

Collaborative Groupware Implementations: A Systematic Literature Review

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Abstract— Application software utilized to assist groups consisting of two or more individuals working towards same outcome is called collaborative software. These software mostly function by allowing process managers to keep track of required group processes that are needed to obtain a specific result. Software development heavily relies upon inter/intra-team collaboration between small teams of developers to build functional software modules. Utilization of collaborative groupware software monitors individual contributions towards process outcomes. Mapping individual contributions will cause a boost in overall productivity by allowing the organization process managers to highlight specific unfulfilled processes over the span of a Software Development Life Cycle (SDLC). Tools designed to facilitate inter/intra-team collaborative interaction were examined. This paper studies factors which influence design of collaborative groupware implementations along with their adoption by end-users in a post COVID (SARS-CoV-2) pandemic impacted world. We present our inferences on existing productivity groupware implementations after going through referenced literature pertaining to their construction and impact on the end-user. We detail the variables which influence usage patterns and implementation of productivity tool, investigating whether User Interfaces (UI) allow for end-user to have an uncluttered experience while navigating the tool, checking for cohesive user engagement using local variables unique to the experiences of domestic teams. Lastly, we conclude with a few points regarding complications faced while designing resources to assist globally distributed virtual networks of teams carrying out complex projects.

Keywords— Collaboration, Software Tools, Groupware, Human Computer Interaction (HCI).

I. INTRODUCTION

The impact of the 2019-20 COVID (SARS-CoV-2) pandemic has resulted in diverse businesses being prompted to utilize web-based services which seek to automate certain processes which would otherwise been performed manually. Some business houses have retorted to automating nearly every administrative component, resulting in better working conditions for employees and near-immediate conflict resolution for consumers.

Collaboration tools are composed of a software suite which aims to support groups composed of two or more individuals to accomplish common objectives, which may or

may not be related to software engineering. These can be utilized to digitize traditional collaboration elements of non-technological nature used in administrative environments like notes, graphs, flipcharts, post-it notes or whiteboards. In addition, collaborative groupware's may also enable (audio/video/text based) communication channels for inter/intra-team communication, by means of implementing sockets between users. Collaborative groupwares have helped lesser-known business houses to streamline administrative processes by allowing individual process monitoring to ensure that fulfilment of eventual outcomes. Doing so has boosted productivity levels across the board, and has trimmed losses in terms of unproductive man hours. The accessibility of a diverse toolset, along with different utility areas and cost slabs has allowed businesses to stay afloat during these uncertain times by offering high quality of service at very low cost to end user.

Teamwork is important within organizations and is a part and parcel of daily life of staff. Interaction within the same team can be difficult due to factors such as compatibility and cohesion within the team. Collaborative groupware's have also been deployed for the enterprise business market as an instance of Business as a Service (BaaS), which is an extension of Anything as a Service (XaaS) paradigm, such that facets of real-life business such as internal processes and product development schedules are provided as an immediate, on-demand service via a cloud server where the business only pays for what services are needed. In terms of daily activities, individuals within a team are permitted to be more productive by building up a more transparent communication portal. Collaborative groupware's include data that is constantly updated such that overall process outcomes can tracked by the whole project team. Collaboration instruments help prioritize tasks, keep individual team members on track, ease collaboration, and allow the team to reflect on issues with end-product which actually need fixing.

Tools like these which are utilized by distributed teams are generally web-based in order to promote ease of user access, compared to an app which will require each user to download an app from an online source and then install it on their mobile device. Web-based tools also generally better indexed by search engines, which allow for more awareness and

documentation around the said collaborative groupware. This results in a refactored User Experience (UX) that is likely free of unnecessary code modules.

