Enabling team collaboration with task management tools

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ABSTRACT
Project and task management tools aim to support remote or face-to-face collaboration. Despite the growing needs for these tools, little is known about how they are utilized in practice. This paper presents the results of an exploratory study using UpWave, a task management tool, and the ways that it enables team collaboration. The group interviewees utilize UpWave for their collaborations and report on its features in terms of use, best practices, motivations and rewards for users to encourage their collaboration. This paper concludes that project and task management tools offer new possibilities for collaborations; it also makes suggestions for using such tools in teams. This study's future work will include a mixed-methods approach to gain a greater understanding of the tools' effects in various collaboration settings.

CCS Concepts
• Human-centered computing→Collaborative and social computing→Collaborative and social computing systems and tools

Keywords
Collaboration; task management tools; project management tools; motivation; best practices; teams.

1. INTRODUCTION
Collaboration is a key component for any activity in communities, such as organizations, where the important ingredient of collaboration is the "communication or discourse that is purposeful, threaded and reflective" [12]. This goal can be achieved across different dimensions with regard to time, place and resources. There are many examples of how people collaborate across long distances, in virtual teams [6, 14], with face-to-face teams [22, 29], in various fields, that is, research and development (R&D), design, research, software engineering and more [22, 18, 31].

Collaboration is often viewed as a method for problem solving [8] and shared creation [20] that indicates the presence of a common goal for team members to work together. The team emphasizes sharing responsibilities among the members and contributing their expertise to accomplish the common goal [1]. Particularly for a work setting, collaboration is defined as "the presence of mutual influence between persons, open and direct communication and conflict resolution, and support for innovation and experimentation" [3]. Project management aims to support team collaboration; it can be applied to any type of project, from R&D to products and services [21]. However, project management remains challenging because of a team's communication problems, many projects' failure to meet their objectives, exceeding budgets, among others. White and Fortune's [32] survey on the practices used for project management reports that some of the critical factors for a project's outcome include clear communication channels, effective monitoring and feedback, and effective team building/motivation.

In response to dynamically changing environments, many companies have introduced asynchronous computer-mediated communication tools to assist with team collaboration, either remotely or face-to-face. Furthermore, the availability of several information and communication technology (ICT) [6] tools for project and task management has enabled remote and online collaboration; these tools have also automated many of the work processes. The value of using ICT tools for project and task management is their help with project execution, either in virtual or face-to-face teams. However, there are many challenges of using these tools in teams, such as integration with existing software tools and processes, team members' motivation to utilize the tools, and more. Despite the growing needs for project and task management tools in various collaboration settings, little is known about how these tools are utilized in such environments. Specifically, the proliferation of task management tools—considered the lightweight versions of project management tools— suggests the need for using them in various settings, and different features assist diverse teams and purposes.

This paper focuses on enabling teams to collaborate effectively by using task management tools. To explore the application of such tools, this paper's authors have studied a task management tool named UpWave [30] and how it supports team collaboration. Interviews were conducted with representatives from selected company partners to identify user motivation and best practice features that could enable and improve team collaboration by employing such tools. This study makes two contributions to expand the understanding about the utilization of task management tools. First, it sheds light on how such tools facilitate collaboration; second, it makes suggestions for using them in team collaboration. This paper is organized as follows: Section 2 analyzes the related work involving project management methods and tools and user motivation. The study's methodology is explained in Section 3, followed by the findings in Section 4. The discussion in Section 5 provides suggestions for using task management tools. The conclusions are presented in Section 6.

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2. RELATED WORK

The need to organize and systematize project work and various resources emerged several decades ago (1900s–1950s) from the defence, engineering and construction industries [17]. The Hoover Dam Project (1931–1936) and the Manhattan Project (1942–1945) are considered representative projects from that period [17]. Numerous methods, techniques and tools have been developed to support every aspect of project management for every type of collaboration, either face-to-face or within virtual teams. This section analyzes related project management methods and software tools for team collaboration and relevant studies on user motivation in this context.

