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RECORDING VIRTUAL TEAMS USING THE SYSTEM OF ORGANIZATIONAL TERMS FOR ARTIFICIAL MANAGEMENT IMPLEMENTATION. RESEARCH RESULTS

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Abstract

The paper describes the potential of artificial management in virtual teams, focusing on how AI can replicate managerial actions typically performed by human team leaders and members. The research is driven by two main questions: (1) What theoretical framework should be used to document managerial actions? and (2) What tools can effectively measure and build knowledge about these actions? Methodology The study adopts a qualitative case study approach, supported by a long-term non-participant observation of a virtual team consisting of a manager and three members. It applies the system of organizational terms, rooted in Wittgenstein's philosophy, to record team behaviors. Data were collected using TransistorsHead.com – 10 online management tools that tracks the sequence and outcomes of team actions over time. Findings.The system of organizational terms successfully identified and categorized specific managerial actions. TransistorsHead.com enabled real-time tracking and visualization of team dynamics across 10

categories of managerial actions. The study confirmed the feasibility of capturing complex human patterns of behavior aimed at artificial management implementation. Conclusion The research demonstrates that managerial behaviors in virtual teams can be systematically recorded and analyzed. These findings are the foundations for implementing artificial management systems capable of autonomously performing core team actions.

Keywords:
System of Organizational Terms, Artificial Management, Artificial Intelligence, Virtual Teams

1. Introduction

Firstly, in the last years virtual teams emerged in organizations, closely linked to the acceleration of business processes and the rise of innovation (Lipnack & Stamps, 2000; Fuller, Hardin & Davison, 2006). Such teams are also common in organizations that engage specialists in research design, data collection, and analysis (Engerer, 2019). The prevalence of virtual teams increased significantly during the COVID-19 pandemic when they became essential in response to employee isolation, marking a defining feature of the organizational landscape at that time (Forst & Duan, 2020).

Secondly, artificial intelligence (AI) is increasing its potential to augment human capabilities in teamwork (Flak & Pyszka, 2022). Research on AI suggests that it can enhance human teams by improving coordination, increasing knowledge sharing and learning, supporting decision-making processes, and assisting in team performance evaluation (Khakurel & Blomqvist, 2022). Furthermore, the integration of language models has led to the widespread adoption of AI-based tools such as ChatGPT across various industries, significantly boosting productivity (Bouschery, Blazevic & Piller, 2023).

Therefore, the prospect of virtual teams led by an artificial manager raises series of research questions that contribute to the broader study of virtual teamwork composed partly or entirely of AI-driven agents. The main research problem, however, remains unchanged and focuses on finding an answer to the question of what a manager and their team members actually do (Flak & Kożusznik, 2023). Only based on this answer artificial management in virtual teams can be implemented (Flak, 2024).

This paper aims to provide insights into two of research questions derived from the research problem:

- RQ1: What theoretical foundations should be used to record the managerial actions of the manager and team members?
- RQ2: What measurement tools should be used to build knowledge about the managerial actions undertaken by the manager and team members?

Section 2 presents the theoretical foundations of virtual teams and artificial management. Section 3 outlines the theoretical assumptions for recording the behavior of a human manager and team members to obtain data for activating artificial managerial actions. Section 4

also describes selected results of the long-term non-participant observation on virtual teamwork. Section 5 contains main conclusions in order to apply artificial management in virtual teams.

2. Theoretical Background of Research

2.1 Virtual Teams

A virtual team is defined as a group of individuals who do not share the same geographic, organizational, or temporal location but collaborate through information and communication technologies (ICT) to accomplish one or more organizational tasks (Powel, Piccoli & Ives, 2004; Kożusznik, Pollak & Chrupała-Pniak, 2020). The extent of technological use determines the level of virtuality within such a team, ranging from semi-virtual to fully virtual (Griffith, Meader, Kirkma & Mathieu, 2005; Hertel, Konradt & Voss, 2006; Lonnblad & Vartiainen, 2012). Another defining characteristic of virtual teams is their temporal nature, as their duration depends on organizational needs and the individual motivations of their members (Gassmann & Von Zedtwitz, 2003). Consequently, tasks became more cognitively demanding, given the greater reliance on technology, task diversity, and knowledge-based work (Parker & Wall, 2001).

The pandemic accelerated the adoption of virtual teamwork, enabling employees to collaborate remotely using digital tools (Feitosa & Salas, 2020). These transformations were accompanied by increased uncertainty due to growing variability and complexity in work processes.