Notably, collaborative groupwares support different cost slabs, ranging from totally free for the end-user, to some which can support giant corporations. These cost slabs, depending on the specific collaborative groupware platform, allow for end-user to use (e-mail/ video conferencing/ document management/ version controlling/ group scheduling) integrations. The approach of collaborative project management offers ample support for the prevalent practice of working with direct responsibility in development teams:

- Constructive, tool-assisted cooperation and interaction replaces the static algorithms of traditional project management frameworks.
- For all team participants, a central database offers current and standardized planning information between businesses and across locations.
- Clear allocation of roles and interfaces encourage knowledge transparency thus ensuring increased efficiency and consistency of planning.
- By identifying significant milestones and key details, project management sets up a top-down planning structure. Group participants independently plan their work scopes, confirm the fulfilment of stated specifications and assume responsibility for collaboration with other projects.
- Communication modules allow for easy and intuitive sub-project networking and thus facilitate fast and clear problem-solving processes. Changes are conveyed to those involved automatically and problems are addressed by finding common consensus on necessary steps.

II. RESEARCH METHOD

In this section, we describe the process of Systematic Literature Review (SLR), which is a protocol that aims to conduct a thorough review of existing literature present on specific research in order to collect research papers and assess them on basis of pre-defined research questions and keywords. Performing an analysis of this nature enables researchers to assess the impact of a certain piece of research.

This section is distributed into sub-sections, such that the first sub-section elaborates upon the research proposition and direction. Following the first sub-section, the second sub-section delves upon the paper extraction process, wherein online libraries were crawled and mined in order to obtain appropriate research papers. The third sub-section details upon the comparison section, wherein a specific query for the corresponding related materials for the proposed research in the specified libraries was run. Subsequently, the fourth sub-section performs performance evaluation on the selected research papers. A variety of recommendations were followed for implementation of generic method of systematic literature review (SLR) administration, as shown in Fig. 1 below:

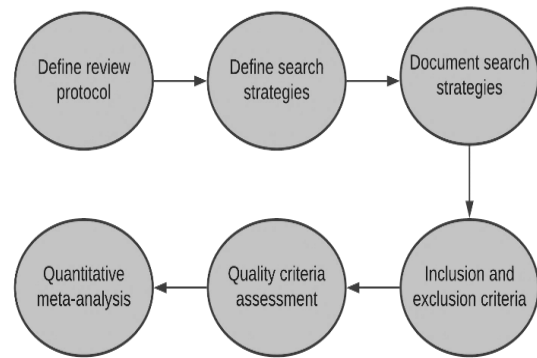


Fig. 1. Generic Process of Systematic Literature Review (SLR).

A. Study plan and Methodology

To perform an efficient and successful search process for original research, an exhaustive search was performed. Research papers are typically indexed in online databases. We crawled through multiple online indexed libraries in order to search for appropriate materials:

- IEEE Xplore
- arXiv e-print archive
- ScienceDirect
- Social Science Research Network (SSRN)
- Springer
- Wiley OnlineMaintaining the Integrity of the Specifications

B. Paper Retrieval Parameters

The Paper Retrieval Parameters (PRPs) of the proposed analysis are as follows:

- PRP1: Applications of team collaboration tools in agile environments?
- PRP2: Performing analysis on existing research work to gauge the impact of productivity / collaborative groupware's on agile environments.
- PRP3: Techniques used to build a cross-platform P2P collaboration tool that is specifically optimized towards scrum environments.

C. Comparison between Research Papers

The task of paper retrieval is complicated since original computing research cannot be overlooked. The method that was employed in order to search included crawling through approximately 5+ common indexed computer science journals, which included IEEE, ScienceDirect, and Springer. Analysis problems were initially established. The reason why these libraries are selected is that they dominate in the field and publish scholarly content, much of which is subject to multiple rigorous rounds of peer-review. Subsequent to this, the following keywords for the search were listed with different Boolean operators: ("collaborative groupware" OR "productivity tool").