2.1 Project Management Methods

Today, project management is applied as a valuable tool for every field and project type [17]. One area in which project management and team collaboration play important roles is software development, where teams of different sizes are required to collaborate on developing a software product. Software development methods aim to manage, control and guide the process of developing a software system. Several development methods exist, which vary in size, scope (e.g. analysis, requirements, architecture, design, implementation, testing and project management) and approach (e.g. waterfall, prototyping, incremental, rapid application, iterative and agile). In the late 1990s, more lightweight approaches gained traction, and the three most important agile methods arose, as follows: Extreme Programming, Dynamic Systems Development Method (DSDM) and Scrum. In 2001, representatives from these and other agile methods joined forces and wrote the Manifesto for Agile Software Development [5] that described the common grounds for these methods in a simple set of statements and principles. Scrum [24] is currently the most popular of these agile methods and can be regarded as a lightweight project management practice for software development that defines a set of roles, events (i.e. tasks), artefacts and rules.

Apart from selecting traditional project management methods, teams today turn to agile approaches and best practices that are more easily adapted to their needs. The Essence specification [11] defines a comprehensive practice framework that allows teams to describe practices (e.g. Scrum) so that these can be followed, advanced and monitored via a task management tool. The aim is to support practitioners of various fields, such as software engineering, to dynamically adapt and customize their methods during the preparation and execution of a project, controlled through company-specific governance, the use of examples and other means. The Essence framework includes a generic definition of a practice language allowing practitioners to describe the essentials of their current and future practices in terms of concepts, such as checklists, states, artefacts, competencies, templates and so on. The Essence framework also contains a software engineering feature that specifies a domain model that can be used as a baseline for describing best practices in software engineering.

Other project management methods focus on describing the collaboration phases and their characteristics. In virtual team management, a heuristic lifecycle model is described [13], consisting of five phases with specific management tasks and topics that should be addressed during teamwork. The first phase, *Preparations,* consists of relevant tasks and decisions for the implementation of virtual teams, such as mission statement, rewards system and selection of technology. The second phase, *Launch,* describes activities related to the beginning of the teamwork, such as conducting a kick-off workshop and developing intra-team rules. The third phase, *Performance of management*, includes issues about leadership, maintenance of motivation and communication within virtual teams. The fourth phase, *Team development*, describes evaluation activities in team processes, together with training of the team and its new members. Lastly, the fifth phase, *Disbanding*, comprises tasks such as recognition of team achievements and reintegration of team members.

Furthermore, a survey [32] reveals that current project management practices include project management methods and tools, decision-making techniques, risk assessment tools, computer models and computer simulations. The most widely used practices employ project management software and Gantt charts; however, limitations are associated with the first practice, which is identified as particularly unsuitable for complex projects.

Different methods overlap in scope and approaches, and selecting an appropriate project management method that addresses the full needs of a project can be difficult. Therefore, teams increasingly apply lightweight approaches, such as task management tools that more easily adapt to their needs.

2.2 Task and Project Management Tools

Various task and project management software tools are employed to support team collaboration, for example, tools for knowledge management, coordination, information exchange, communication, shared authoring or co-creation and collaborative learning [10]. This subsection examines some well-known software tools that support various purposes for task and project management, such as Trello, Slack, Asana, Todoist and Teamwork.

Trello [28] is a visual online project and task management tool that provides many features for collaborative use, such as notifications, calendars, comments, file attachments and so on. Either for individual use or for teams, users can create checklists, add labels and due dates, invite people to join tasks, and connect with other applications, including Google Drive, Dropbox, Box and OneDrive. Trello works in real time and is synchronized across devices, with apps for different mobile devices. Some advanced features include power-ups, calendar, voting and card aging.

Slack [25] is a cloud-based collaboration tool for team communication that provides an open channel to organize team conversations for a project, a topic or a team. It provides a transparent view of teamwork, as well as a private channel for sensitive information. Slack includes features such as direct messages, file sharing, comments, stars for later reference, connection and synchronization with other services (e.g. Google Drive, Dropbox or Box), integration with other software tools, notifications and more. All files are also automatically archived and synchronized across different devices.

Asana [4] is a personal task and project management tool with features such as tasks, projects, conversations and dashboards. It offers a quick progress view of projects at a glance without scheduling meetings and selected team updates. Some features of the tool are task and project creation, setup due dates and times, attachments and more. Advanced features include “hearts” to encourage participation in an activity, task and project conversations, a searchable archive of files, calendars, dashboards for checking progress on all projects, an inbox for automatic updates, team management features with task assignees, followers

and guests, integration with other software tools (e.g. Dropbox, Slack, Chrome, GitHub, Google Drive) and more.