Research on virtual teams has increasingly focused on key aspects of teamwork and group dynamics in digital environments. Team collaboration in virtual settings involves measurable outcomes such as customer satisfaction, task completion time, and operational costs (Pyszka, 2015). However, the emphasis extends beyond achieving goals to include the methods by which teamwork is conducted, highlighting the interdependence among team members in executing tasks and attaining results (Morrison Smith & Ruiz, 2020). The functioning of virtual teams can be analyzed from three perspectives: (a) a systemic approach, focusing on input-output relationships in group processes, (b) an organizational approach, where performance is assessed based on resource utilization and goal achievement, and (c) a factorial approach, which considers both quantitative and qualitative factors, where quantitative analysis pertains to performance and qualitative analysis examines team dynamics (Talebnia & Dehkardi, 2012).

The most crucial factors influencing successful teamwork in virtual settings are associated with team members' characteristics, including technical competence, cognitive skills, conscientiousness, integrity, communication abilities, willingness to cooperate, amicability, emotional stability, self-organization, trust, and cultural acceptance (Hertel, Konradt & Voss, 2006; Kożusznik, Polak & Chrupała-Pniak, 2020).

In the current era of artificial intelligence development and the replacement of certain functions in virtual teams with AI agents, research on the activities undertaken by managers and team members is more important than ever. Especially when considering the goal of replacing a human manager with an artificial manager, in line with the concept of artificial management.

2.2 Artificial management

The concept of artificial management first emerged in discussions envisioning a future where "computers" would extend beyond decision-making to encompass a broader range of managerial functions (Drucker, 1967). In exploring the feasibility of substituting human team managers with IT systems, the terms "artificial management" and "artificial manager" were introduced (Geisler, 1986). Initially, artificial management and its operational application in the form of an artificial manager were perceived as an attempt to remove human managers from organizational processes, thereby dehumanizing management. Consequently, most scholars restricted artificial management applications to organizational decision-making frameworks or well-structured operational tasks (Pomerol, 1997; Courtney, 2001; Gigerenzer & Gaissmaier, 2011). This led to the necessity of defining systematic patterns of managerial work and focusing on automated decision-making (Zimmermanna, Schmidtb, Sandkuhlc & Jugela, 2019).

However, the role of artificial intelligence (AI) in managerial functions has significantly expanded, increasingly permeating various areas of team management. AI is progressively recognized as a potential tool for enhancing teamwork in professional settings. Nevertheless, its practical implementation remains relatively nascent and underdeveloped, limiting the widespread integration of AI in optimizing team dynamics (Webber, Detjen, MacLean & Thomas, 2019). Emerging technologies such as robotics, automation, and intelligent assistance are reshaping corporate structures, necessitating the reconfiguration of team management, especially in virtual environments (Franken & Wattenberg, 2019).

The automation of managerial actions is often interpreted as the gradual replacement of human managers with algorithm-driven systems in specific areas of team oversight. As a result, numerous organizational processes are now entirely governed by AI technologies (Petrin, 2019). AI systems have assumed managerial responsibilities such as task allocation, performance evaluation, and team composition (Jarrahi, Sutherland, Nelson & Sawyer, 2019). Some scholars argue that AI-based technologies possess the potential to encompass the full spectrum of managerial responsibilities traditionally executed by highly skilled human managers (Susskind & Susskind, 2015). This shift introduces both opportunities and challenges in workplace management, particularly concerning the collaboration between AI managers and human team members.

Artificial management presents both opportunities and challenges in the realm of teamwork. While AI-based management can streamline specific managerial functions, its impact on planning, creativity, motivation, and problem-solving remains a subject of ongoing investigation (Wong, Lian & Sun, 2023). Understanding the limitations and potential of artificial management is crucial for effectively integrating AI into team dynamics and ensuring productive collaboration between human and AI-driven managerial systems. However, for AI technology to be fully utilized in building virtual teams composed of AI agents, it is essential to develop knowledge about what a manager and their team members actually do.

3. Theoretical Background of Research

The answer to the first research question mentioned in Introduction is an original research methodology for recording team management - namely, the system of organizational terms, which has been developed and rigorously tested in recent years (Flak, 2018; Yang, Flak & Grzegorzek, 2018; Flak, 2019; Flak, 2024). This methodological approach enables the sequential documentation of managerial actions, facilitating an understanding of the precise actions undertaken by both team managers and their team members (Sinar & Paese, 2016). The theoretical foundation of the system of organizational terms is rooted in Wittgenstein's philosophy, particularly his conceptualization of facts as the sole entities in the world and "states of facts" as their structural arrangements (Brink & Rewitzky, 2002). It contains primary organizational terms (possible to record by the online management tools – in green circle in Figure 1) and derivative organizational terms.

