Workstream and Board-based Collaborative Work Management Tools to Analyze and Improve Productivity at Work

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Abstract

Data and software are currently changing and growing by leaps and bounds. Consequently, the way we used to understand the world until now has radically changed. Many authors know this era of change and exponential growth that we are living in as the 4th Industrial Revolution.

It is a context characterized by volatility, uncertainty, complexity and ambiguity, among many other problems, known as a VUCA environment. This situation worsens work performance, preventing workers from maintaining a high level of productivity. These problems affect knowledge workers in many different ways in their day-to-day work, as has been studied in [1], getting an ordered taxonomy of fourteen challenges that negatively affect productivity.

On the other hand, Workstream Collaborative Work Management Tools (WSCTs in advance), as Slacks or Teams (i.e.), are one of the most trending software applications nowadays. The flexibility they offer and their different and powerful features make them one of the best techniques to deal with the problems arising from the VUCA context. In particular, we have already deepened one of these possible solutions in order to improve working performance in these environments in [2]. In this case, we focused on board-based collaborative work management tools (BBTs in advance) as Trello or Planner (i.e.), defining eight design patterns for boards of these tools.

This PhD Project seeks a twofold contribution, aligned with the two above cited works. First, we want to extend the analysis of the challenges that negatively affect productivity at knowledge work, understanding their causes, relationships between them and the impact of each one, based on [1]. We will use WSCTs for that purpose, focusing on the four most important productivity challenges and their solutions. Secondly, in particular, we will focus and delve into the study of BBTs, analyzing how are they used and making its use help improve productivity (defining how to do it). In this way, we want to study if better use of BBTs leads to better productivity, how much it improves it and how it improves it (which problems it solves or mitigates).

Keywords

Kanban, workstream collaboration tools, productivity, digital transformation

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1. Introduction

Current business work has been characterized as volatile, uncertain, complex, and ambiguous world since some years ago. This is known as a VUCA context, taking the acronym of each of the previous adjectives. One of the context in which these problems increase the most are digital transformation context. In these two contexts (VUCA and Digitalization environments) there are some software tools that have become very popular for managing knowledge work: Workstream Collaboration Tools (WSCTs).

Although productivity has been widely studied by many authors as Drucker [3], Davenport [4], Bosch-Sijtsema [5], or Palvalin [6], to the best of our knowledge, it has not been deeply studied in this particular context of VUCA, digital transformation and knowledge work at the same time. As proof of this, in an initial work of my research group [1], the 14 challenges that most negatively affect productivity in these environments were discovered and characterized together. In addition, there was a review of the solutions to these challenges, according to the existing literature. Unfortunately, the combined impact of these solutions has not been studied together (analyzing them in isolation for each challenge).

In this work we will focus on the conjuction of the three previously cited areas: VUCA context, knowledge work in digitalization processes and productivity, as represented in Figure 1. To do so, we will delve into the study of the four most frequent challenges detected in the above cited work [1]. For this, we will work in two main blocks: first we will analyze the combined impact of using WSCTs to solve or mitigate the four most frequent challenges. Secondly, given that the main solutions for challenge 3 and 4 implies the use of BBTs, we will study how they are used, how their use can be improved and how its use impact on the challenges.

The rest of this document is organized as follows: next we will present the Research Questions that we will address during the PhD Project, in Section 2. Later we will sketch the Research Plan that we will follow in this PhD Project, and we will resume our Current Results in Section 3. We will finish the document with the conclusions in Section 4 and the References.

2. Research Questions

All the project summary described above could be outlined around the following Research Questions that structure the whole PhD Project in the context of digitalization knowledge work in VUCA environments:

- RQ1: What are the relationships between the four most frequent productivity challenges? What is the impact of having them together? Are there common solutions for them using WSCTs?
- RQ2: Are design patterns for BBTs useful in practice? What are their benefits and their impact of use in terms of efficiency and effectiveness? Are they useful to solve or mitigate organisational coordination and planning/task management challenges?
- RQ3: Is it possible to automate the board design process including the knowledge of our eight design patterns? Does it have practical benefits?
- RQ4: Can we infer knowledge from the traces of use of the boards? Is there relationship between their use and their expected theoretical knowledge?