Todoist [27] is a task manager for personal or collaborative productivity in managing to-do lists from different devices. It supports functions such as setting up and managing tasks, projects and teams, either online or offline, across many different platforms. This tool supports collaboration on shared tasks and goals in real time and customizes the user experience. Some of its features are notifications, real-time data synchronization, visualization of productivity, comments, labels and filters.

Finally, Teamwork [26] is an online project management platform that supports features such as time logs to keep track of work hours per project task and team member, milestones, tasks view, the ability to quickly reassign all tasks from one person to another and more. Other software tools for collaborative use – such as Dropbox and Google Docs for file sharing and Skype and Google Hangouts for communication – are also employed for project and task management.

2.3 User Motivation for Team Collaboration

For successful team collaboration, members must be stimulated to participate in team activities. Therefore, user motivation is an important and complex issue for team collaboration.

Motivation has been discussed as "an emergent state of individual inducing high levels of effort toward collaboration goals, conditioned by an accompanying ability to satisfy some individual need" [7]. Generally, human motivation towards work can be categorized into two distinct types – intrinsic and extrinsic [7]. Intrinsic motivation emphasizes inherent satisfaction from doing an activity, while in extrinsic motivation, the activity is perceived as an instrument for accomplishing a certain desired outcome of a future event [23]. For example, intrinsic motivation for team collaboration could be related to a vision or a personal need for learning and training. Extrinsic motivation is often associated with financial rewards, bonuses and other benefits. Some of the reasons for using team rewards are to support the structure of a team, foster cooperation and productivity among team members and avoid issues about larger group-based plans such as gainsharing [9]. On the other hand, possible limitations of team rewards refer to competition among teams, conflicts regarding their roles and perceived inequity [9].

User motivation has been discussed a lot in various fields and collaborative settings, such as information systems (IS), social media, virtual worlds and open innovation communities, as well as in studies about rewarding mechanisms. User commitment and collaboration in development projects have been studied in IS [7]. One of the antecedents of commitment involves the motivation of individuals, while the other two antecedents refer to personal and job characteristics. Empirical evidence from the study shows user commitment as a full mediator between user ability and extrinsic motivation towards user–IS collaboration. The study concludes that project managers perhaps need more decision authority to provide rewards to user participants [7].

Similarly, team motivations to utilize social media for collaboration have been analyzed [33]. Social media provide efficient and accessible means to encourage and support teams who work together on shared objectives, for example, performing collaborative tasks. The study finds that the most important motivational factors for team members are (a) the content related to motivation, such as relevant/significant content, (b) the availability of a new way of information dissemination and (c) an increased efficiency in daily work [33].

The differences of team collaboration in virtual worlds and alternate media are discussed, as well as the issues of identity and leadership in virtual worlds [16]. Furthermore, the study argues that "leaders of virtual teams will be better able to choose appropriate virtual world features and leadership behaviors to heighten group effectiveness with a more thorough understanding of the complex interactions among leadership, context, and team members" [16]. The study concludes that virtual worlds offer new possibilities for virtual team collaboration, while highlighting the importance of understanding the impact of virtual worlds on virtual teams.

In open innovation communities, user collaboration among users was explored and how users can be motivated to collaborate [2]. The results discuss that monetary reward is not always suggested as the best way to offer incentives to users [2]. Many intangible factors are valued by contributors as well, such as community cooperation, learning and enjoyment. Contributors also appreciate excellent support and the right cooperation tools from their service providers [2].

Additionally, the issue of rewards is discussed in virtual team management in relation to the initial phase of collaboration [13]. It is argued that “the development of a fair and motivating reward system is another important issue at the beginning of virtual teamwork” [13]. Whether with conventional or virtual teams, incentives can have positive impacts to stress the importance of team cooperation. Moreover, Hertel et al. [13] explain the regulation of virtual teamwork, specifically the management of motivational and emotional processes, in the third phase of performance. They argue that physical disconnectedness in virtual teams can lead to various challenges to members' work motivation, such as anonymity and trust issues [13]. Other studies also demonstrate that trust dynamically changes over time and can increase cooperation in computer-mediated groups [15].

