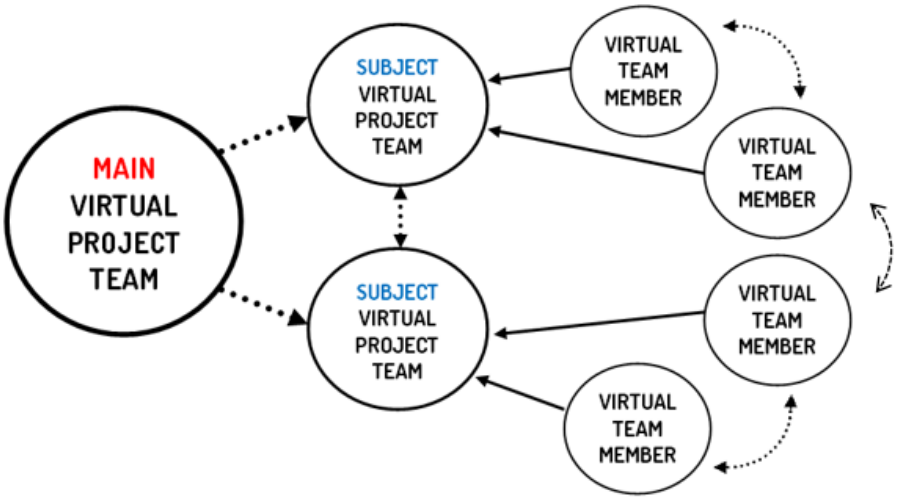

Figure 1. Network structure of a complex Virtual Project Team. Source: own work.

Building a strong VPT not only requires a group of qualified developers, proper team organisation, trust or knowledge-sharing, but also access to professional hardware. The latter is mainly used to establish a collaborative working environment. Scientists indicate that a VPT's

environments are built upon three specialised layers such as: organisation layer, virtual team management layer and resource layer, as shown in Figure 2 (Chen, et. al., 2008).

