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An Empirical Study on the Influence of ICT-Based Tools on Team Effectiveness in Virtual Software Teams Operating Remotely During the COVID-19 Lockdown

Uday Kumar Kanike
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An Empirical Study on the Influence of ICT-Based Tools on Team Effectiveness in Virtual Software Teams Operating Remotely During the COVID-19 Lockdown

by

Uday Kumar Kanike

A Dissertation Submitted in Partial Fulfillment of the Requirements for the Degree

Of

Executive Doctorate in Business

In the Robinson College of Business

Of

Georgia State University

GEORGIA STATE UNIVERSITY

ROBINSON COLLEGE OF BUSINESS

2023

ACCEPTANCE

This dissertation was prepared under the direction of the *UDAY KUMAR KANIKE* Dissertation Committee. It has been approved and accepted by all members of that committee, and it has been accepted in partial fulfillment of the requirements for the degree of Doctor of Philosophy in Business Administration in the J. Mack Robinson College of Business of Georgia State University.

Richard Phillips, Dean

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ACKNOWLEDGEMENTS

I am profoundly grateful to the individuals who have played a pivotal role in the completion of my dissertation. Their unwavering support, guidance, and encouragement have been instrumental in making this academic journey a success. I would like to express my heartfelt appreciation to each of them for their invaluable contributions.

First and foremost, I would like to extend my deepest gratitude to my family. My wife, Malathi Adike, has been my rock, offering constant love, support, and understanding throughout this demanding process. Her unwavering belief in me and her sacrifices have been the cornerstone of my perseverance. To my children, Tanish Kanike and Nitya Kanike, your presence and unwavering support have been a constant source of inspiration. I am grateful for the moments of joy and laughter you brought into my life, providing a much-needed balance and motivation. To my mother, Shantha Kanike, and father, Shiva Raju Kanike, your unconditional love, guidance, and belief in my abilities have been unwavering. I owe my success to your unwavering support and sacrifices.

I am deeply indebted to my advisor, Dr. Yusen Xia. His expertise, guidance, and unwavering commitment to my academic growth have been invaluable. Dr. Xia's extensive knowledge, insightful feedback, and continuous support have played a pivotal role in shaping the direction and quality of this dissertation. I am profoundly grateful for his mentorship, which has not only enhanced my research skills but also fostered personal and professional growth.

I would also like to express my heartfelt appreciation to the members of my dissertation committee, Dr. Satish Nargundkar and Dr. Likoebe Mohau Maruping. Their expertise, insightful feedback, and constructive criticism have significantly contributed to the refinement and rigor of this research. I am grateful for the time and effort they dedicated to reviewing and guiding me through this process. Their valuable inputs and suggestions have greatly influenced the quality and depth of this dissertation.

Furthermore, I would like to extend my gratitude to my friends and colleagues who have supported me along this academic journey. Their camaraderie, intellectual discussions, and moral support have been invaluable. I am grateful for the exchange of ideas, encouragement, and inspiration they have provided along the way.

I would also like to acknowledge the support and resources provided by Georgia State University and its staff. Their assistance has been crucial in facilitating my research and ensuring a conducive environment for academic pursuits.

Finally, I extend my deepest appreciation to all the individuals who have influenced and inspired me throughout my academic career. Their contributions may have been indirect, but they have shaped my research interests and scholarly pursuits.

To my family—Malathi Adike, Tanish Kanike, Nitya Kanike, Shantha Kanike, and Shiva Raju Kanike—you have been my pillars of strength and motivation. I cannot thank you enough for your unwavering love, understanding, and sacrifices. To Dr. Yusen Xia, Dr. Satish Nargundkar, and Dr. Likoebe Mohau Maruping, your expertise, guidance, and feedback have been invaluable. I am forever grateful for the knowledge and wisdom you have shared.

To all those mentioned above and to those whose names I may have inadvertently omitted, please accept my deepest appreciation for your unwavering commitment, guidance, and support. This dissertation would not have been possible without your contributions.