The study of DeMatteo et al. [9] presents a framework that identifies four sets of variables related to the effectiveness of team-based rewards, as follows: (a) reward system characteristics, including reward size and frequency of reward payout, (b) organization characteristics, such as culture and congruence of rewards, (c) team characteristics, involving team composition and task interdependence and (d) individual characteristics, comprising ability and need for achievement. DeMatteo et al. [9] also discuss the negative impact of motivation, arguing that team-based rewards can lead to demotivation, particularly for stronger team members.

Lawler [19] contends that a reward system should be adapted to a specific team's aspects, such as goals, task interdependence, autonomy, diversity and degree of virtuality. Furthermore, Lawler [19] considers four types of teams – parallel, production and service, project and management – that require different processes and behaviours. As a general rule, the four types of teams have different operating characteristics and consequently need varying reward systems. To encourage individuals to learn the necessary new skills, Lawler [19] recommends skill-based instead of job-based systems, for-pay systems in virtual teams and pay-for-performance systems that focus more on collective than on individual performance to motivate and support cooperative behaviours. Reward systems might also influence a company's strategy implementation and effectiveness, for example, in motivating performance, promoting skill and knowledge development, and attracting and retaining employees [19].

2.4 Summary

To conclude this section about related work, most of the project management methods address domain-specific needs and requirements. The task and project management tools follow the same logic but not in the majority. These tools offer new possibilities for team collaboration, either virtual or face-to-face, while considering the importance of understanding the impact of the medium used on teams and how to apply the tools more effectively in team collaboration. Additionally, the growing number of such tools reflects the need to support project management with ICT tools, especially the demand for lightweight versions such as task management tools. Depending on various collaboration needs, methods and tools might impose limitations. Many intangible factors, such as team interaction and motivation, enable collaboration. Therefore, as a starting point, team collaboration can be explored in a particular task using a project management method and tool, with a specific set of features and functionality.

3. METHODOLOGY

This study takes the form of an exploratory case study, drawing on qualitative data to explore which features enable team collaboration with the use of task and project management tools. For this purpose, UpWave, an online task management tool, has been selected because of its simplicity. UpWave [30] helps teams collaborate and organize the project work. The tool targets bridging the gap between project management models, best practices for project management and simple ways of task management. It also provides a visual and simple interface, promoting user efficiency and motivation. Figure 1 shows a screenshot of UpWave's user interface, with columns for "to do", "in progress" and "completed" tasks, assigning tasks to people and highlighting task priority by colour. Additionally, the Essence framework has been chosen, particularly its generic practice definition, to study how best practices – checklists, states, artefacts, competencies, templates and so on – can be supported by such a tool.

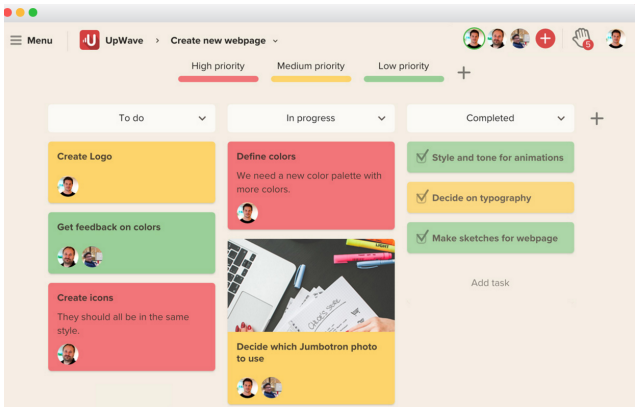

Figure 1: User interface of UpWave, a task management tool

This study's participants are users of the UpWave tool. Additional selection criteria include the requirements to (a) work in diverse projects, such as design, software development and financial projects, and (b) utilize this task management tool for internal collaboration, as well as with other business partners and customers.

3.1 Data Collection

The authors of this paper conducted group interviews with employees of five Scandinavian companies that utilized UpWave, either its present or previous version. The selected companies had different characteristics in terms of specialization, firm type, team structure and need for using a task management tool. Table 1 shows details about each company's participants in the interviews, identified by code. Two to five representatives from each company participated in a group interview conducted by two researchers. An interview guide was prepared for the semi-structured interviews. Each interview lasted approximately two hours and was audio recorded. The audio files were transcribed and analyzed with a software tool (QDA Miner Lite), following the grounded theory approach. The transcribed text was categorized into themes and subthemes. Examples of subthemes are the use context of the project and task management tool, tool features and other software tools used for the same purpose.