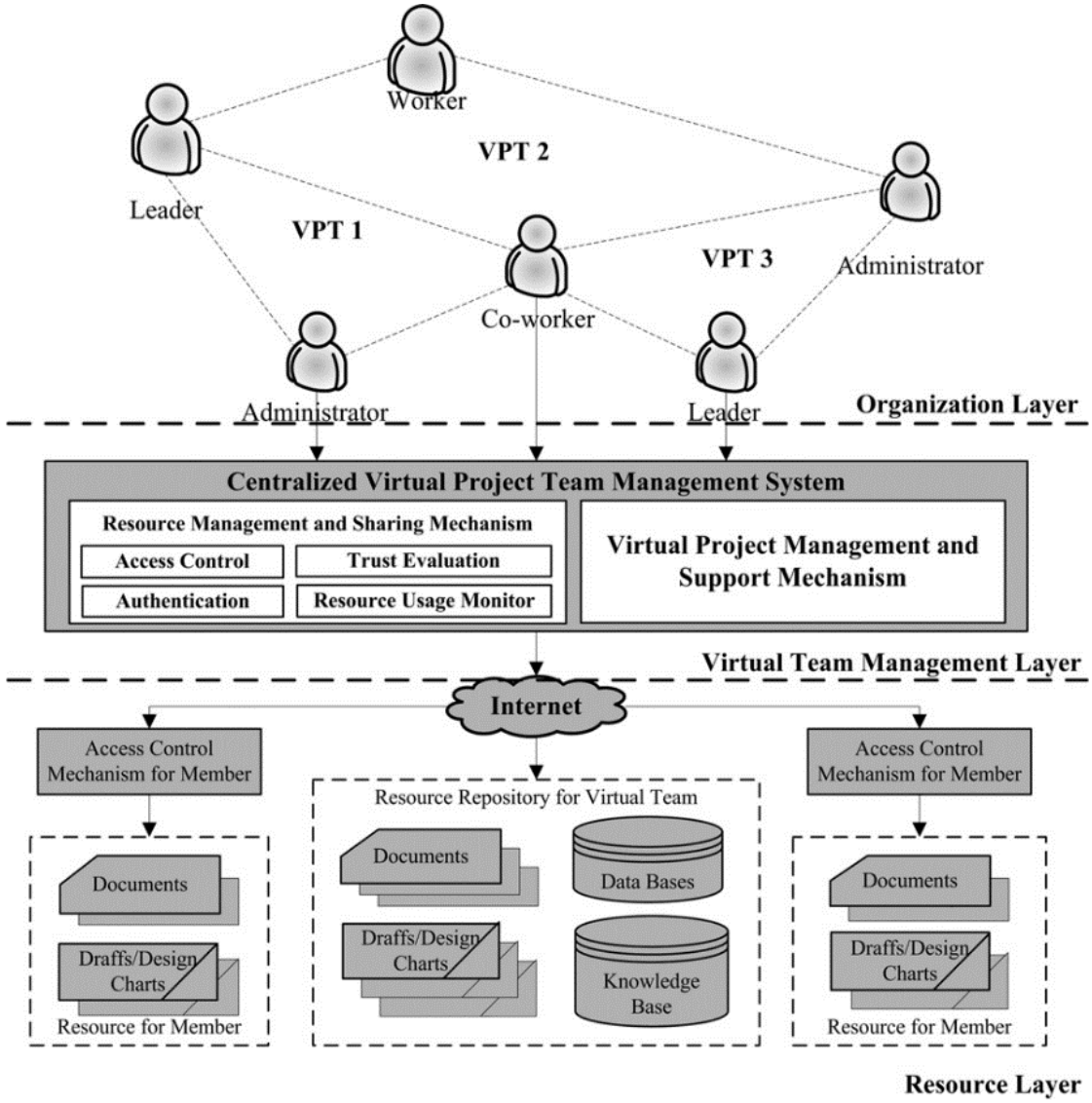

Figure 2. Structure of the Virtual Project Team Working Environment. Adapted from: Chen T., Chen Y., Chu H.: Developing a trust evaluation method between co-workers in a Virtual Project Team to enable resource sharing and collaboration. Computers in industry. Computers in Industry 59, Elsevier, 2008.

The organisation layer is defined as the overall Virtual Project Team structure, including important stakeholders and network administrators. The Virtual Team Management layer consists of Virtual Project Management and the Support Mechanism, as well as Resource Management combined with the Sharing Mechanism. Both mechanisms operate through the use of virtual environment framework software and a variety of useful IT tools. Other aspects such as trust evaluation or access control are associated with leadership style and common procedures used in a particular enterprise. Finally, the Resource layer contains virtual drives and resource management databases, which are being used for knowledge sharing and as a document

repository. Proper configuration of the resource layer may have a significant impact on the workflow of a virtual team.

People, processes and technology are considered as components of Virtual Project Teams (Conill, 2013; Olaisen, Revang, 2017). People are the key element of every VPT, and such factors like task-related communication behaviours, team integration and a set of soft skills have an important impact on the level of trust among virtual team members (Rico et al., 2009). Properly established processes organise the general workflow of the team and allow them to manage resources in a more efficient way. Technology is considered as ICT hardware, IT systems and software solutions which are mainly used to manage new product development projects, support team collaboration and store valuable knowledge in data repositories. The project management features of the aforementioned software solutions help virtual teams track various dependencies associated with projects, such as product backlog, deadlines and milestones. They also provide better control over project resources. Team collaboration features are mainly used to aid team members in establishing fast communication, asset creation and to support decision making. Such software solutions like Wrike or Monday offer special dashboards where every user can check the current status of the project, manage tasks and get an overview of all project objectives.

By combining all the aforementioned features and characteristics of a VPT, a new approach may be considered, where Virtual Project Teams can be formed on the basis of three aspects: Transparency Aspect, Technological Aspect and Social Aspect (also identified as Soft Skills Aspect). On the basis of these assumptions, a conceptual model of a VPT has been constructed – we have decided to call it the Three Aspects Model (Figure 3). The model presented below has been based on a literature review which indicated the most important factors and features of Virtual Project Teams. The essential literature that laid the groundwork for the Three Aspects Model consisted of scientific papers in which three key attributes and elements of virtual teams were identified (these attributes are often referred to as three dimensions of virtual collaboration):

- People, links, purpose (Lipnack, Stamps, 1999);
- Time, space, culture (Fisher, Fisher, 2001);
- Time, place, organisation (Kimble et al., 2000).