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ABSTRACT

An Empirical Study on the Influence of ICT-Based Tools on Team Effectiveness in Virtual Software Teams Operating Remotely During the COVID-19 Lockdown

by

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August 2023

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Major Academic Unit: Executive Doctorate in Business

Aim: The research aims to examine the impact of usage of Information-and-Communication Technology tools on Software Team Effectiveness, especially the virtual teams, during work from home because of the Covid19 outbreak.

Variables: The research has considered the Salas et al. (2005) model with eight constructs (adaptability, mutual performance monitoring, mutual trust, team orientation, closed-loop communication, leadership skills, shared mental models, and backing-up behaviour) for measuring team effectiveness. The usage of ICT tools has been measured using the instrument developed by Nagi and Habok (2018). In addition, the moderating effects of the variables 'age' and 'gender' have also been tested in this research.

Methodology: This study employed quantitative research methods. Cluster sampling was used to collect data from 279 software professionals who worked at home during the pandemic. In order to analyze the primary data, SPSS software is used. In order to test hypotheses, the research uses ANOVA, regression, simple percentages, and principal component analysis.

Findings: The findings showed that using ICT tools impacts all 8 constructs of the variable team effectiveness. Among the most used ICT tool, the project management tools, and social media were mostly used by the employees. Similarly, the mutual team trust, backup behaviour and shared mental models were found to be more impactful than other constructs.

INDEX WORDS: ICT tools, virtual teams, software development, Covid19, team effectiveness, team performance, mutual performance, leadership skills, communication.

I INTRODUCTION

Technology and communication have taken up the world as a “whole population” under its impact and dependence. Without technology or any source of communication, no human could survive currently, especially those who are employed and depend on technical aspects, software developments, hardware productions, and operations. Henceforth, the study will be focusing on “virtual teams and their performances in software along with the impact of Covid-19” since the trend has altered many sectors (non-technical based sectors) to depend on ICT-based tools.

I.1 Research background

The term ICT, along with its application and concept, has been defined by authors Yekini (2014), Yekini and Lawal (2012) as “unified and integrated communication along with telecommunications (wireless and wired), computers and other electronic gadgets towards manipulating information, storing, and accessing data and transmitting information (audio-visual).” Furthermore, Assar (2015) defined ICT as the extended form of IT (Information Technology) and a combination of IT with IS (Information Systems). ICT is thus an affiliation that combines technology and communication as a unified resource for communicating. Similarly, organizations also use ICT-based tools for meetings, group discussions, and integration of clients from varied time zones. Thus, ICT is vital in all sectors.

Various sectors employ ICT-based tools for their technical operations, but healthcare has been a significant player until Covid-19. Currently, ICT is also commonly adopted and utilized by the education sector for simulation courses and e-learning practices (digital learning); the finance sector to organize, store and access data; the healthcare sector for employees and patients’ record maintenance; and so on. Therefore, as per the usage of ICT-based communications, there are huge opportunities globally for the educational and healthcare sector. Nevertheless, on the other hand, when the organizations are concerned, the technical aspect-oriented teams (especially the software-based teams) rely upon the ICT solely for rapport communication and delivering projects through SMAC (Social, Mobile, Analytics, and Cloud) systems (Adamczewski, 2016).

Though the organizational environment is essential for employees to maintain rapport relationships with employers, generally, in the current trend, people (work-from-home, different time-zone employees) globally seek ICT-based tools for the purposes of accounting/finance (82%),

warehouse management (58%), human resources (71%), production management (19%), Customer Relationship Management (49%), sales and purchase services (54%) and office work-support including e-mail services (93%) (Adamczewski, 2015); The Virtual Team as a concept emerged within the office-works that assists employees with similar real-time experiences which gained acceptance and importance in the late 90s and early 20s (Adamczewski, 2016).

The management or supervisors create virtual Teams (VTs) within organizations to ease the processes and operations by grouping people with similar tasks and goals, unlike the employees who do not share the same goals and tasks. In laypeople's understanding, the VTs are created to achieve successful project deliverables with a large group of employees at different time zones and with no organizational boundaries. The virtual teams in an organization will provide the employers with benefits and minimize their operational costs, and on the contrary, the employees under the virtual teams will be monitored and assisted by the team managers appointed by the management or the employer(s) (Hacker et al., 2019). VTs, in general, consist of many issues, where: language, misinterpretation of communication, interpersonal trust, leadership management, and geographical barriers are the primary challenges.