TABLE I. SUMMARIZED ENUMERATION OF QUERY EXECUTION IN GIVEN RESEARCH PAPER DATABASES

Sr. No.	Research Paper data		
	Research Paper Database	Results	References
1	IEEE Xplore	1106	[3], [5], [9], [11], [18]
2	Springer	7197	[8], [10], [12], [14], [19]
3	Wiley Online Library	1969	[6], [7], [13], [16]
4	ScienceDirect	5008	[1], [2], [4], [15], [17]

Performing a search on an individual keyword basis of libraries is not an efficient way to choose relevant information. For the formulation of an efficient query, operators like "AND" and "OR" are considered. For each library, the formulated search query is then used to select papers written during the last 3 years (2017-2020). Identical keywords were found for each keyword phrase in order to classify and identify relevant research.

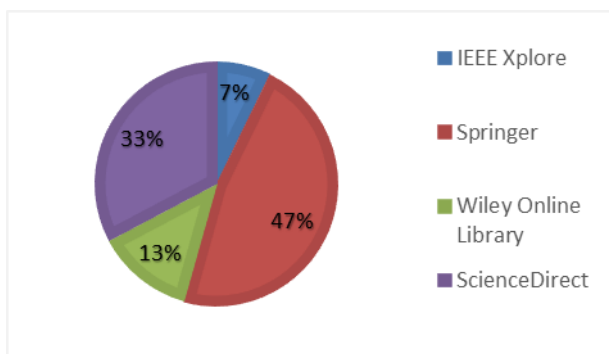


Fig. 2. The total number of research papers and the initial result of the library names

III. LITERATURE SURVEY

Smaller businesses can reduce employee downtime on non-essential tasks and optimize employee productivity by virtue of productivity tools (such as Google Docs/Lucidchart/Teams/WebEx/Slack/Monday.com). Utilization of these productivity tools seeks to improve organizational networking along with monitoring progress rates for individual processes within an organization in a cost-effective manner. It is thus important, especially in the aftermath of the 2019-20 COVID (SARS-CoV-2) pandemic for smaller businesses to deliberately select productivity tools that support rather than hinder the achievement of business goals.

Bhabendu Kumar Mohanta et al [1] focused on implementation of survey that provided a comprehensive analysis on utilization Blockchain technology, especially in terms of real-world consequences for academic research purposes. Over 130 research papers that detailed upon Blockchain integrations in sectors ranging from Internet of Things (IoT), Healthcare, Cloud Computing (CC), Law and online business (eBusiness) were reviewed in order to tabulate issues faced while implementing Blockchain integrations. Different Blockchain concepts were listed (with architectures ranging from Public/Consortium/Private) and their functioning was evaluated. Presence of associated security issues (such as consensus/commitment

protocols/authentication) that can arise on implementing Blockchain integrations were mentioned, along with resultant privacy issues that can compromise end-user data integrity.

Viktoria Stray et al [2] emphasize upon performing processes of introspection where we observe how software engineering teams use meetings and collaboration tools as a process to coordinate different processes across the globe. They further suggest better practices that enable greater productivity rates in meetings by virtue of utilization of collaboration tools, considering team diversity (in terms of roles/gender) and assuming that the said teams are building products that are widely used by end-consumers.

The collaboration tool platform Slack was considered for a longitudinal case study, where meetings performed using it were investigated using a mixed-methods approach which utilized surveys of individuals using the platform, along with observations that were noted while teams used the said platform. Users were subsequently interviewed as to the effectiveness of the platform, and chat logs were logged for diagnostic information. In terms of unscheduled meetings (with undefined agendas), the individual within a team spent approximately 9 hours on a weekly basis. Individuals within teams, and teams on the whole inadvertently set up norms for inter/intra-team, communication. Researchers should perform studies on how inter/intra team norms/identities are set in meetings. In addition, another concept worth pursuing in future work is to gain better understanding of the fundamentals of team members directly messaging each other when using tools like Slack, as directly messaging causes a process to quicken up, but directly reduces transparency in decision-making. Utilization of personal/group modes of co-ordination, along with the working hours spent in doing so to directly observe the impact on team performance is something researchers must investigate. Research work in future must aim at mitigating these never-ending roadblocks that constantly hamper progress.