Table 1: Overview of the study's participants

Code	Number of partici-pants	Specialization	Type	Number of employees
C1	2	Consulting	Private	350
C2	5	Consulting	Private	60
C3	2	Business development	Private	12
C4	4	Administration	Public	60
C5	2	Software engineering	Private	10

4. FINDINGS

This section reports the findings categorised in three themes, (a) the use context and the features in use, (b) team collaboration and best practices, and (c) user motivation and rewards.

4.1 Use Context and Features in Use

Based on the findings, the context of using such tools is associated with two factors. First, each company's specialization shapes the way that tools are utilized. Although it is recognized that the tool is intended for organizing and monitoring tasks and projects, each company's specialization and work processes influence its use of UpWave. For example, in the software engineering company (C5), existing methods and practices also lead the way that the use of UpWave, such as the method of Scrum backlog, is compared with how UpWave works.

Second, the team structure directs the way that tools are utilized. For example, the use of UpWave is connected with both internal and external management processes, but according to the business development company (C3), if its team is in the same workplace, there may be a limited need for UpWave. For collaboration projects with external company partners, the task management tool is used in a shared way, such as in the software engineering company (C5). Additionally, the UpWave tool is suggested to other companies as an easy method for their collaboration, as mentioned by one company (C5). Generally, the use of UpWave is associated with five work processes, as follows: (a) task and project management for sharing responsibilities and managing the work (C2 and C5), (b) group meetings to organize the project work and delegate responsibilities among team members (C2), (c) monitoring of the work progress, both of teams and of team members (C3), (d) organizing ideas and creating individual to-do lists (C1 and C5) and (e) product development and management,

either individually or in teams (C4). Examples of quotes regarding the use context mention the following:

> *"We used the previous version of UpWave for all the leader meetings" (C2).*

> *"In the end, it was just a list of to-dos that had no due dates […]. It was just a set of ideas, in the end. So we didn't really use that to run the project" (C1).*

UpWave's user interface and features are important factors for companies to transition from the older to the newer version of the tool. The experience with the first version is perceived as positive by the participants, who cite many features as "convenient" for their work, such as the general logic of the tool, the intuitiveness of the user interface, the simple process to complete an action and the reuse of the "templates", among other comments. Specifically, the participants describe the features that best apply to their needs and work processes. First, they find the calendar a useful and a basic feature that is actively used. It is viewed as a function that could be shared with everybody, who can see, agree on or reject the due dates of tasks and projects. For example, during internal work processes, the calendar can trigger a discussion about the projects, project roles, dates and deliverables, providing a short-term or a long-term overview of the projects. Interactivity with the calendar is also valuable in terms of editing the due dates. Second, the participants report that colour plays an important role in prioritizing tasks and project roles. People might use colour for their convenience although in the tool's first version, colour performed a significant function for the participants. Third, notes, comments and hangouts are regarded as promoting simple communication in team collaboration. Google Hangouts is especially perceived as an essential feature for remote collaboration. Other useful features for the participants include the search function and the pen tool for editing, in contrast to attachments, which are less used due to security considerations about personal data. Here are representative excerpts of the interview quotes regarding the features in use:

> *"I think one of the first things I checked was whether there was the calendar function" (C5).*

> *"But yeah, when we do these meetings, we definitely use some kind of a Hangout or conferencing tool" (C5).*

4.2 Team Collaboration and Best Practices

Team collaboration – both internally and with external groups – is reported to have various challenges regarding the project management process supported by the corresponding tools that previously have used, for example Trello and Slack. At the general management level, the challenges of team collaboration include prioritizing and organizing projects and tasks, but the participants also find it difficult to decide on task delegation in terms of task owners and due dates. The process of dividing projects into smaller and concrete tasks is demanding. Likewise, the process of building and leading teams with a project or task management tool is mentioned as difficult. At the process level, time management is a major issue with the project group, including keeping track of the time allotted for each task. Other challenges for team collaboration are updating the project status according to the team's progress, tracking the team's progress and aligning various tasks with team members. It is also problematic to focus on both the micro level (e.g. team roles and tasks) and the macro level to obtain a holistic view of a project. According to the software engineering firm (C5), during the project status meetings, multiple options are needed to display the project results (e.g. desktop view, wall projection) and lead the meetings. Furthermore, the security limitations of the project management tool are challenging. In some cases, it is restrictive to use the task management tool because the safety of the shared content is a priority. Another issue involves managing the company's contacts and the team members assigned with various tasks and projects. Celebration of successes and milestones is also mentioned as something that should be considered for every project. Examples of quotes regarding the challenges for collaboration are presented below:

> *"The hard thing is to keep track of what everyone does on each project. Some tasks are common, and some tasks are specific for your project. Also, the graphic designers […] feel it's awkward to break down their job into smaller parts. It's sort of an iterative individual process" (C1).*

> *"Knowing who is supposed to do what, I think it's a problem, especially with the clients" (C2).*

> *"Yeah, we are also not good at celebrating milestones […]. So it's just a continuous thing without celebrating what we actually have achieved" (C5).*

According to the participants, collaboration varies greatly among teams, depending on project types and existing processes. For instance, one company (C5) has followed Scrum processes in some of their client projects but has faced difficulties in having different teams adopt the same approach. In the same example, the company would like to see support for different ways of working within and between teams. Another company, which focuses more on capitalization processes (C1), has no predefined procedures but would like template support based on previous versions of UpWave. A couple of quotes refer to best practices, as follows:

> *"We have so many internal or try to have some internal routines […]. I think there's no lack of best practice, but it's the execution of it […]" (C5).*

> *"[…] we would try to fit all disciplines into the sprints and the sprint board of Scrum planning. We found it quite hard to get the [...] for example, the graphic designers or art directors to participate in that way of working" (C1).*

According to the participants, the key benefits of task management tools, such as UpWave, rely heavily on their simplicity and ease of use. The interviewees raise concerns about implementing rich practice features that would make the tool more obtrusive. This issue has led the authors to examine the simpler features of the Essence framework, such as (a) checklists for projects and tasks, (b) state of and completion criteria for projects and tasks and (c) templates for projects and tasks.

4.3 User Motivation and Rewards

Although motivation is an essential factor for supporting team collaboration, intrinsic and extrinsic motivations are valued differently by teams. The motivation for the participants to use project or task management tools depends again on the team structure and the project type. People are stimulated to work with partners who have different backgrounds and competencies in the context of a project. Furthermore, the holistic view on projects and teams could also be a factor that triggers team collaboration, as well as the various tools that a team uses. The participants report that their motivations to use the task management tool for their work and collaboration with teams involve various factors, including the following:

- gain an overview of the project and tasks;
- access a source of information, which also provides visibility to the projects and teams;

- adopt the tool as part of the company culture;
- engage in remote collaboration with other partners;
- have intrinsic motivations in sharing with teams;
- access a learning source that expands the systems thinking of the company;
- gather all ideas in one place; and
- satisfy their curiosity about the new software tools and their simplicity of use.

Excerpts of quotes showing the motivations for using the task management tools are presented below:

> *"But I saw that he started using it because he saw that it was a source of information. So he could pull the information where we are in the project without contacting us" (C3).*

> *"I'm always curious about new things […], and I've been part of startups all my life, so I'm very curious" (C3).*

> *"[...] and learning different tools makes us more confident to understand any kind of system because we used to develop this kind of thinking to understand how it [would] work […]. We can advise our clients better by knowing these tools" (C2).*

A topic related to user motivation and team collaboration that has been discussed by the participants refers to rewards of the task management tools. The participants suggest specific reward mechanisms that could be employed by UpWave, such as the following:

- point-based mechanism, where the tool rewards a user for completing an activity;
- time-based mechanism, where the activity needs to be completed within a limited time;
- role-based mechanism, where specific team roles reward other team members for an activity;
- process-based mechanism, where a process, such as on-boarding, could be rewarded;
- statistics that visualize relations of a project, personalized by a user in an attractive way;
- project-dependent rewards, where the level of rewards could be adjusted according to the formal or informal level of project groups;
- activity-dependent mechanism, where a regular activity turns into a gamified one;
- visualizations to motivate users to complete activities; and lastly,
- fun as a reward.