Virtual teams could also be defined as "Global Virtual Teams (GVTs)" since the individuals are virtually connected and could be from varied geographical regions and time zones. To attain this cross-sectional group management, team leaders or managers from the organization should train their employees and should also maintain positive rapport to achieve an organizational goal; however, the VTs face trust issues and misinterpretation of communication where the leaders and managers ought to coordinate the team members through proper ICT collaboration. Adopting the right ICT tools and communicating, managing, monitoring, and evaluating the members would involve the individuals and work towards achieving their goals and organizational goals (Lee, 2016). The virtual team's location is dispersed, and the traditional team's location is co-located; similarly, the communication of the virtual team is asynchronous, and the traditional teams are synchronous.

The dimensions of traditional teams in an organization are based on face-to-face communicative channels, minor ICT usage, and homogenous socialization and culture. In contrast, the virtual teams' dimensions are heterogeneous in socialization and culture, intense ICT usage,

and media-based communication (Grober and Baumol, 2017b). Henceforth the team's effectiveness and the project deliverables will vary in quantity and quality.

Team effectiveness in an organization is essential and crucial since the project deliverables of software teams are based on time, budget, and delivery rate. Since the VTs in organizations are ICT dependent and teamed up as geographically dispersed people under the same goal and tasks, the trust and belief among the virtual participants are considered as the utmost factors that affect the team effectiveness and achieve a higher team effectiveness rate such that the barriers and challenges must be solved (Ghavifekr et al., 2016). The ICT collaborative tools could be utilized for various operations by people in varied environments, such as education (e-classrooms), healthcare (e-counseling and e-consulting), agricultural and food (e-consulting, online discussions). The IT sector thus assists various industry-based organizations and companies with the ICT collaborative tools (computers, laptops, digital cameras, printers, scanners, interactive teaching-box, data projector, software programs, and so on) towards gaining profit through surpassing traditional practices of "physical presence" of an individual in assistance (Harerimana and Mtshali, 2017). ICT tools play a vital role when considering the effectiveness of a team in an organization. They provide the organization and the employee with numerous benefits, creating a win-win situation for both.

Mostly the people who are into business operations and processes of manufacturing, purchasing, production, distribution, sales (supply-chain management), designing, engineering, and sorting would depend on ICT tools rather than the traditional processes. The UNESCO (2006) define the ICT as "the application and utilization of telecommunications, microelectronics, and computers in the acquisition, storing of data, retrieving data, manipulating data, transferring and disseminating information." The ICT collaborative tools in software teams in organizations assist the employers effectively by reducing the operational cost and similarly the teams by providing them with no boundaries as working time, working place, or environment. Howsoever an individual might psychologically (stress, loneliness, depression, insomnia) get affected by routine scheduling of VTs when he fails to follow the regular schedule in his wellness; contrarily, people who are introverts and avoid expressing their opinions tend to adapt to VTs rather than traditional teams to avoid direct communication and misunderstandings (Satveer et al., 2017).

The ICT tools have been in existence, but it has not been utilized by many people extensively. However, the current technology and internet-based generation have not only adopted the ICT tools into regular/ daily based lifestyle but have also become dependent on social media and other internet-based activities that make their work easier, quicker, and faster in communicating. Similarly, organizations globally adopt ICT tools to make their employees' work more accessible and quicker to deliver the projects and products to the clienteles to gain profit and achieve reputation. Moreover, to achieve stability in the market and gain more reputation among customers, companies adopt new technologies and e-services. However, it could be observed that many companies and organizations fail to achieve success and thus change their product development plans or operational plans accordingly since ICT is considered a "catalysts for change" (Ratheeswari, 2018).

The changes the management implement with ICT in organizations would not affect the traditional teams at large, whereas the VTs will suffer the impact since they lack training and physical assistance of supervisors with technical errors and issues, especially the software VTs. Implementing hardware within organizations will impact the employees' performance; thus, properly assisting or training them with required knowledge and processes would not affect the teams' performances (Siddiquah et al., 2017).