Preethi Chatterjee et al [3] state that modern day collaborative channel platforms such as Slack are being utilized in a manner that is parallel to social media. Platforms like these are used to represent public/private communities that converse with a wide user-base with an agenda on specific software development modules/frameworks. Preliminary studies performed revealed that on performing data-mining on specific developer conversations (like Frequently Asked Questions (FAQs), set of likely outcomes would emerge. Performing data-mining would enable building of software tools that map evolution of software platforms. The study investigated mined information from other developer communication channel platforms, notably Stack Overflow. Chat conversations of a free-style nature are carried out in Slack platform, questions asked by user may be followed up with a set of additional questions, or the said question might receive a clarification from another user. It is possible to apply automation to perform data-mining on chat conversations conducted in Slack, owing to complete sentence availability coupled with indicators (natively embedded within Slack) which denote accepted answers. Lack of formal Q&A Process Integration within Slack causes roadblocks in the data-mining process. Identification of whether a given solution is non-trivial requires knowledge of

whether the considered sentence(s) are responsive. The authors note that platforms like Stack Overflow do not permit opinionated statements (e.g., API X has better design or usability than API Y) on their site. To software engineers, obtaining opinions is inherently valuable to write better code. Availability of diverse range of information allows for more opportunities to mine for more data, allowing for better software development. The authors plan to investigate the ability to mine a range of diverse opinion statements available in public Slack channels as their future work.

Judith Tiferes et al [4] systematically summarize relationships in a manner that measures team communication characteristics along with situational contexts by virtue of performing a cross-referenced literature survey between at least 3 scientific research databases which are (including: SocINDEX/PsycINFO/MEDLINE). Findings show task/duty of individual on a team is linked to how often the individual takes part in conversations, along with the context of the conversation. These variations in team member interaction reflects upon various roles and equations between each other. Articles were considered for final review in this study, had at 1 or more communication measures related with a particular team. Out of more 700 articles which were taken into consideration, 99 articles met criteria of inclusion. Extracted article data was composed of team characteristics along with reported nature of specific teams. corresponding communication relationship properties between team members. Corresponding relationship properties between team members in each team was noted. As attributes (such as individual abilities/anxiety situations/reparation strategies/behavioral elements) were observed to be associated with substitutions in overall team interaction over a period of time.

Research in future should be directed towards measuring the dynamic attributes that determine team communication aspects. The influence of these attributes on inter/intra-team interactions should be quantified in a scientific manner. The authors note very little research is performed regarding impact on communication between team member on basis of individual experience within the team and familiarity of individuals with others in the same team, and factors that affect inter/intra-team interaction such as location, role within the team, and individual personalities along with how management hierarchy is structured (top-down/bottom-up). There is a co-relation between the above-mentioned factors which needs to be investigated in future. Differences in how existing research performs is revealed in terms of how familiarity and team location has impacted overall quality of inter/intra-team interaction. In summary, updates are provided on team coordination study results, along with suggestions on how future studies in this area should proceed.

Maria Paasivaara et al [5] detail a report where case study is performed related to agile practices in an organization that has clients in Malaysia and is headquartered in Norway. The said organization has approximately 50 employees, and performs enterprise software development. There are prior instances where impact of Agile practices is detailed in context of small/middle-sized projects, however the impact of agile practices within long-term projects remains unstudied.

To this end, interviews were performed with 7 individuals within the organization, and successful impact of Scrum practice application was detailed, especially in contexts of using team-collaborative platforms to fulfill requirements for agile frameworks. Impact of performing procedures related to Agile framework within the organization, in order to deploy the completed product to end user was also elaborated upon. Different Agile practices (such as Daily scrum meetings/sprint demonstrations/2-week maintenance sprint/Nightly builds/automated testing) are detailed upon. Subsequently, limitations included having the ability to interview more than 10 people within the organization from diverse teams/roles. Doing so would have enabled the authors to demonstrate their point in a better manner. Moreover, direct interaction was possible with only one team member (of Malay ethnicity), with telephonic interviews being performed for 2 other Malaysian individuals. In telephonic interviews, it is comparatively tougher to put the interviewee in a secure/confidential mindset. Aligning with future research direction, the authors have presently already conducted 2 interviews with persons from other projects which are diverse and distributed in nature. These projects have implemented Agile practices from Scrum into practice. Comparisons are to be performed on how agile practices are applied to distributed environments, along with hurdles encountered and net-positive attributes that can be considered.