Within this framework, team management is structured around events and objects. Each event and object is labeled with the notation n.m, where n denotes a specific element, and m represents its version. The process unfolds as follows: event 1.1 initiates object 1.1, which subsequently triggers event 2.1, leading to the formation of object 2.1. Concurrently, object 1.1 instigates event 3.1, resulting in the emergence of object 3.1. This sequence ultimately generates a new iteration of the initial event - event 1.2 - thereby producing an updated version of the original object, designated as object 1.2. Consequently, managerial action structures can be delineated through sequences such as event 1.1 and object 1.1. As depicted in Figure 1, the comparative analysis of goal 1.2 and goal 1.1 highlights key differences that enable inferential reasoning about the team management process (Flak, 2018).

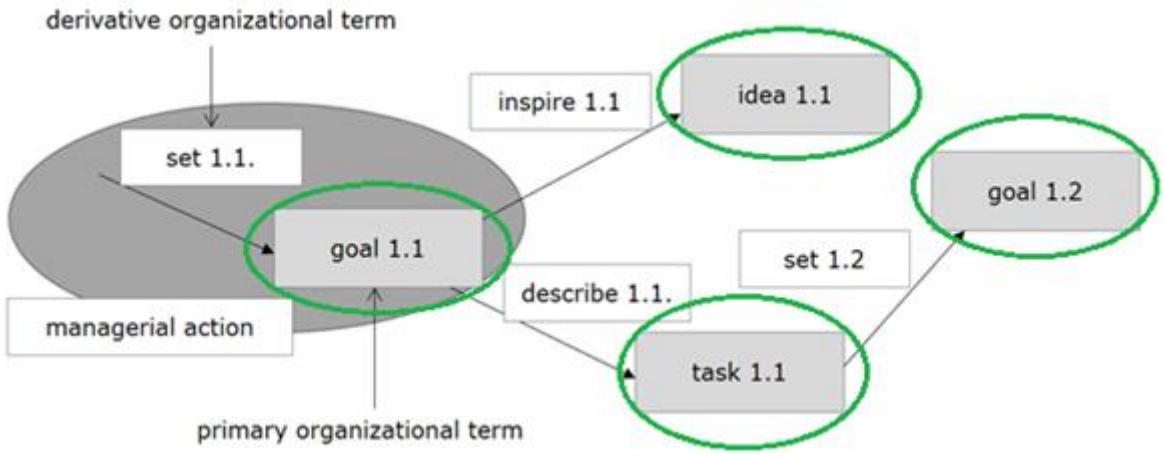

Figure 1: *Structure of team management*

The answer to the second research question mentioned in Introduction is a set of online management tools, exemplified by TransistorsHead.com, which serves as an interactive dashboard (see Figure 2). This system systematically records parameters of managerial actions, with their outcomes denoted by green circles (see Figure 1 - e.g., goal 1.1 as the result of set 1.1). By capturing transitions in team management dynamics, TransistorsHead.com functions are able to record of teamwork, preserving snapshots of the defining features of team management processes. The collected data, when combined with pattern recognition techniques and machine learning algorithms, will create a knowledge system on managerial actions of human managers and members of virtual teams ready to use as artificial management. This approach represents a

pioneering fusion of self-learning research tools and machine learning technologies, designed to replicate and model the fundamental managerial actions commonly exhibited by human managers.

Figure 2: *Dashboard of online management tools*

4. Results of research

To illustrate the usefulness of the system of organizational variables and online management tools for recording managerial actions in a virtual team, the results of one of the studies conducted by the author using the non-participant longitudinal observation method are presented below.

The study took place between December 14, 2022, and January 14, 2023, involving students from the Management Faculty at Jan Kochanowski University in Kielce, Poland. A total of 26 participants were divided into five groups.

As part of a long-term observation, participants were tasked with documenting a program project for a YouTube channel in a Talent Show format. Their assignment included identifying an organizational challenge and developing a solution - creating a detailed format for the program and planning its execution.

To complete the task, participants utilized 10 online management tools available on the TransistorsHead.com platform, as illustrated in Figure 2 and explained in Section 3.

This paper presents a case study of one particular team, which consisted of a team manager and three additional members. The online management tools implemented on the research platform TransistorsHead.com recorded the entire team's work throughout the project's duration.

Data were collected in both the time domain and the content domain. Below, histograms of the manager's and virtual team members' work are presented. Such a study enables the development of knowledge about the sequence and content of managerial actions in the work of virtual teams, which can be directly applied to the implementation of artificial management - for example, in the form of automatically executed managerial actions by an information system.