The above factors and characteristics were extended by the common issues and challenges of virtual teams, such as:

- Proper team organisation and setup of technologies (Munkvold, Zigurs, 2007);
- Multicultural communication and collaboration (Duran, Popescu, 2014);
- Soft skills and trust within virtual team development (Greenberg et al., 2007);
- Leadership issues (Liao, 2017);
- Problems associated with knowledge sharing (Pinjani, Palvia, 2013);
- Problems associated with communication in virtual teams (Marlow et al., 2017);
- Issues associated with optimal selection of ICT tools and IT systems (Dávideková, 2017);
- Problems associated with diversity among virtual team members (Taras et al., 2019).

All three aspects of the proposed model can be considered as maturity states pursued by evolving virtual teams. In other words, virtual team members put a lot of effort into achieving

a high level of transparency in knowledge sharing, enhance self-organisation, optimise technological tools to maximum capability and obtain a superior level of cooperation and feedback. There are other types of approaches which describe the proper establishment of virtual teams from the perspective of project management (like the one presented by Rolfes, M., 2001), but they mainly focus on certain project phases. Apart from project management, the Three Aspects Model puts more emphasis on social aspects and the collaboration level among VPT members, including technology combined with knowledge-sharing, and proposes a slightly different point of view in this matter. This model mainly concentrates on a Virtual Project Team and its attributes as a unique construct instead of focusing mainly on a Virtual Project or Virtual Project Management.

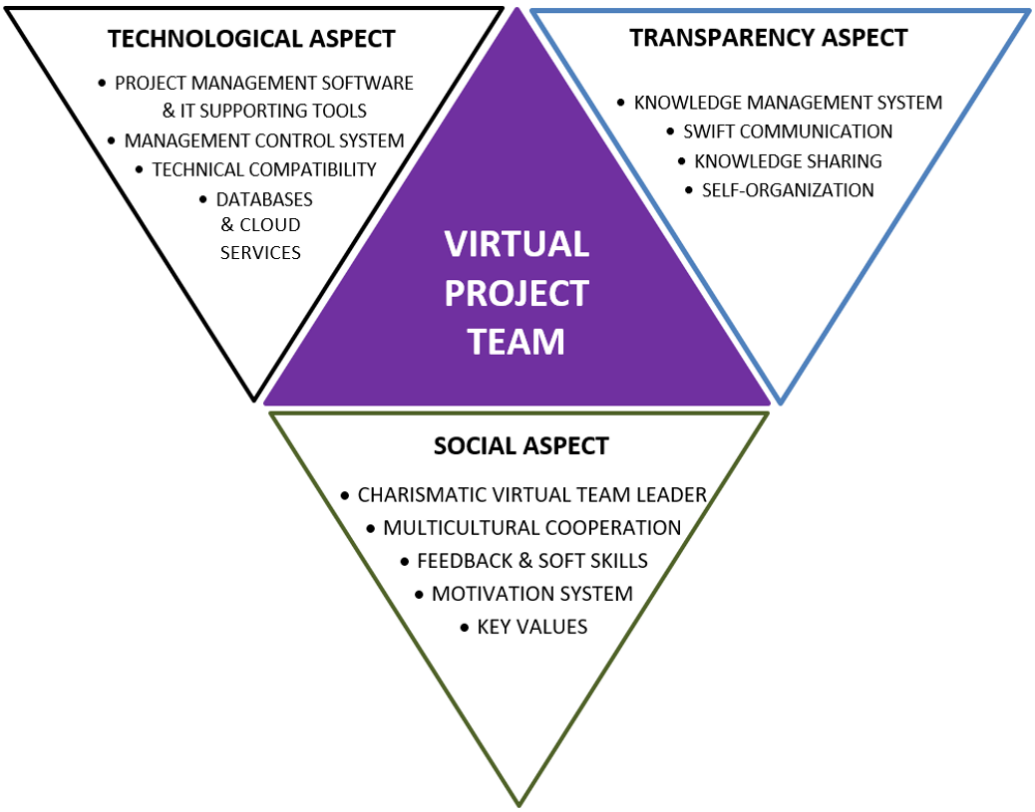

Figure 3. Conceptual Three Aspects Model of a Virtual Project Team. Source: own work.