Examples of quotes that describe the suggested reward mechanisms are presented below:

> *"[...] it would be nice if the project manager [could] praise people when they finish their task. […] gamification as a tool for on-boarding, teaching people how to use it" (C3).*

> *"So if you also have reward mechanisms, then you can see who was the more popular in the network […] and how strong are the connections […]. So you can get a lot of statistics out of that. And that will just contribute to the fun part, I think" (C5).*

5. DISCUSSION

This study's findings are in line with those of previous research regarding the project management process and the use context. The present results also increase the knowledge about the application of project and task management tools. The study's participants possess diverse characteristics in collaboration settings, but they all express the need for efficient task and project management tools across projects, people and teams. Specifically, the use of UpWave is associated with many work processes apart from project and task management – for example, group meetings, monitoring the work progress and organizing ideas – that would require different tools to be used in other cases.

Team collaboration could benefit from the utilization of task management tools in various phases of a project. First, the selection criteria for such tools should be decided according to a company's culture. The participants recommend choosing tools with a simple and intuitive interface that can easily be integrated with existing company systems. They also comment on the design aspects of such tools:

> *"So I think [that] really focusing on [the] interface is key for you to make the hurdle as low as possible" (C3).*

> *"[...] it should be as intuitive as possible and as few clicks as possible. So you don't really need to save" (C3).*

> *"[…] security information needs to be very clear. So people know if it's a secure system or not" (C3).*

They also suggest setting up both formal and informal communication channels (e.g. chat rooms) for team support throughout the collaboration. The selected task management tools can facilitate team collaboration by supporting common project activities, such as time tracking, visualization of task dependencies and reporting mechanisms. Additionally, these tools can support online, real-time and transparent collaboration in terms of processes, resources and the project status. However, the main challenge is to convince team members to use the tool. Both intrinsic and extrinsic motivations should be employed for various users, along with plenty of gamification or playful elements to motivate people. Below are interview excerpts that describe the playfulness of task management:

> *"You get points if you delete the task, and you get a lot of points if you do it" (C2).*

> *"You can't be serious eight hours a day [...]. You need some fun" (C1).*

The findings from the relevant user motivation studies highlight the need to delegate team roles and to offer motivations and the right tools to collaborate. Project managers need more decision authority to organize their teams, provide rewards and follow best practices in team collaboration, considering the diverse team characteristics. We conclude that task management tools, such as UpWave, offer new possibilities for team collaboration, but it is important to examine the use context in order to adjust the evaluation criteria, checklists and rewards.

5.1 Suggestions for Team Collaboration, Using Task Management Tools

Based on this study's findings, the authors propose a list of suggestions for the effective use of task management tools, such as UpWave (summarized in Table 2). These recommendations are intended to be applied and communicated within the tool. The suggestions are structured according to the phases of the lifecycle model of virtual team management [13].

A. Preparation phase. In the first phase of setting up a team to collaborate, team roles should be clarified, as well as the responsibilities corresponding to each role in the project. This step can be achieved by choosing traditional roles (e.g. project manager and project leader) and responsibilities during the project and naming the corresponding user accounts in the tool. The second step is to review (e.g. previously used practices) and select

the best practices suitable for the project scope and the team size in order to set up the evaluation criteria and checklists accordingly. Third, it is important to select or suggest reward mechanisms to match the tasks, roles and project completion that could motivate users to finish their work. A small team or the person who organizes the project can initiate this phase by describing concrete tasks and activities.

B. Launch phase. In the launch phase, the project management tool should be part of the first project meeting. Invest time in inviting the team for an on-boarding process and demonstrating the selected tool to justify its use for the project. Introduce the basic features, functionality, potential rewards and how it can be integrated with existing systems/software. Additionally, highlight the benefits of using the tool. Second, another important aspect of this phase is to agree on the evaluation criteria and checklists created in the previous phase. The team should be informed about the evaluation criteria for project collaborations and if the tool will assist the evaluation. Third, set up reporting mechanisms according to the time plan and show the connectivity and relations among the tasks. Invite the team to choose individual tool settings and adjust the tools' notifications. It is necessary to archive the tasks and activities as well. Several interviewees' comments and suggestions about notifications, the calendar and reports are cited below:

"[...] if it's possible to say that all notifications [...] come on Friday at 8:00, or is it possible to make some kind of system that [is] ok, you know, when they come" (C2).