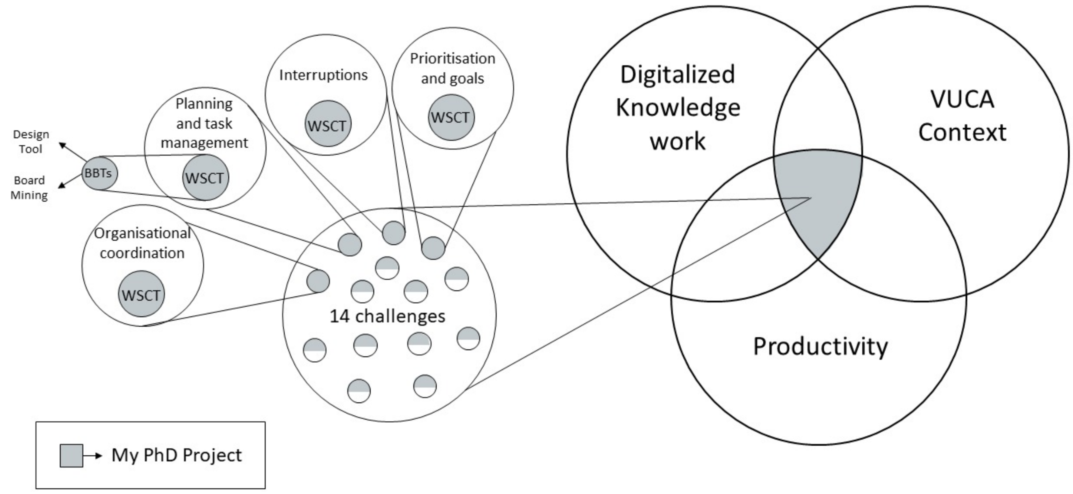

Figure 1: Diagram of the expected scope of my PhD Project.

3. Research Plan and Current Results

We have studied yet some of the problems that negatively affect the work productivity, in [1], conducting a study with more than 350 knowledge workers from three different sectors: retail, commodities, and manufacturing, immersed in digital transformation processes in all three cases. The questions that give rise to the 14 challenges of Table 1 were carefully selected to try to cover the concept of productivity from as many points of view as possible. As detailed in Related Work section of [1], to carry out that work we studied the factors that affect knowledge worker's productivity from many different authors cited above. From this large pool of factors that affect productivity, we focus on those that negatively affect work productivity, which are the object of our research, taking a common factor from the definitions of the cited authors. As result, we characterized up to 14 different challenges that negatively affect a good working performance, which are collected in Table 1.

In [1], the challenges arise from the perception that the worker himself has about each challenge, collecting their answers by survey. In particular, the most important question, because it is the backbone of that study, was an open-ended question that provided qualitative data. Namely: *"What are your main problems/improvement points when it comes to being productive and managing your time better?''*. However, in the cited survey the workers were asked about a same challenge from many different points of view, with questions such as if the challenge can be resolved by the worker or if he/she needs the help of his/her boss or company, how much of the problem do he/she think corresponds to him/her as a worker and how much to his/her boss or company, what does he/she think would be the expected impact of introducing a technique to solve a challenge.

For the analysis performed in [1], we only used a very reduced subset of all the available data of those workers (only the cited question about the perceived level of each challenge). For this reason, in this PhD Project, we plan to exploit the remaining and unused data (the other cited quesions), in order to analyze the relationships between the previously cited challenges or between the different productivity factors. We also want to study and compare their combined impact against the work productivity. In particular, we will focus on the four most frequent challenges.

Challenge	Frequency
Interruptions	121
Prioritisation/goals	88
Organisational coordination	67
Planning/task management	57
Work overload	34
Lack of knowledge or training	25
Email management	21
Volatility	21
Concentration/focus	17
Bureaucracy	17
Meetings	15
Software	14
Motivation	13
Information overload	12

Table 1
Challenges that negatively affect a good working performance, discovered in [1].

In addition, besides analyzing the previously cited problems itself, in section 6 of [1] (6. Implications for WSCTs) there are collected many possible solutions to these challenges, using WSCTs, according to the related literature. In that section there is sketched how its use could mitigate, reduce or even solve the previously cited problems (e.g. speech detection sensor data, location information, computer activity, and calendar information to solve Interruptions and Concentration/Focus challenges [7], or topic-based communication channels instead of one email single inbox, which facilitates knowledge management, in order to solve Email Management and Lack of Knowledge challenges [8]).

In [1] these solutions are sketched isolating the challenges, not considering them together. For this reason, in this PhD we will empirically analyze the relationships and impact of the . As proposed in [1], Board-based.