Alok Mishra et al [6] state in their research that on comparing over 15 tools utilized in agile environments, Jira was one of the most popular agile tools. Jira was supported by over 15 integrations and enabled workflow adaptation. Other instances utilized to streamline workflow processes are Trello (which supports Jira integrations, and is suitable for globally distributed projects), and VersionOne. SpiraTeam and Pivotal Tracker are instances of competitively priced popular agile project management tools with cost slabs applicable to a variety of users. It was observed that some tools (Icscrum/Asana) were very suitable for senior projects, which help in automating collaborative assignments, versus tools such as (Taiga/Agielan/Axosoft/Planbox) which are better suited for start-up projects. General trends observed in productivity tools is that as feature sets increase, tool complexity increases which results in decrease in user productivity. More features and tools can be compared and conducting your own surveys would help in more targeted and relevant questions and improve the accuracy of the comparison.

Yeon Sook Hwang et al [7] state that analysis of the protocol and surveys were used to select Social Networking Services (SNSs) for the experiment. Teams were asked to design a home where the flow of time and was sustainability could be observed. Every team had a choice between a collaborative groupware and a Social Networking Service (SNS) to use and to interact with their peers. Then the data of these teams were analyzed and studied. 3 platforms namely Instagram, Facebook and a closed-chat platform was used to collaborate for over 15 weeks of time. 2nd year architecture students were the main contributors to this experiment. Each team consisted of 3 or 4 people. Although students immediately and briefly exchanged ideas using the closed-

chat platform without exploring the problem completely, using Instagram and Facebook, students could share data and discuss it in detail. In particular, it appeared impossible for students to find and return later to unique past discussions using the closed-chat site, but the students using Instagram and Facebook had no difficulty finding their saved data every time they needed it for more debate. For the purpose of evaluating faculty involvement in social contexts affects design practices and learning methods within the framework of a certain course, we believe future studies should systematically analyze teachers' active participation in student interaction through SNSs and what roles interfaces play within that context. More research on design practice should be conducted to recognize the capacity of SNSs as a collaborative groupware to facilitate design coordination in team partnership.

Paolo Ciancarini et al [8] took opinions of people from different professional backgrounds and their requirements in an agile system. These requirements are then mapped to the open-source components that could satisfy the professionals needs. A survey was also conducted to find out the most popular tool for agile development. The survey results showed that Jira was most prominently used for agile implementation. The Compositional Agile System (CAS) is composed of two sub-structures namely server and client. The CAS client is integrated with Integrated Developer Environments (IDEs) like Eclipse and IntelliJ while the CAS servers use Gitlab. CAS contains different components in it like Bugzilla which is used as an issue tracker, Mattermost which is used for team communication, Sonarcube for code analysis and taiga for sprint backlogs and burndown charts.

Fabio Calefato et al [9] review each of the collaborative groupware in all the 3 categories namely- communication, workspace and lifestyle. In the category of communication, Slack was the clear winner. Web conferencing systems such as Cisco WebEx are the popular alternative. For workspace use, GitHub and GitLab are software's that aid with project workspace and increases the efficiency and comfort of developers by combining a structured tool set composed of a version control system, such as Git, in one place to exchange software objects in a con-trolled manner and a problem tracking system, i.e., a database to handle fault reports and change requests, and a content management system to store content. PLM and ALM provide assistance during a product's lifecycle management. While PLM considers products such as vital mechatronic devices and embedded electronics and several different product artifacts, ALM focuses mainly on IT and software applications without the specifications of essential structures, such as functional protection. A stronger link between business and Knowledge management must be established. The production processes, product lines, and project teams must be driven and controlled by aligned business goals and metrics.