The Transparency Aspect integrates features of knowledge sharing and access to all important enterprise data. It also includes a knowledge management system, which determines the flow of all valuable information and knowledge throughout the environment of a Virtual Project Team. Collaborative and integrated knowledge sharing is a fundamental factor for creating a successful virtual team (Olaisen, Revang, 2017; Zahedi, et. al., 2016). Interpersonal trust, knowledge transfer, efficient communication and understanding of informal knowledge sharing all have a positive impact on a virtual team's performance and on a project's progress (Navimipour, Charband, 2016). Knowledge management helps to develope collaborative activities and maintain the overall development endurance of the group (Alsharo, et. al., 2016). The SECI model of knowledge sharing plays an important role here, as ICT systems, IT software solutions and

cloud computing solutions may enhance the four modes of knowledge conversion – socialisation, externalisation, combination and internalisation (Nonaka, et. al., 2000).

The Technological Aspect consists of all IT project management supporting software solutions, team-work collaboration software solutions, video and communication software solutions, databases and file repositories, additional applications, management control systems and, most importantly, technical compatibility and network accessibility for all Virtual Project Team members (Conill, 2013; Majchrzak, et. al., 2000; Conforto, Amaral, 2016). Software solutions and IT tools may vary depending on the type of the project. Some tools offer additional features like cloud computing or social media services (Conill, 2013). Proper arrangement of an evolving virtual workspace is a critical factor required for achieving Virtual Project Team synergy (Marlow, et. al., 2016). Supporting software can help in building virtual team structures, and most importantly, it provides features that allow the team to check the current status of the project. A proper management control system is required to set order in a team's workflow. Such a system should contain a governance system which regulates all duties and rules of cooperation (Bisbe, Sivabalan, 2017). Databases and file sharing systems also have an important influence on tasks performed by VPT members.

The Social Aspect (also known as Soft Skills Aspect) combines the need for a charismatic team leader and project manager with a proper motivation system, leadership style, multicultural cooperation, key values and a variety of soft skills for the virtual team (Jarvenpaa, Leidner, 1999; Warkentin, et. al., 1997). Team feedback turns out to be effective only when team trust is high (Pennaroja, et. al., 2015). Thus, trust is one of the main key values in virtual teams (Ford, 2017). The motivation system is the most challenging aspect of virtual environments (Conill, 2013). Team leaders and project managers must understand how to motivate their co-workers in online networks and which ways of encouragement are the best to increase the commitment of VPT members. Comprehension of content and forbearance are crucial in achieving a communication balance in a virtual environment (Jarvenpaa, et. al., 2004). Soft skills also have an important role in maintaining appropriate relations with stakeholders during the realisation of a project (Pokharel, 2011).

4. Overview of Virtual Project Team collaboration software and IT tools in the perspective of the Three Aspects Model

4.1. Description of research methods

In this study, we have assessed and rated 10 different types of project management software solutions which provide support in establishing a comprehensive workspace for virtual teams. These tools were selected on the basis of top 10 virtual project management software solutions rankings made by various tech and software-related websites. The analysis presented by the G2.com site seems most interesting, as it includes hundreds of user reviews of as many as 770

pieces of software and applications supporting project management and virtual teams. The 10 most popular project management and virtual team collaboration tools were selected, recommended by many software and business services websites (available in December 2019)[1]. In order to rate all features of selected software solutions in the perspective of the Three Aspects Model, we analysed 150 reviews (available on G2.com) of every software solution. Additionally, we conducted individual tests of every project management solution and assessed the quality of its features. The main objective of the research was to rate every unique piece of software and determine whether it is able to provide additional support within particular aspects of virtual project teams, namely:

- Project management support (technological aspect) – considered as utilities and features crucial for project-related activities, like project objective management, task and backlog management, schedule management, quality management, risk management, budget management and resource management;
- Database & cloud services support (technological aspect) – considered as availability of advanced features and functions which can be used in the virtual cloud, like simultaneous work on a certain case in a virtual workspace or the possibility to temporarily use (or pay a periodic subscription fee) additional tools available in the cloud, which also concerns compatibility with various types of databases;
- Technical compatibility support (technological aspect) – considered as the possibility to use certain piece of software on every type of mobile and standalone device, which also concerns the level of integrity and compatibility with other types of software;
- Swift communication support (transparency aspect) – considered as utilities in the form of messengers, information boards and online chat systems and their integrity with other popular communication workspaces like Slack;
- Knowledge sharing support (transparency aspect) – considered as features which enhance knowledge and data sharing, e.g. in the form of solution repositories such as general guides, practical FAQ sections and other types of advice which may provide answers to unique problems;
- Feedback & soft skills support (social aspect) – considered as functions and features which may enhance the integrity of the whole team, provide easier access to send feedback or have a positive impact on conversations;
- Motivation system support (social aspect) – considered as an employee gratuity system, e.g. where every team member can be rewarded with special badges or score points for successfully completing a specific task.

The level of support of every aspect has been rated on a scale from 1 to 5, where 1 was the lowest rating (very low support) and 5 the highest possible score (very high support).

[1] There are many websites and web portals which offer an overview of virtual team collaboration tools or project management software solutions, such as: project-management.com; capterra.com; pcmag.com; proofhub.com; techradar.com; scoro.com; thedigitalprojectmanager.com; mopinion.com; g2.com. Most of these recommend similar solutions among the top 10 project management supportive software.

Table 1.
Results of empirical research – ratings of virtual project management supportive software in the perspective of VPTs & the Three Aspects Model

No	Key capabilities & functionality / IT Tools & Software	Software price (per user/ month)	Technological aspect support			Social aspect support		Transparency aspect support		Customisation and quality of User Interface (scale of 1 to 5)	Learning curve on a scale of 1 to 5 (1 – long, 5 – short)	Final score of software solution (average score)
			Database & cloud services support rating (scale of 1 to 5)	Technical compatibility support rating (scale of 1 to 5)	Project management support rating (scale of 1 to 5)	Feedback & soft skills support rating (scale of 1 to 5)	Motivation system support rating (scale of 1 to 5)	Knowledge sharing support rating (scale of 1 to 5)	Swift communication support rating (scale of 1 to 5)			
1	Trello	Free or $12.50	2 (Low)	3 (Medium)	3 (Medium)	3 (Medium)	2 (Low)	3 (Medium)	3 (Medium)	3 (Medium)	5 (Very short)	**3.0**
2	Asana	Free or 13.49 €	4 (High)	4 (High)	5 (Very high)	5 (Very high)	3 (Medium)	4 (High)	5 (Very high)	3 (Medium)	2 (Long)	**3.9**
3	Wrike	$9.80	4 (High)	4 (High)	4 (High)	4 (High)	2 (Low)	4 (High)	4 (High)	3 (Medium)	1 (Very Long)	**3.3**
4	Basecamp	$99	4 (High)	3 (Medium)	4 (High)	3 (Medium)	3 (Medium)	3 (Medium)	5 (Very high)	3 (Medium)	2 (Long)	**3.3**
5	Monday	Free trial or $29	4 (High)	4 (High)	4 (High)	4 (High)	2 (Low)	4 (High)	5 (Very high)	4 (High)	2 (Long)	**3.7**
6	Teamwork Projects	Free or $9	3 (Medium)	3 (Medium)	3 (Medium)	3 (Medium)	2 (Low)	3 (Medium)	5 (Very high)	3 (Medium)	2 (Long)	**3.0**
7	Redmine	Free	3 (Medium)	3 (Medium)	3 (Medium)	3 (Medium)	3 (Medium)	3 (Medium)	3 (Medium)	2 (Low)	2 (Long)	**2.8**
8	Citrix Podio	Free or $9	4 (High)	3 (Medium)	3 (Medium)	4 (High)	3 (Medium)	4 (High)	4 (High)	3 (Medium)	2 (Long)	**3.3**
9	Zoho Projects	12.5 €	4 (High)	4 (High)	4 (High)	3 (Medium)	3 (Medium)	3 (Medium)	4 (High)	3 (Medium)	3 (Medium)	**3.4**
10	Microsoft Project Server	$30	3 (Medium)	2 (Low)	5 (Very high)	3 (Medium)	2 (Low)	3 (Medium)	3 (Medium)	3 (Medium)	2 (Long)	**2.9**