In this PhD Project, we aim to empirically analyze the impact of using the WSCTs and measure how productivity is expected to be enhanced, applying in practice some of the solutions proposed in [1]. During this PhD Project, we plan to conduct a controlled empirical experiment to do so, in which we will compare the intensity level of a challenge with (experimental group) and without (control group) the corresponding solution using a WSCT (or measuring the intensity of the challenge before and after applying the solution). We plan to carry out this experiment to analyze the four most frequent productivity challenges, namely: interruptions, prioritisation and goals, organizational coordination and planning and task management, as represented in

Figure 1. We want to study if there are statistically significant differences in the intensity of these four challenges after applying the corresponding solutions using WSCT (whether the intensity of the challenge decreases). Likewise, we will check if the changes produced by a solution or technique only affect the related challenge, or if it also affects other challenges (and see if it affects positively or negatively).

On the other hand, in [2] we have already focused on one of those possible solutions and one specific WSCT: the board-based collaborative work management tools (BBTs). These tools are quite related with the fourth challenge (planning and task management), as they are mostly used for that purpose. In the cited article, we defined a set of eight different design patterns, as eight different structures and ways of using these software tools, which is summarized in Table 2. This split is based on the metamodel of [2], shown in Figure 2.

Pattern	Card type	Sem. prec.	Card flow	Examples
Information Lifecycle	Info	Yes	Yes	A publication lifecycle
Ordered Information	Info	Yes	No	A course syllabus or a recipe
Kanban	Tasks	Yes	Yes	Scrum
Process Tasks	Tasks	Yes	No	Waterfall engineering process
Assigned Information	Info	No	Yes	Employees assigned to their departments
Categorized Information	Info	No	No	Notes classified by category or by topic
Assigned Tasks	Tasks	No	Yes	Tasks assigned to workers or groups of workers
Categorized Tasks	Tasks	No	No	To-do lists organized by topic

Table 2
Design patterns for WSCTs as defined in [2].

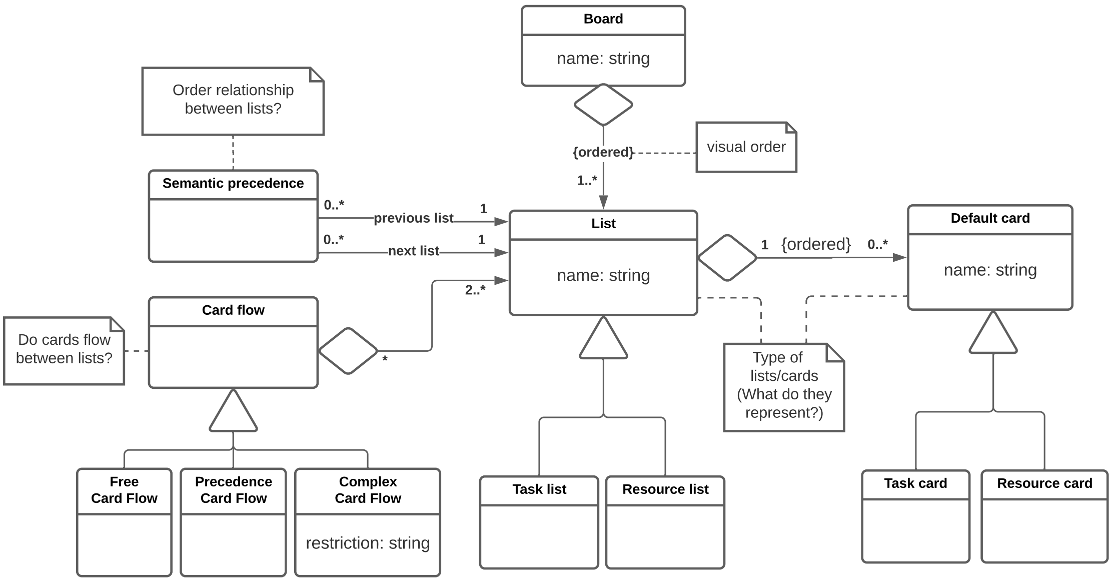

Figure 2: A metamodel for board designs, as defined in [2].

We believe that the theoretical knowledge of this work should suppose a substantial benefit in its use, reducing design errors, reducing the time spent on that design, allowing its reuse, and improving the performance of use of these applications. One of the goals of this PhD Project is to check whether these potential benefits are met in practice by conducting several controlled empirical studies, as detailed below.