Team effectiveness in many organizations depends on everyone; hence, managing and monitoring each individual for the team's performance is essential; similarly, an individual's goal and vision also contribute to the organizational growth and effectiveness. The VTs should also follow the traditional teams' practices and value their goals and interests towards organizational growth by collaborating with the managers and team leaders. Team effectiveness relies on ICT tools that assist them with reliable and valid communication, howsoever some issues and challenges could affect the teams' performance which in turn affects the organizational development and profit. For example, independent employees who tend to work and reach their goals will resist cooperating with the team/ peers; it affects the team and organization's performance, and the individuals who work for varied organizations (i.e., freelancers who work for no organizations but for their personal gain) might end up with trust issues with the employer and peers. Hence building up a team with familiar people from the same organization would minimize trust issues and conflicts (Palacios et al.: 2014). Though it seems evident and possible to

team up familiar employees within an organization, individuals with similar experiences, skills, knowledge, and innovation will be targeted and grouped as a team for higher organizational performance by the management. The members in the software VTs, encounter more technical challenges and issues in their tasks, and thus their performance is affected individually; contrarily, the traditional teams are assisted by the technical professionals within organizations in a timely manner, and thus their performances are better, and their work will be delivered on time (Nhu et al., 2013). The ICT in software VTs may provide quicker access, information storage, data manipulation, and other opportunities; however, the outcomes are interrelated with individuals' performances, capacity, willingness, and involvement.

The study focuses on the impact of ICT on software VTs and their performance and hence the ICT tools, team effectiveness, VTs, impact of ICTs on the working environment, especially among the software team members in VTs, and other relevant studies will be analyzed in the later section of the study.

I.2 Problem statement

Information and Communication Technology (commonly known as ICT) is the major element when electronic communication through various devices like computers, mobile phones, laptops, and more, along with IT-based organizations, is concerned. Currently, the technology-based generation requires communication and information for everything that happens around, and without ICT, communication would be impossible. Thus, it is required that ICT-oriented tools must be offered to the client-end appropriately without bugs, lags, and errors towards uninterrupted communication. Therefore, varied sectors, such as the healthcare sector, education sector, and finance sector (i.e., it may be public and private sectors) adopt the ICT into their operations as a vital tool for mass communication, especially among a large group of people.

When an individual seeks facts and knowledge through communication, the primary tool that assists in gaining access and transforming an individual's skill and performance into heightened ability with wide data access (Kumar et al., 2015) would be ICT. The impact of Covid-19 on all sectors (especially healthcare and education) has made the software teams focus on specific areas in ICT that allow users to provide end-to-end communication to minimize the virtual experience and offer the real-world experience. ICT in public and private sectors has thus boomed and paved the way for software developers to append new advanced techniques and tools into the

existing tools, to stay at the top, and to develop more new software that could overcome the existing tools and applications to eradicate errors towards offering the user with more advanced processes.

The software teams strive through day-and-night processes, but it is not achievable in a short time, budget, labor, and effort. Hence software teams focus on appending changes rather than developing new teams and operations towards providing the best outcomes within their limited time access through virtual assistance. However, there are new and developing issues, hindrances, and challenges in developing software and appending changes within the existing software through "virtual assistance." Thus, the study focuses on "investigating the impact of ICT-based tools on team effectiveness of virtual software teams" to develop a model and strategies for overcoming the issues and also to assist the organizations that seek virtual team assistance.