Kara L. Hall et al [10] state that impactful influences associated with some targeted conditions were considered and on the basis of these influences the results were used to create a tailor-made Collaboration Plan. To direct the process of Collaboration Planning, ten main influences on team science were established, which vary from the primary scientific basis on how a team prepares to engage with people

and organizations, to team relays and collaboration processes to grade enhancement methods for team operations. These plans will continue to highlight ongoing challenges and guide analysts to optimize collective development to acknowledge technological innovation required to strengthen the health and well-being of our population.

Vipin Balachandran et al [11] noted increased utilization of technology frameworks for teamwork coordination is counterproductive for application infrastructure maintenance. Developer conversations are a part of Slack which are composed of log messages along with source code comparisons and stack traces. The presence of these allows for better problem solving and taking better decisions. In the event that a corresponding Slack channel may be private to a team, vulnerabilities present may not be accessible to developers and administrators. A large number of vulnerabilities (over 1500+) do not contain URLs on Slack conversations. This causes information fragmentation, a direct result of which is increased difficulty in terms of application management. Recovery of diagnostic information on private channels on the Slack platform is possible with embedded search methods. In the event that high number of unstructured communication records exist which address multiple subjects, then threaded dialogue is required for mapping and coordinating between subjects. However, utilization of threaded dialogue is low in these frameworks.

Nurius Paula et al [12] observed that a lot of individuals with both the expertise and skillset are being hired in "T-Shaped", for collaborative problem solving and innovation. Fundamental expertise (vertical trunk) is integrated by T-shaped professionals with borderline credentials who serve to involve individuals and offer guidance, analysis and implementation resources. Meta-Competence is utilized as a methodology by many T-shaped specialists to refer to skills that usually apply to team specifications. These practices have created a number of key areas and guidelines that are typically framed in cross-disciplinary research by the transdisciplinary (TD) and translational (TL) components. These are divided into four domains:

- values, behaviours, and opinions,
- mind habits,
- Competencies dependent on information and
- Leadership skills.

Albreach, F. et al [13] identified the impact of the introduction and use of electronic collaborative groupware on the information management systems of the Jordan's Generations for Peace (GFP) organization. A questionnaire was created, consisting of 40+ items using an analytical description method to fulfil the aim of this study. The thesis contained a survey, and the 250+ questionnaire were distributed amongst the research community. Out of those, 94% were received back and 270 were assessed. In order to assess the findings, SPSS was used. The use of electronic interconnection was found to be lacking as a part of the results of the study.

In contrast, students have been disadvantaged by GFP's use of strategies to reduce bureaucracy. The promotion of informal meetings between GFP employees to exchange opinions on employment has also been described as a further weakness. The frameworks of know-how management have,

however, been highly rated. The results indicate that information management is a crucial phenomenon for social change promotion. Providing the answer to today's business market's survival and growth and that the only way to survive modern day's industry is to produce information and to constantly seek the production of innovations known as efficient knowledge management.

Hemon, Aymeric et al [14] found that a literary representation of Hard Ability indicates the conclusions of the literary review. Usually, DPM and PO rely rapidly on administrative capabilities, while PE supports highly specialized organizational competencies (TST, QSY). They found out that at the automation level, hard skills were rarely affected whereas at the lower level, it has been rising. Engineering skills tend to overcome all other competencies, regardless of the level of automation. On the other hand, as the level of automation grows, the lesser the MNG skills are addressed by the interviewees. A pattern was observed which suggested that automation caused an impact on the teams which convinced them to organise themselves.

