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From Ordinary to Virtual Teams: a Model for Measuring the Virtuality of a Teamwork

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Abstract — Virtual teams and teamwork have been researched as a group level phenomenon as well as a new emerging type of organisational form. As most of the modern teams use to some extent virtual teamwork the question raises - how to measure the degree of virtuality of the teamwork used (v-score)? The current paper presents a communication based approach model that enables to develop a typology of virtual teams by joining ordinary- and virtual teams into one model and also describing all the middle forms of teams in between those two pure types of teams.

Keywords — virtual team, ordinary team, v-score, typology of teams.

I. INTRODUCTION

A. The aim of the article

Virtual teams and management processes in them have been researched mainly theoretically. Most of these papers concentrate on presenting the definition and/or on outlining the advantages/disadvantages of virtual teams. As most of the contemporary work teams use at least some extent virtual teamwork, then the question raises – how to measure the degree of virtuality of the teamwork (how to calculate the v-score)? If there would exist such kind of framework enabling to measure the degree of virtuality then researching of virtual teams as well as management of virtual teams would be easier as this model would be bases for drawing a typology of virtual teams and at the same time would enable to distinguish ordinary- and virtual teams. Based on that suggestions how to manage & how to avoid most common mistakes in virtual team management, for managers of teams with different degrees of virtuality, could be made. The aim of this article is to present a model that enables to draw a typology of teams from pure ordinary teams (only face-to-face meeting) to pure virtual teams (never meeting face-to-face); including all the forms of teams in between these two pure forms of teams and that is possible by measuring the degree of virtuality of teamwork (v-score).

B. Background and definitions

The organizations have started to use teamwork for solving the problems and tasks mainly during the past 15 to 20 years. A *team* is a group of individuals who work interdependently for solving the problems and accomplishing tasks [1]. Relatively recent developments in the field of information- and communication technology (ICT) have enabled the organizations to start using also the so called virtual teams. Virtual teams have been defined as: "...groups of workers with unique skills, who often reside in different geographical places and who have to use for co-operation means of ICT in order to span the boundaries of time and space [1]". Use of virtual teams is a growing trend in our modern society and most of the organizations are increasingly affected by that.

The subject of virtual teams requires further research mainly due to the fact that management of ordinary- and virtual teams are substantially different. The change is required in: understanding of the group processes, manager-subordinate communication, communication among the group members (colleagues), delegation, empowerment, achieving of synergy, main functions of management *etc.* Turning ordinary teamwork fully (or at least partially) into virtual teamwork introduces a whole new range of problems for managers; and first of all there is required a clear understanding of the difference between an ordinary (mostly or only face-to-face meeting team) and a virtual team (never or rarely face-to-face meeting team). Also would be beneficial to have a model encompassing all the middle-forms of teams (described by different degree of virtuality) between those two „pure” types of teams. That kind of model would serve as bases for further analyses, what kind of managerial problems are there present in teams with different kind of degrees of virtuality.

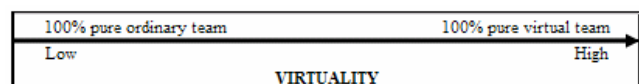


Figure 1. Level of virtuality in ordinary- and virtual teams.

Here and in the following text the *pure type of team* is used and understood as such kind of team that does not use any other elements of the other extreme type of team (see Figure 1). Pure ordinary team (or 100% ordinary team) is a team that uses for co-operation purposes only eye-to-eye meetings (without any use of ICT for co-operation). Pure virtual team (or 100% virtual team) is a team that uses for

co-operation purposes only ICT mediated communication (without any eye-to-eye meetings between the team members).

The number of published articles and books on the subject of virtual teams (and ICT mediated communication) has grown substantially during the past five years. Most of these publications deal with the issue of the definition of the virtual team [2], [3], [4], [5], [6], [7] and/or are written on outlining the similarities and differences between ordinary and virtual teams [2], [8], [9]. Second major group of works concentrates on discussion of the strengths and weaknesses of virtual teamwork in some specific area, e.g. education: challenges related to and reasons to use e-learning [10], [11], [12].

Regarding the term „virtual team” can be found many alternative options that are used to describe the same phenomena: off-site teams [8], off-site employees [13], remote teams, distance work etc. At the same time it is apparent from the context or definition, that these terms are synonyms and all mean virtual teamwork, but not in all cases pure virtual teamwork.

Some of the authors go even further and expand the virtual teamwork idea from group level to organizational level by describing virtual teamwork as a new form of organization. Lipnack, Stamps [14] and Potter *et al.* [15] state that virtual teams are the newest forms of organizations. By Lipnack and Stamps [14] the 21st century organizations are made up of virtual teams and networks of teams. Although the authors start with the statement about the birth of a new organizational form they still continue with the discussion, definition and analyses at the group level.