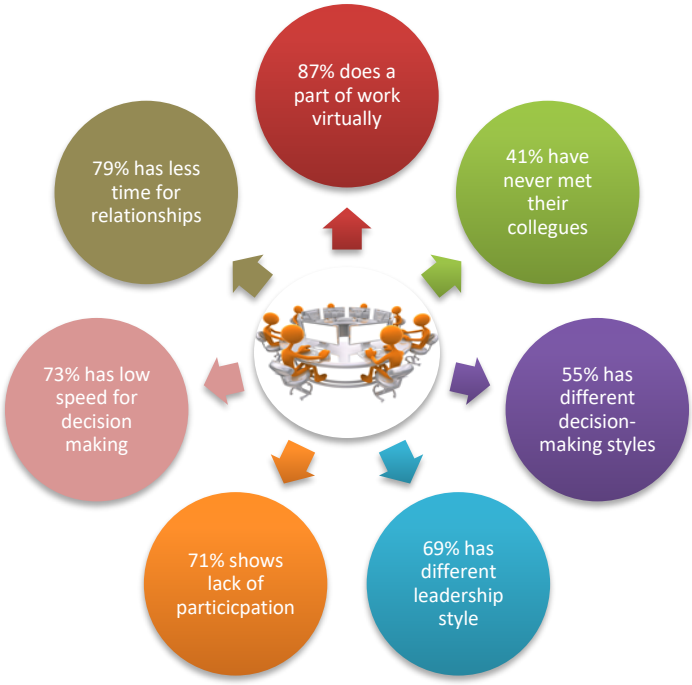

Figure 1: Virtual team's challenges

The main issues towards the virtual team in organizations as identified by Experteer World (2018) are: trust issues, language barrier, interrupted communication, individual participation, leadership and management issues, technical decision making, time-zone issues, collaboration and communication among the participants/peers, indirect communication could be cause for errors, etc. (refer fig 1). When the same is considered for software virtual team effectiveness, it can be

identified that trust issues and miscommunication play a more vital role than any other factors (Hacker et al., 2019). Therefore, to identify the primary determinant of the virtual team effectiveness in software, the study will focus on analyzing the impact of ICT collaboration and how effective the outcomes are than the traditional software team effectiveness in organizations.

The problem could be stated as follows: ICT majorly impacts the team effectiveness, whether it is virtuality or through real-time experiences, and thus studying its factors will offer the research with evident proof that ICT collaborative tools have an impact on virtual software teams both negatively and positively, where the negative factors outweigh the positive determinants (Gheni et al., 2016).

I.3 Objectives and Aim

I.3.1 *Aim*

This research aims to identify the impact of the usage of ICT Tools by the software professionals working virtually because of Covid19 lockdown on the Team effectiveness of the software teams and examine how the demographic characteristics of the professionals moderate the relationship between the usage of ICT Tools and team effectiveness of virtual software teams.

I.3.2 *Objectives*

Based upon the focused or developed aim, the objectives are:

i. to identify the factors constituting the effectiveness of software teams working virtually because of the Covid19 lockdown situation.

ii. to investigate the usage of ICT Tools by software professionals working virtually because of Covid19 lockdown impact the team effectiveness of the organizations.

iii. to examine the role of gender of the software professionals who are part of the virtual software team in moderating the relationship between usage of ICT Tools and team effectiveness.

I.4 Research questions

The research focuses on finding solutions for the identified problem through aims by analyzing the following questions:

i. What are the factors that constitute the team effectiveness of software teams that are working virtually because of the Covid19 lockdown situation?
ii. How does the usage of ICT Tools by software professionals working virtually as a consequence of Covid19 lockdown impact the team effectiveness of the organizations?
iii. How does the gender of the virtual software team's software professionals moderate the relationship between ICT tool's usage, and team effectiveness?
iv. How does the age of the software professionals who are part of the virtual software team moderate the relationship between ICT tools usage, and team effectiveness?

I.5 Significance

The study's significance offers the readers and the investigators of similar topics to adapt the techniques and tools along with the information. The researcher chose to analyze the impact of ICT-based tools on virtual software team effectiveness since the current global trend and innovation rely hugely upon ICT and communication. Though there are existing research and studies (Govender and Govender: 2014; Harerimana and Mtshali: 2017; Lee et al.: 2018; Tseng and Yeh: 2019) that focus on the impact of ICT and team effectiveness as a separate subject, there are lesser recent literature resources (Bhat et al.: 2017; Gao: 2014; Palacios et al.: 2014; Xiao and Jin: 2010) when the "virtual software team effectiveness" and "effective team performance through ICT based tools" are concerned.