IV. DISCUSSION

In this section, we discuss existing implementations of collaboration tools. Attributes that are relevant to real-world application are detailed upon. Subsequently, we detail the implementation process behind our own collaborative groupware implementation, and describe our current progress. Enforcing Work-From-Home (WFH) causes knowledge workers to encounter new challenges as the new home-based working environment is shared with their families and household members. This causes rise to forms of irritation and distraction that were not encountered before. Hybridity of home and work environments can trigger issues related to lack of productivity and loss of work-life balance.

Lena Waizenegger et al [16] conducted a survey which quantified the outcome of the 2019-20 COVID (SARS-CoV-2) pandemic in workspaces. Features of technological advancements were deployed to maintain the status-quo on how business was conducted, especially as the pandemic struck. A wider range of social activities ranging from stand-up comedies and movie screenings became the norm for workspace activities, especially after working hours. In Fig. 3. below, transition of working environments before and after the COVID pandemic are demonstrated. Affordance shift into technological (Scenario 2) from workspace environments (Scenario 1) was caused in order to ensure that similar team collaboration objectives were still achieved, even when working away from workspaces.

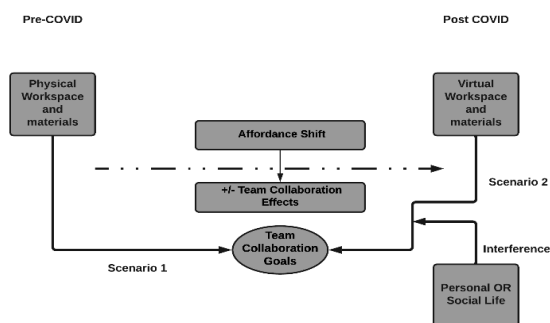


Fig. 3. Impact and Resultant impact on Team Collaboration.

Fred Davis et al [17] proposed a technology acceptance model which aimed to identify the factors that drive people to accept/reject Information Technology (IT), as illustrated below in Fig. 2. He states that the two most critical perceptions about the usage of information systems are their perceived usability and ease-of-utility factor. The perceived utility of a said product is defined as the degree to which a person feels the utilisation of a particular product will increase the efficiency of his/her task. The perceived usefulness is based on the value underlying the philosophy of rational action. It is believed that a person's decision to use informational technologies is ideally indicated by its intended usefulness.

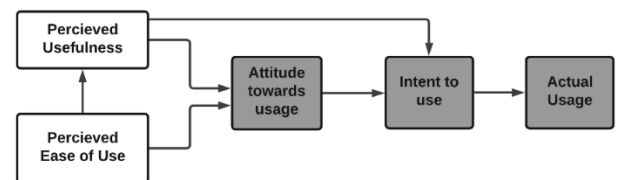


Fig. 4. The Technology Acceptance Model (TAM)

As a construct for perceived behavioral control, Icek Ajzen [18] introduced the Theory of Planned Behavior (TPB) which has been illustrated below in Fig. 3. The construct was characterized by the expected challenge of carrying out a certain behavior. The Theory of Planned Behavior (TPB) considers each individual as a rational decision-maker. Individuals test perceived behavioral control using a process analogous to the model of expectancy-value model. Individuals multiply the strength of the control belief by perceived power of the control factor. Individuals multiply the strength of the control belief by TPB has since been commonly used to understand the reasons behind why an individual is likely to accept certain technology.

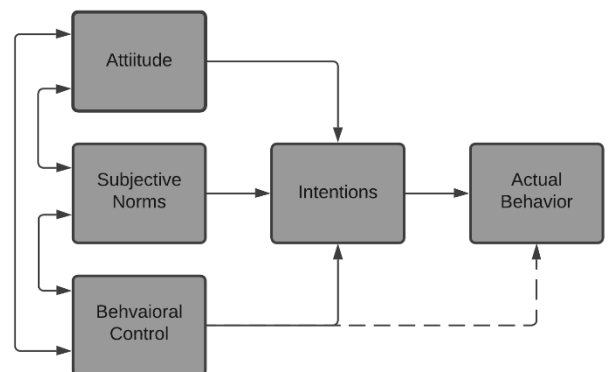


Fig. 5. Theory of Planned Behavior (TPB)