There is a variety of names used for virtual teams and virtual organizations (in many cases there is no clear distinction made between organizational and group level): „*spider web, modular, cluster, learning network, perpetual matrice, spinout, third-millennium group, boundaryless organization, postmodern organization, alternate office, extended enterprise, flexible manufacturing network, distributed global work team, turbo task force and autonomous work group outside existing organizational structures* [16]”. By their meaning and definition all of them can and have been used for virtual teams. Below are outlined just a few definitions used to define the virtual team:

„A virtual team is a group of people who work interdependently with a shared purpose across space, time, and organization boundaries using technology [9]”.

“Group of geographically and/or organizationally dispersed coworkers that are assembled using a combination of telecommunications and information technologies to accomplish an organizational task [17]”.

„Virtual team is a collection of task-driven members behaving as a temporary group, whose members are separated by geographic or temporal space [18]”.

„Groups of people who work closely together even though they are geographically separated and may reside in different time zones in various parts of the world.” And also “cross-functional work-groups brought together to tackle a project for a finite period of time through a combination of technologies [19]”.

As it appears from this relatively small selection of virtual team definitions there are a few reoccurring words, phrases (underlined in the definitions), that are similar in meaning and are thus the core of the virtual team phenomena. These are: shared purpose/working together, use of ICT for communication, team members are separated from each other geographically, team members work in different time zones. The first of these aspects is currently not important, as it is not specific for virtual teamwork and is a general aspect of teamwork. In this article the definition of virtual team by Henry and Hartzler [19] is used.

Different author's have different views which of those aspects to consider the most important in differentiating the virtual team from the ordinary team. Rad, Levn [20] consider it to be the geographical distance between the team members. At the same time other authors, trying to come up with a precise and important aspects' describing definition for virtual team phenomena, have come to conclusion that not the geographical distance, but use of ICT for communication between the virtual team members is the main criteria, that distinguishes virtual teams from the ordinary ones [1]. This is a logical conclusion, because if team members, who work together in the same building, but use for communication and coordination only tools of ICT (instead of meeting eye-to-eye) is a team with a high level of virtuality and the team members of that team experience the same problems and challenges as if they would be separated by a long distance. The author agrees with the reasoning that the main criteria for distinguishing virtual teams from ordinary teams is the use of ICT for communication between the team members and continues with the development of the virtual teams' typology model from that notion.

II. TYPOLOGIES OF VIRTUAL TEAMS

Before introducing the new model – overview of the work done on that field. In author's view there are only a few serious (academic, scientific) type of works attempting to offer a framework for showing that there are different types of virtual teams used, e.g. Bell, Kozlowski's [2]. Their typology is based on all the main characteristics that are outlined and considered important in the virtual team definitions by the time the article was written. Firstly Bell, Kozlowski [2] outline the differences between ordinary and virtual teams and then stress that, although usually in the papers it is assumed that there is only one ideal type of virtual teams, then actually there are used many different types of virtual teams in daily work practice. They offer four important characteristics for describing different virtual teams:

- 1) temporal distribution;
- 2) boundary spanning;
- 3) lifecycle;
- 4) member roles.

Bell, Kozlowski's contribution to the development of the typology of virtual teams is mainly to be the initiators of the discussion and research in this field. The newest and most interesting in their work is the idea that there is no one specific type of virtual team as a type of team among others, but there is the virtual team phenomena and it

appears to have many sub-types that can be described based on the four previously outlined characteristics.

Rad, Levin [20] also consider in describing virtual teams the communication aspect important, but they also point out the geographical aspect (team members' location) and subordinate status. Lipnack, Stamps [9] go beyond the communication aspect and inner processes of a virtual team and concentrate in their research on the idea that virtual teams and their networks are the newest organizational form. Figure 2 gives historical background and context for the development of virtual organizations; and the virtual organization is thus the newest of the forms.

| SMALL GROUPS | HIERARCHY | BUREAUCRACY | NETWORKS |
|-------------------------|---------------------------|-----------------------------|---------------------|
| Time → | | | |
| Nomadic society | Agricultural society | Industrial society | Information society |
| 3.million - 10,000 B.C. | 10,000 B.C - 18th century | 18th century - 20th century | 1945 - 21st century |
| Members | Levels | Purpose | Links |

Figure 2. Four ages of organizations [9].

Lipnack, Stamps [9] state that virtual organization is the future form of organizations and development trend of current organizations. And although the previous organizational forms remain, the virtual organization will be the surrounding structure of the previous organizational forms. There can be noticed two alternative directions in development of the typology of virtual teams:

- a) internal processes related typologies;
- b) form, structure related typologies.