Thus, the current study will offer information, valuable resources, and reliable insight that could significantly produce outcomes when studied by future researchers. The research also provides information on ICT-based tools team effectiveness, which could be studied for comparative analyses upon traditional team effectiveness, and a cross-sectional study. Howsoever, the data collection under global targets would be a huge time-consuming factor; restricting the targets would significantly provide the author with more accurate and appropriate outcomes. Thus, the study will focus on US companies and employers based on the virtual team concept, in other words, who work from home because of Covid19 lockdown restrictions. The study will examine to what extent the Team effectiveness is accomplished despite working in a virtual mode.

II CHAPTER 2: REVIEW OF LITERATURE

The literature in investigations is the most significant part and offers the researchers much data and numerous facts that could be analyzed against the chosen topic. However, some studies analyze the data to contradict the subject matter to prove that the existing facts and truths about a particular issue are just a myth or conducted based on invalid data and non-reliable resources.

II.1 Review on the impact of ICT Tools in Organizations

Petiz et al. (2015) examined the relationship of ICT in the organization and how it impacts organizational growth as core learning and innovation (L&I). Through their investigation, it has been found that organizational capability depends on the employees' performance and skills, knowledge, and innovation. Through their extensive study, the authors found that market surveillance, technology surveillance, idea generation, knowledge and dialogue transfer, problem-solving skills, competence, and training development are the main factors towards organizational growth that offers employers higher profit. On the contrary, the study insisted that the ICT resources in the organization also assist the employees in seeking innovative strategies to attain development rather than leaning on the organizational practices alone. As a result, the study showed that ICT provided employers and employees with a positive impact on the company's development and capability.

Fuller et al. (2016) and Ishaq et al. (2020) studied the impact of ICT tools upon the students and teachers and the students' performances through virtual assistance. Through the study's findings, the authors claimed that ICT as the new trend in education has been and will impact the education sector. Hence, the adoption of ICT-based education in public and private institutions was analyzed. The outcomes insisted that ICT-based services provide an individual with ease of access, quicker communication, real-time-based experiences, and independent attention. Furthermore, the study emphasized that through ICT collaboration, the educational sector will gain more benefits than other sectors and could provide global assistance for students that seek guidance by eradicating time, longitudinal and geographical distances, and familiarity.

Similarly, Tvenge and Martinsen (2016) studied "manufacturing education" through ICT tools, especially in engineering education. Rather than the students' experiences, the authors studied the teachers' experiences in utilizing the ICT tools to assist the students in e-learning in

engineering. The basic structure in education through virtual assistance comes from "interaction as communication," monitoring the performances of each individual, and administering solutions for those who lack training. The same practices and processes are applicable in the workplace, where the team leader is the coach, and the employees are the learners. The research concluded that the ICT tools impact the coaches and learners, but the influence on the learners is more than on the coaches. The study also established that monitoring, manipulating, examining, and evaluating learners through e-learning (virtual assistance) and assessing their performances impact the coaches, physically and psychologically.

The educational sector primarily utilizes ICT tools. But during the COVID-19 pandemic, it was found that the tools used in the workplace affected the employee-employer relationship when the outcome was negative, inflicting loss upon the organization. Hence, many authors have analyzed and examined the ICT-tool adoption and utilization to analyze workplace behavior, the impact of ICT, and team effectiveness, especially the software virtual teams. Oregi et al. (2015) studied the ICT tools for integrating energy in urban-based projects. The study focused on urban-planning development in Burgos, Spain. Through their findings and conclusions, it is observed that when ICT services are delayed, the outcomes achieved through planning and designing, along with applying the schemes, were a failure. However, compared to similar projects designed and planned through ICT tools in Nijmegen, Netherlands, the rate of success for the projects was higher. Hence, the authors conclude that ICT tools and services impact the projects positively and increase the organizations' profit.

ICT tools have become a part of many individuals' lifestyles. However, it also impacts the employees and employers in the workplace. Most research work is focused on "team leaders," "employers," and "managers" since they assess the performance of employees. To prove this, Wet et al. (2016) extensively examined the studies on ICT in workplaces and how it impacts the employees and their personal lives. The study analyzed employees' wellness (25 participants) through interviews (semi-structured questionnaire). It concluded that unlike the initial stages of ICT implications in workplaces and the negative impact of ICT tools on employers and employees, the current ICT-tools-based work is efficient and quicker, resulting in more positive than negative well-being. However, the quality of the communication and interactions decreased while the quantity increased, which was considered a disadvantage.