Figures 3, 4, 5, and 6 show different trajectory of 10 managerial actions, recorded by 10 managerial tools in TransistorsHead.com in team work period. Numbers in types of managerial actions mean: 0 – no managerial action, 1 – set goals, 2 – describe tasks, 3 – generating ideas, 4 – specifying ideas, 5 – creating option s, 6 – choosing options, 7 – checking motivation, 8 – solving conflicts, 9 – preparing meetings, 10 – explaining problems.

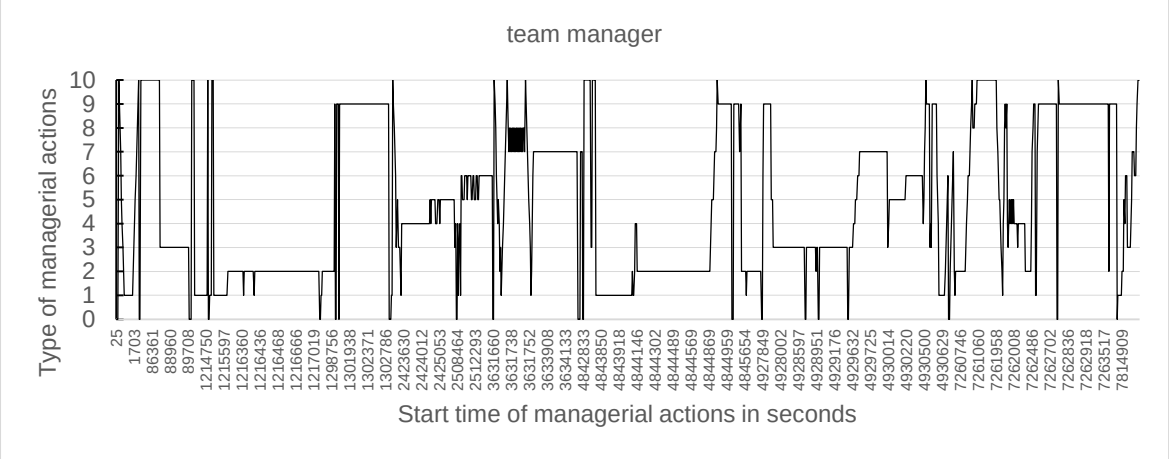

Figure 3: *Trajectory of 10 managerial actions taken by a team manager*

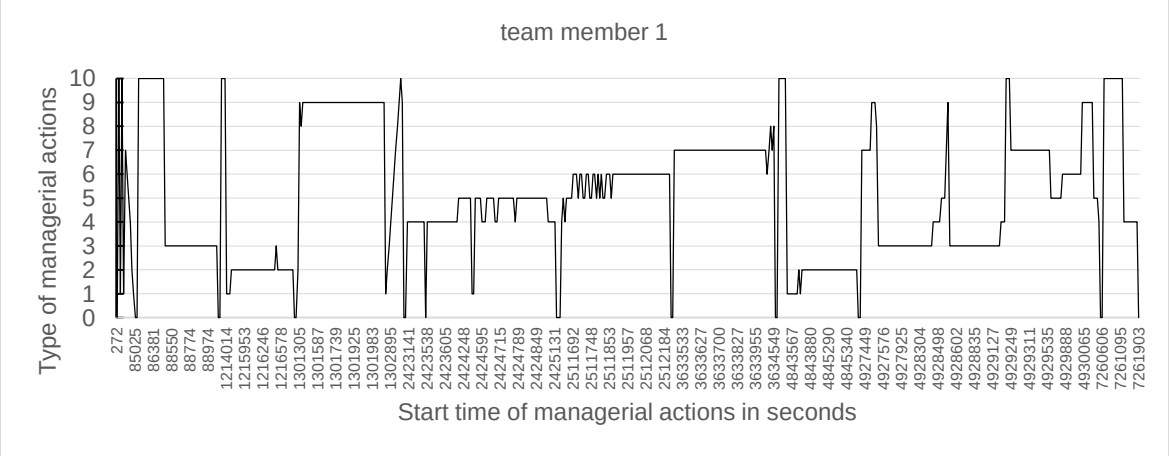

Figure 4: *Trajectory of 10 managerial actions taken by a team member 1*

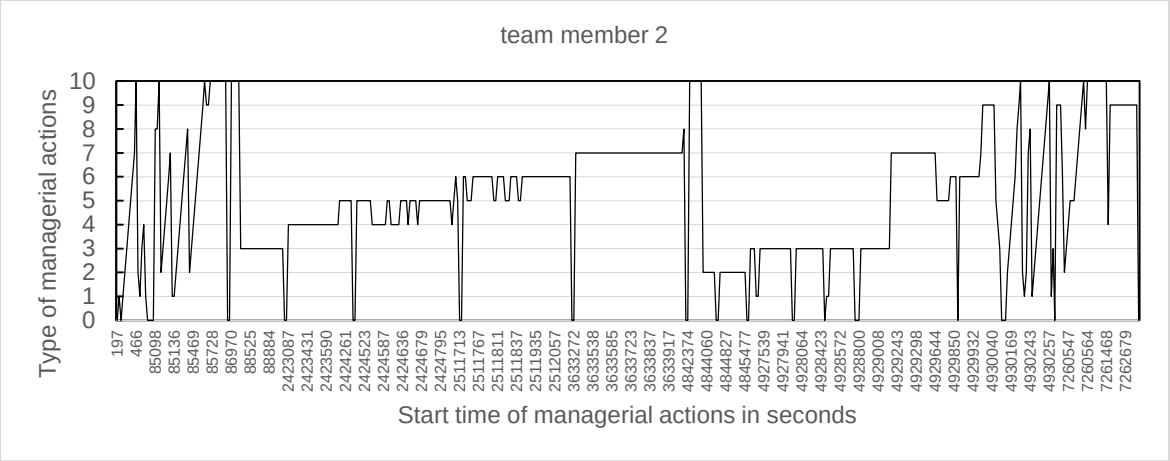

Figure 5: *Trajectory of 10 managerial actions taken by a team member 2*

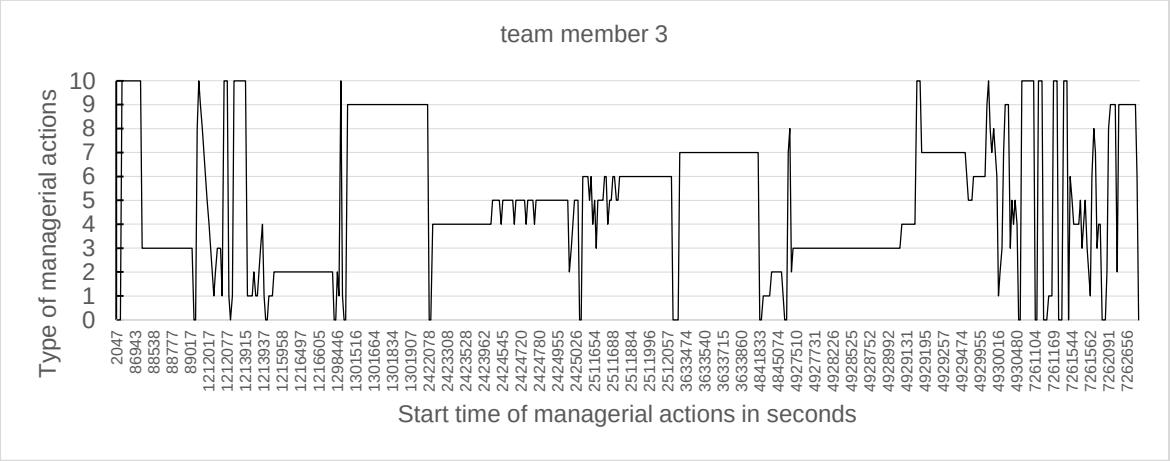

Figure 6: *Trajectory of 10 managerial actions taken by a team member 3*

5. Conclusions

This paper aims to examine the use of online management tools as research instruments facilitating the implementation of artificial managers as a substitute for human managers. The development of managerial tools within the framework of organizational concepts is based on the premise that there is a strong correlation between the meaning attributed to a given phenomenon within an organization and the metric measured by the assessment tool, which simultaneously functions as a managerial tool.

The managerial tool collects data on the actions undertaken by managers or other organizational members, assuming all other conditions remain constant (ceteris paribus) (Flak, 2018). As discussed in Section 3, this tool enables the identification of where and when it was used, who utilized it, what resources were generated at different stages of its application, and how the process it was employed for was executed. Examining these parameters is essential for detecting behavioral patterns that could inform the implementation of an artificial manager.

The rapid advancement of technology compels companies to adapt swiftly to change while highlighting the role of teams in driving innovation adoption. It is anticipated that human virtual teams may evolve into artificial virtual teams supported by artificial intelligence along two primary trajectories.

The first, vertical evolution pathway involves a shift from virtual teams led by a manager to self-managed virtual teams. The second, horizontal evolution pathway refers to the transition from entirely human virtual teams to fully artificial virtual teams (Flak & Pyszka, 2022). Both trajectories present promising avenues for future research.

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