4.2. Research results

The analysis of available project management software solution reviews was conducted in the period of November – December 2019. The research results are presented in Table 1. All reviewers were software users (not managers or supervisors) that work at small, medium and large enterprises associated with new product development activities. The level of customisation of the user interface and learning curve were also included in the overall assessment of software features, as they were indicated as important issues among user reviews. The level of learning curve was rated on a 5-level scale of 1 to 5, where a level of 1 indicates a very long learning curve, and a level of 5 depicts a very short learning curve. Important note – the software prices presented in Table 1 were available on 16.12.2019, and they are most probably subject to change.

5. Discussion

The results indicate that most types of analysed software solutions offer a comprehensive set of features which have a positive impact on Virtual Project Management and on Virtual Project Team collaboration. Each project management software solution provides support for VPT activities, at least to some extent. Despite this, there are a few aspects and areas where they fail to do so due to lack of functionality or a high level of complexity. As shown in Table 1, Monday and Asana are the most advanced, refined and polished solutions designed for virtual teams. On the other hand, Microsoft Project Server and Redmine seem to be less suited for VPTs.

In the aspect of technological support, most tools successfully provide VPTs with a decent level of integrity and project management components. Technological compatibility allows virtual team members to use various additional tools and apps (accessories like software version tracking systems, communication workspaces or resource managers). Mobile devices and tablets are supported by almost every software solution, which enables project members to track all ongoing tasks and get feedback about current issues whenever and wherever the project member is located. Only Microsoft Project Server stands out from the rest of the solutions as it does not have sophisticated applications and functions compatible with mobile devices. However, this may be due to the specific nature of the software itself. Each solution offers a wide range of project management features, including task management, Gantt charts with detailed schedules, assignments, resources management, budged management, calendars, Kanban boards, to-do lists, workflow management, project team management and some basic components for risk management and issue tracking. The latter feature is rather limited and may still require more development by software providers, as risk analysis and risk management are quite difficult to manage in a virtual environment. Some tools like Trello or Redmine offer

a bit lesser set of project management features. Database and cloud services support is at a satisfactory level in most cases. The only exception is Trello, which is a simple Kanban-style task management tool that doesn't provide any additional functions of data transferring or cloud-related services.

Social aspect support turns out to be the most problematic area, where the majority of the assessed software solutions perform poorly or at least sufficiently. In other words, almost every software solution lacks a proper motivation system. For example, a user panel with badges, experience, abilities and description of individual skillsets would be an extraordinary feature for every virtual project member. Such individual virtual project user charters could also include developer's achievements, rewards and completed challenges from the past few months or years. Moreover, this could allow for a faster exchange of human resources among various projects that require a particular set of professional skills. Zoho, Basecamp, Citrix Podio and Asana have some of the team member motivation features, but only to a small degree or with minor functionality (usually in the form of a simple list of skills, which includes the proficiency level of every skill). In the case of feedback and soft skills, there are just a few project management software solutions that can been highlighted for having more advanced feedback-related functions or attributes, such as 1 on 1 virtual meetings or built-in virtual discussion sections, namely Asana, Wrike, Monday and Citrix Podio.