Internal processes related typologies are based on the specifics of virtual teamwork (or on differences compared to ordinary teamwork), like Bell, Kozlowski [2] propose – boundary spanning, member roles etc. Although not a typology, but more of a test approach, using virtual team continuum, to find out employees attitudes towards virtual teams [24]; can also be seen as a start towards creating a typology of virtual teams by describing inter-organizational processes. Form, structure related typologies (e.g. Lipnack, Stamps) are based on the idea that organizational structure needs to be analyzed and that the virtual team or networks of them are a new organizational form. The model described next is based on the analyses of internal processes of virtual teamwork.

III. A MODEL FOR MEASURING THE VIRTUALITY OF THE TEAMWORK

All the previously outlined typologies of virtual teams start with the assumption that there are pure ordinary teams and pure virtual teams used in daily work practice and continue from there with the sub-types of virtual teams. None of these typologies tie together ordinary and virtual teams into one model enabling to outline all the middle forms in between those two pure types of teams. This can be done by using virtuality of the teamwork as the main characteristic of the teamwork used and in this case the

degree of virtuality can vary from 0% (pure ordinary team) to 100% (pure virtual team). Figure 1 illustrates the idea graphically.

It must be agreed that, it is very senseless and unrealistic to try to distinguish only the pure types of teams, as it is mostly only theoretical construction that enables it [1]. In real life, in daily work practices, all the teamwork used can be described by the characteristic of virtuality. Naturally, in the one end of the scale remain the teams that do not use any virtual teamwork elements for coordination of work. To the other end of the scale remain relatively smaller group of teams that use only virtual teamwork; but most probably the trend is in the direction of growth in that end of the scale, as well as in the middle. And the biggest amount of teams remains in the middle of the scale [21], [22] and can be described by some certain degree of virtuality. Much information could be obtained about modern teamwork reality, if research would be conducted about how much virtual teamwork is used by organizations in teamwork situations. Fortunately, in recent years also empirical research in this field is emerging. Beneficial for that kind of research would be a model, which describes the middle-forms of teams in between the two pure types of teams (basically the degree of virtuality can be used for showing how ordinary team becomes gradually a virtual one).

As the most crucial aspect that distinguishes virtual teams from ordinary teams is use of ICT for communication, then it is important to analyze more in detail the communication aspect of virtual teamwork. In the current (virtual)teamwork model communication is described using three dimensions:

- Richness of the communication channel;
- Time spent on communication;
- Frequency of communication.

Nowadays people use for communication very many different channels of communication (see Figure 3) and some of them are rich channels enabling to see the other person/people, hear the voice, observe the body language *etc.* At the other extreme of communication channels are the poor communication channels that do not permit the

previously outlined benefits. Due to different reasons in many cases members of the virtual team use a lot of relatively poor communication channels (or at least much less rich than ordinary team members who mostly use eye-to-eye meetings).

| Richness of the communication channel | | | | | | | |
|---------------------------------------|---------------------|-------|--------|-----------------------|-------|--------------------|--------------------|
| Poor channel | | | | Rich channel | | | |
| Official written report | Memo, ordinary mail | Forum | E-mail | On-line communication | Phone | Web-camera + phone | Meeting eye-to-eye |

Figure 3. Richness of the different channels of communication [23], with author's additions.

Time spent on communication is also an important aspect that needs to be used in the model as the degree of virtuality of the teamwork is different when the virtual team members communicate e.g. once a month for 10 minutes using a web camera compared to an other virtual team that is constantly (24h) connected by web camera.

Frequency of communication shows how often the means of ICT are used for communicating with the other team members. The degree of virtuality is different when the team members change an e-mail once a month or once a day. Thus the degree of virtuality can be calculated based on the following equation (see Figure 4).

$$\text{TIME} * \text{RICHNESS} * \text{FREQUENCY} \\ = \text{SCORE OF VIRTUALITY (V-score)}$$

Figure 4. Equation for the score of virtuality.

Basically the new model is 3-dimensional, where each dimension is measuring one aspect of virtuality. If all three scales are constructed with the variation maximum up to 4, then there would be formed a cube that is made up of 64 smaller cubes. Later, in the empirical testing phase, these smaller cubes would be associated with the different types of (virtual)teams; in the theoretical framework these symbolize the different types of teams with different degrees of virtuality (see Figure 5).