Shirley Taylor et al [20] established a hybrid approach which utilized Theory of Planned Behavior (TPB) in conjunction with integration of Technology Adoption Model (TAM) in 1995 and named it as the Decomposed Theory of Planned Behavior (DTPB) as the said model did not take into

account belief frameworks. Implementation of this approach was carried out by integrating the TPB predictors with TAM perceived utility constructs, and an illustration of this has been demonstrated subsequently in Fig. 6. Perceived utility and ease of use/compatibility are included. The moral system of faith includes peer discipline and superior power. The mechanism for regulating belief requires self-efficacy, tools that promote the adoption of technology.

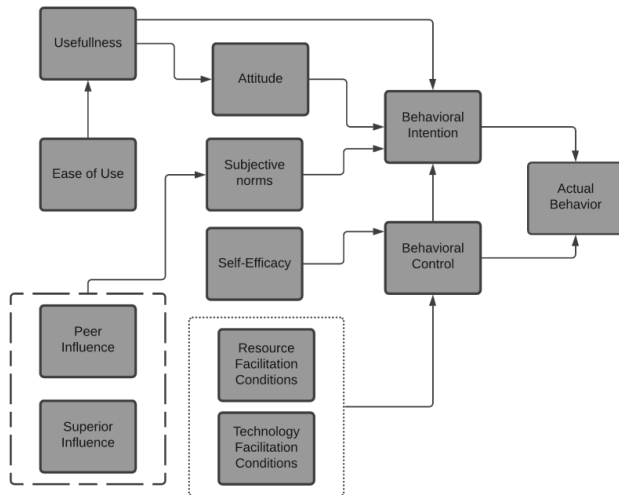


Fig. 6. Hybrid approach utilizing Theory of Planned Behavior (TPB) in conjunction with Technology Acceptance Model (TAM).

To perform an analysis over cost-effectiveness of existing collaborative groupware implementations, we have evaluated and chosen examples of collaborative groupware that support a diverse range of user requirements, at appropriate price points with respect to the end-user. A comparison of these collaborative groupware along with their domain-specific use cases and pricing options is given below in Table 1. Standard Pricing in the comparison table below refers to the pricing rates that are relevant for the individual user.

TABLE II. COMPARISON TABLE OF USE CASE AND STANDARD PRICING OF PRODUCTIVITY TOOLS

Sr. No.	Product Details		
	Product Name	Category	Standard Pricing
1	Slack	Communication	\$ 6.67 /month
2	Monday.com	Project Collaboration	\$ 9.99 /month
3	Microsoft Teams	Document Management	\$ 5.00 /month
4	Flock	Project Collaboration	\$ 4.50 /month
5	SharePoint	Document Management	\$ 5.00 /month
6	Google Docs	Document & Project Collaboration	\$ 5.00 /month

V. CONCLUSION

The primary objective of this research paper is to study the factors that direct collaborative groupware implementation and overall effect on group performance. Perceived utility of collaborative instruments governs the deployment of software tools that can boost the team productivity. In addition, it has also shown that the use of tools to facilitate the completion of

a task affects the efficiency the group's performance positively. This research paper will help researchers who intend to build their own collaborative groupware implementations. Researching the use of tools in the corporate sector helped us understand that having instruments with versatile functionalities can act as a support role in constructing better designs and make the maximum out of available resources. Whilst performing this literature survey, a few potential points which needed future investigation were determined. These points include learning more about worker interaction in a virtual environment to improve their efficiency in complex tasks. A direction that future research in this area should aim at is to develop a deeper understanding of an end-user's Point-of-View (POV) and preferences with regards to productivity groupware. This could be implemented by conducting an institutional level survey to help determine their requirements. Gaining a deeper understanding of this will enable designers to design better implementations.

In summary, this research paper will help researchers who intend to build their own collaborative groupware implementations and integrations.

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