"It could even be better if it could be integrated with our calendars. Because we use Google calendars, and I think that's a premium feature" (C5).

"[...] it would be a nice if you could combine reporting of hours with planning of tasks. I mean, planning ahead with reporting what you've done" (C5).

C. Performance management phase. A necessary step in the mid-phase of the project is to review and evaluate the progress and history of actions, based on the selected tool and reporting mechanisms. If there is a repetitive task or process, create templates of work processes to reuse and to save time for the team. Furthermore, evaluate the checklists' progress and provide mid-phase rewards to motivate the team. At this point, the team has probably developed specific needs regarding the tool. Ask for a quick evaluation of the tool, the reporting mechanisms and other functions of the tool.

D. Team development phase. In the fourth phase, the collaboration has been established, and improvements are expected according to the evaluation of the tool. First, share part of the project statistics to motivate the team members and to visualize the project status. Invite the project leader to explain the statistics and what should be done to achieve the project goals. If necessary, delegate more or different people to perform complex tasks. Second, fun should be part of the tool. Invite team members to reward fellow members for their collaborative activities via the tool.

E. Disbanding and reintegration phase. In the last phase, the team collaboration will end shortly, and the results will be disseminated. First, celebrate the project's completion and reward the team members for their contributions and achievements. Provide the project highlights based on reporting mechanisms and checklists. Share the final project statistics, and evaluate the project status according to the initial checklists. Finally, ask for a quick feedback and evaluation of the overall team collaboration, using the task management tool. If there are plans for future activities, use the project feedback to create new templates, checklists and a list of rewards.

Table 2: Suggestions for team collaboration, using task management tools

Project Phase	Suggestions
A: Preparation	Set up team roles for better control and task delegation. Select best practices for the project scope and the team size. Select reward mechanisms.
B: Launch	Invite the team for an on-boarding process and demonstration of the tool. Review the evaluation criteria and checklists. Set up reporting mechanisms, and adjust the notifications.
C: Performance management	Create templates of work processes. Evaluate the checklists' progress. Provide mid-phase rewards.
D: Team development	Share project statistics with the team, as a motivation mechanism. Reward one another's collaboration activities.
E: Disbanding and reintegration	Celebrate the project completion. Share the final project statistics. Evaluate the project status according to the checklists.

6. CONCLUSION

This paper reports on the results of a study regarding specific ways to enable effective team collaboration, supported by task management tools. The study has aimed to capture how such tools are used in practice for team collaboration. UpWave, the selected task management tool, reveals diverse characteristics for team collaboration. Despite the participant companies' different characteristics (e.g. specialization, company type, team structure and need for using a project or task management tool), their representatives all comment on the usefulness of such tools in everyday team collaborations. The use of UpWave is associated with various work-related activities, expanding the initial use of the tool.

Additionally, the selected Essence framework of project management, with its generic practice definition (checklists, states, artefacts, competencies, templates and so on), is a valuable method to support the exploration of the tool. The participants have been asked about the practical things necessary for their collaborations within a project, with the framework as a basis for the discussion. Checklists, templates and other artefacts have been mentioned as best practices that can be supported by such tools.

Furthermore, the inclusion of both intrinsic and extrinsic motivations, such as learning, enjoyment and performance, is recommended. Rewards are valued differently by teams and should be decided based on each team's criteria, the project roles, achievements or similar factors. Gamification mechanisms could

offer a wide variety of concepts to apply in task management tools, for example, points, badges and leaderboards.

The findings have helped expand the understanding of how task management tools could enable team collaboration in the process and through motivations. These results can be generalized to project management tools; practitioners are encouraged to apply the suggestions in various contexts. However, the study's limitations include the selected method of the interviews. Supplementary data are needed to gain more holistic knowledge about team collaboration, and future work should include a mixed-methods approach. Additionally, the study provides recommendations for applying such tools in team collaboration that can be useful to practitioners, for example, developers and designers of such tools, as well as project managers who want to employ software tools for project and task management. Future work will include the authors' ethnographic study to monitor real-time use of task management tools in a collaborative setting, along with a survey to acquire a deeper understanding of the tools' effect in various interacting processes within teams.

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