Knowledge sharing and swift communication support are the most praised and well-developed aspects of every project management software solution for VPTs. Virtually every tool offers an excellent package of communication and collaboration features, such as messengers, chats, discussion boards and panels, or even audio-video call systems. Communication is swift, effective and on demand due to mobile apps and fully-fledged desktop solutions. Only Trello, Redmine and Microsoft Project Server have limited communication capabilities. Trello lacks a decent built-in chat system among users. Redmine is an open source tool which requires complicated configuration in order to achieve a transparent environment for project's team. Lastly, Microsoft Project Server lacks advanced mobile device support and collaborative features. Knowledge sharing is rather well-developed in most cases, but some reviewers pointed out that many software solutions have limited file sharing functionality. For example, sometimes users are unable to send photos or project-related graphs including important data (these issue concerns solutions with a 'Medium' rating).

Customisation and user interface are one of the main issues of every software solution. Many users complained about the confusing design of various features, buttons or panels. Some elements of dashboards and task panels are strangely resized on different platforms and a bit puzzling to beginners. Lack of personalisation and customisation is a major problem of almost every software solution. The only exception is Monday, which has some positive reviews concerning this aspect. On the other hand, the most outdated and criticised tool is Redmine, which uses an older type of visual design. All tools have an extremely high learning curve, which means that their adaptation and proper configuration is a very difficult and demanding

challenge for VPTs. Some reviewers stated that it took them weeks to fully implement a particular solution in their company (Wrike is the hardest to learn project management software solution). The only exception is Trello, which is very easy to learn. This is mainly a result of its low complexity, as it is a simple tool for managing tasks in smaller teams.

In order to summarise the results of our project management software solution overview, on the basis of the analysed data collected from 1,500 reviews (150 reviews for every software solution) and our individual tests, we have identified 10 of the most common disadvantages that applied to almost every project management tool for VPTs – these are the following:

- Lack of features associated with motivation;
- Limited feedback functionality;
- Steep learning curve and high level of complexity;
- Low or limited customisation of features;
- Low customisation of User Interface;
- Serious performance problems;
- Lack of proper integration with other applications or software types;
- Limited mobile device support;
- Limited knowledge sharing (e.g. limited file repositories);
- Unpolished project management features (Gantt chart issues or limited resources management).

6. Conclusion

In the era of agile scrum frameworks and iterative product development, a need for better organisation of workflow has emerged, especially in software development teams. Project management software solutions allow virtual NPD teams to effectively organise their product backlog and properly manage all tasks of an IT project. These tools are also becoming the main channel of communication for a project team. This article provides a general overview of supportive project management software solutions and assesses their value in the perspective of VPTs. The Three Aspects Model of a Virtual Project Team, which consists of the Transparency Aspect, Social Aspect and Technological Aspect, was used to evaluate the supportive potential of every software solution.

Research results indicate that most software solutions provide VPTs with a vast and wide range of useful features that have a positive impact on team collaboration and project management. Unfortunately, each tool has some disadvantages and lacks functionality in particular aspects of VPTs. Most software solutions are unable to properly support motivation aspects in virtual teams. Maybe a system of gratification in the form of an individual charter

with project member's achievements, rewards, badges or individual skillsets could be an interesting solution here. However, this should not be confused with an employee evaluation card - the key aspect in this case is to motivate and satisfy the team member. Another problem is the steep learning curve of every software. Complex or highly priced software solutions are difficult and discouraging to many users. Some project management features of software solutions also seem to be limited or unpolished. Finally, the lack of demanded customisation and confusing user interface are the major issues of every project management software solution.

The study presented in this article has some limitations. First of all, this research was of a qualitative nature and took into account the subjective opinions from user reviews. Secondly, company size and the experience of the user may have a significant impact on the final assessment of a particular software solution. Another limitation was the number of selected tools which support VPTs. There are literally hundreds of tools that support virtual project management, and dozens of tools could be assessed, but a detailed evaluation of all their features could be an extremely complex research process. The results presented in this paper can be considered as a pilot study that will serve as a starting point for further research on the Three Aspects Model for VPTs.

In conclusion, more research is required in this area, especially since VPTs and IT projects are a crucial part of a very dynamic and evolving industry. Future studies should verify even higher numbers of software solutions and identify more factors which may have a significant impact on VPT collaboration. The presented Three Aspects Model is also a concept – it may be modified or extended with new elements, attributes or additional factors.

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