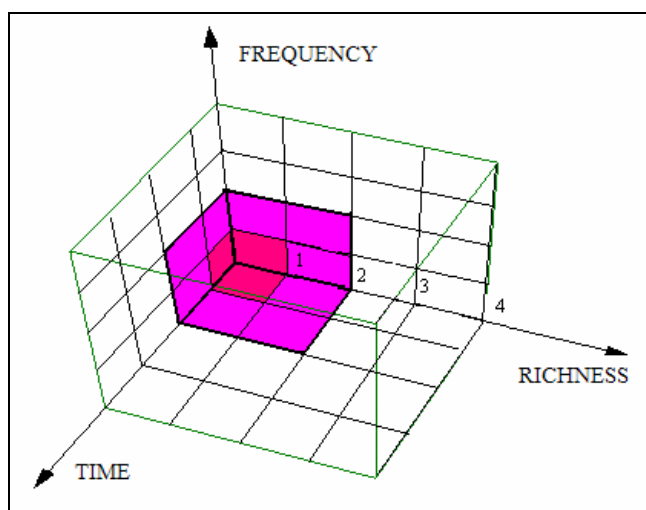


Figure 5. Model for measuring the virtuality of the teamwork.

The highest degree of virtuality has the cube (the pure type of virtual team), that is situated in the contact/start point of the dimensions. In this case the cube would have the smallest V-score. At the other end of the biggest cubes' diagonal are situated the ordinary type of teams and the pure ordinary team would have the biggest v-score, maximum 64. Thus the v-score vary from 0 to 64 points. Dividing scales into four should be numerically enough to describe all middle-forms in between the two pure types of teams.

The model also enables to draw a line between ordinary and virtual teams: the line bisects all the three dimensions in the middle, at the value of 2 (the 50% margin in case of the max value of 4). Thus there forms around the most virtual cube, in addition a group of 7 cubes and all together they form a cube of 8 sub-cubes. This is the bases for the typology of virtual teams in the context of this model, as these 8 are with the highest degree of virtuality. Stemming from that, there is possibility to outline 8 different types of virtual teams.

In the daily work practice the degree of virtuality of the teamwork varies in the different stages of the work process. The difference stems from the fact that the team members during the team formation stage, formulating the goal and distribution of tasks and roles (in the first phases of group processes) can choose to meet eye-to-eye much more often than during the other, later phases. The same applies in many cases to the final phase of work – eye-to-eye meetings, e.g. to finalize the groups' collective report of work or for giving direct feedback of the reasons of (un)success of the teamwork or for celebrating the end of the project. Thus the v-score calculated is not a constant, but rather a variable that differs in time and the teamwork's degree of virtuality can, and most probably does, vary in different phases of work. This is an important aspect regarding the planned pilot-testing of the model and in the future research in that field.

The model has 2 goals, options for use:

- 1) the model enables to measure the degree of virtuality of different teams;
- 2) the model enables to classify teams – from pure ordinary teams to pure virtual teams and all the middle-forms in between, using the v-score.

First of the goals is more practical in approach, as the measuring itself can not be the goal, the next step after that would be to associate different problems of virtual teamwork (e.g. managerial, communication, empowerment, decision making, the most suitable leadership style etc.) with different degrees of virtuality. This enables later to inform managers and members of teams with different degrees of virtuality, what are the major problems related to that type of virtual team and make suggestions how to prevent them. The second goal is more of theoretical value.

There is being constructed a questionnaire based on the model for testing the idea introduced in this article. After gathering empirical data the v-scores can be calculated and possible other forms of equation developed and the model itself can be re-constructed, if needed. Based on the v-score the researched teams can be then classified under a specific type of team. After the questionnaire based research, is planned case study based approach and interviews with the team members and managers of different types of teams. This enables to find out more in detail the (management) specifics and main problem areas of the specific types of teams. Starting with the 8 types of teams with the highest degree of virtuality; the results of the research enable then to outline the specifics of each type of virtual teams, name the types of the teams and also rank the main problem areas.

IV. CONCLUSIONS

The virtual team term is being used very frequently, but its definition varies relatively lot. The most common assumption appears to be that virtual teamwork requires use of ICT and that there is a big distance between the virtual team members. It is concluded in the article that the use of ICT for communication is the most important characteristic for describing a virtual team.

There can be found relatively many articles describing the difference between an ordinary and a virtual team. There is still very few typologies developed describing different virtual teams. The current typologies of virtual teams tend to describe the virtual team either based on internal characteristics (member roles, boundary spanning etc.) or based on external characteristics. The authors of the last ones are convinced that virtual teams and their networks are the newest form of organizational structure.

The new model described in the article enables to measure the score of virtuality for all types of teams. It can also be used to develop typology of virtual teams that includes ordinary teams. The model is based on communication analyses and defines virtuality using three scales: richness of communication, time spent on interaction with the team members and frequency of communication with the team members. The model is yet not empirically tested, thus it is new in its approach to virtuality and may have to be revised after the empirical data is used for testing.

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