As a brief summary of Figure 2 and Table 2, all boards have an implicit design that can be captured by the board design metamodel introduced in [2]. This metamodel allows one to represent both the structure of the board and its dynamic use. The former comprises of the board, its set of lists and, possibly a set of default cards. However, a board design is not only its static structure. Boards have an implicit or explicit set of rules collected in natural language about their semantics and how they should be used. The board design metamodel identifies three elements that characterize how the board must be used: the *type of cards*, the *semantic precedence* and the *card flow*.

The first one determines the board's content, distinguishing between cards representing tasks and those representing information or resources. The *semantic precedence* specifies that there is some high-level connection between two lists in the board besides their visual representation. For example, we can have an order relationship between the phases of a project (requirements before execution), the states of a task lifecycle (doing before done), or just temporal order (day 1 before day 2). Having an order relationship between two lists does not mean that cards can be moved between them. For instance, when lists represent phases of a project and cards represent specific tasks for each phase. In this case, there is a semantic relationship between lists, but cards do not move between them. Therefore, we need a third element, *card flow*, to specify the set of lists between which cards can be moved. The meaning of a card flowing between lists depends on the specific board. For instance, a board in which lists represent people and cards are tasks, moving a card from one list to another means assigning a task to another person. Instead, a board in which lists represent states and cards are resources, moving a card from one list to another means changing the state of the resource. Attending to how the *type of cards*, the *semantic precedence* and the *card flow* are used, it is possible to define eight board design patterns (cf. Table 2) that determine different ways of using the board [2].

In this PhD Project, we want to test that benefits in practice, studying the applicability of the design patterns for BBTs defined in [2]. First, we need to analyze their practical usefulness, ensuring that they are more than just a theory. To do so, we have already conducted an empirical experiment in order to compare designs and board solutions made with and without our purposed patterns, to analyze them and see if there are measurable quality differences (efectiveness) and differences in time spent on the board design process. For now, the results obtained have been quite promising, statistically proving the effectiveness and efficiency of the use of design patterns for WSCT, versus solutions designed without our patterns, but we have not yet published this work (we plan to do so shortly).

After that, we plan to develop a software tool to help and guide the user in the board design process, including our design patterns and their related knowledge (*Design Tool*). With this tool, we aim to speed up the design and facilitate this task to the user, at the same time that we want to reduce errors in this phase. This tool should characterize the user's problem, analyze it, determine the solution that best fits its needs, and in last term, it should implement it in a BBT, including the corresponding best practices and restrictions of use imposed by our eight design patterns. Once developed, we should conduct another empirical study in order to analyze the benefits of using this tool, measuring the time saved at the design process (efficiency) and the usefulness of the support of the tool (effectiveness). All this should be understood as a set of actions carried out to enhance the use of BBTs and, consequently, reduce the related productivity challenges when using them.

Finally, we also want to study the design process of BBTs in reverse: analyzing traces of board's use to see what behavior is behind it (*Board Mining*, similar to process mining). With this we will try to obtain additional information about the use and about the board that we could not obtain only with its design. In addition, this could help us to analyze if the board is being used as expected and if there are more efficient ways of using it for that purpose. Finally, this study will allow us to correlate the theoretical knowledge of [2] with the real uses of the boards, in order to see if the theory and the real world go hand in hand. This will help us to check if the boards are really used to face the productivity challenges related to them, as well as to analyze if they are used appropriately for this purpose.

4. Conclusions

As we have seen, this PhD Project has two main and different parts. The first one is the analysis of the problems that hinder good working performance in actual VUCA context for knowledge workers immersed in digital transformation processes, and how the WSCTs can solve, reduce or even mitigate those challenges. As represented in Figure 1, we will deepen the study of the four most frequent challenges. To do so, we plan to empirically analyze the impact of some of the solutions related with these four challenges, using WSCTs. Secondly, we will focus on the practical applicability of one particular WSCT, which are BBTs, in order to reduce some of the previous challenges (especially planning and task management). To do so, we will empirically analyze the practical benefits of using the eight design patterns for BBTs defined in [2], in order to study their efficiency and effectiveness. We will practically delve into BBTs as one of the WSCTs to deal with productivity challenges in two different ways: developing a tool that helps in the design of the boards and mining the traces of their use to obtain further information.

We can see it as the two faces of the same coin: on the one hand, we have the motivation and the problem that we want to solve with this PhD Project (the productivity challenges), meanwhile, on the other hand, we will deep in one of all the possible solutions that we have previously sketched: BBTs, as represented in Figure 1.

Acknowledgments

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