Aziz et al. (2016), in their study, observed that ICT tools in the current technology-based generation depend hugely upon the software-oriented tasks that inflict pressure and stress upon the team leaders. In addition, the diversification of ICT tools for varied sectors has impacted the software developers to focus on innovative, creative, skill- and knowledge-based solutions rather than providing structured and standard ICT tools.

According to the demand, the ICT tools are restructured and often updated with rapid software changes, making the software employees learn and execute under supervision as per the industry's needs and demands. Changes and innovation are necessary when demand fluctuates, and market necessity is assessed based on competency. Hence, the authors focused on assessing the latest technologies and their impacts on employees in creating software that changes along with needs (i.e., ICT evolution). The study, thus, established and emphasized to their readers that software developers (employees) aim to create ICT tools for varied sectors that could append changes into their existing ICT services and operations under ease towards evolution rather than depending on newly developed ICT tools.

The early literature on ICT by Palvalin et al. (2013), Stawnicza (2014), and Goncalves et al. (2014) examined the ICT-tool-based teams versus traditional teams in organizations. Through extensive analyses, conclusions, and findings, the investigators observed that the traditional teams in organizations have direct communication, whereas virtual teams lack direct/face-to-face/eye-contact-based communication. With the virtual teams, there is also a lack of direct monitoring (physical monitoring) of employees in accessing essential data/files and deleting or manipulating data in VTs, along with restricting them from unwanted or unimportant activities that affect the work's quality and timely delivery. Additionally, lack of training and assistance in VTs and dissatisfaction towards peers or managers for de-motivating or embarrassing an individual in a group meeting in traditional and virtual teams were observed. The studies conclude that though both methods have advantages and disadvantages, due to the current environment induced by the COVID-19 pandemic, employees prefer VTs to traditional teams.

Moreover, it is globally accepted that the projects done through virtual assistance are not necessarily failures, delayed, non-applicable, costlier, and non-dependable. On the contrary, like the products/development created by traditional teams in organizations, the VTs are also able to create valuable and reliable products impacted by the ICT tools. Thus, the studies insist that virtual

teams' performances should be evaluated to keep them on par with traditional teams to achieve organizational development and growth.

Hortovanyi and Ferincz (2015) examined the ICT's impact on on-the-job (OTJ) learning in 62 SMEs by targeting around 200 managers and knowledge workers. The study insisted that ICT positively impacts OTJ training or learning by employees. The author concluded that an organization's internal processes depend on training, learning, and the right tools for operations, where the adoption of ICT and strategic solutions by an employee is a must. Through their findings and investigation, it is found that by utilizing the ICT optimally, intra-organizational knowledge transfer and learning increase rapidly; however, this statement is contradicted by Jain (2020). Jain (2020) studied ICT's impact on enhancing employees' knowledge. She found through her extensive research that although knowledge management is maintained among peers and team members, some individuals tend to limit their "knowledge sharing" practices and "knowledge transfer" ability with their team members and peers. These challenges among individuals or self-barriers in assisting others have increased recently, especially among the growing software developers and design planners. The same challenges and issues have been identified in the software VTs in organizations. Hence, when the barrier is knowledge-based in software creation among the VTs, the innovativeness, creativity, uniqueness, and genuineness decrease, and employees tend to offer the same skill and knowledge-oriented products that could affect the organizational growth. The study concludes that sharing knowledge about organizational performance will improve employees' performances.

According to Corgnet et al. (2015), Software in the Virtual Organization (VO) integrates people into teams and varied departments within one platform. So that the teams across varied departments and employers could monitor the projects' overall completion rate; similarly, the software teams could integrate their sub-teams (planning, designing, engineering, and development.) and their opinions through intranet or chat and e-mail facilities. Furthermore, the author developed a software model where the teams could collaborate and cooperate to minimize the tasks' load, and thus, everyone could keep an eye on the project's development prior to the management's decisions upon delivery. Thus, VTs also achieve real-time effort, assistance,

training, and access, and gains more control over the project, like traditional teams. However, the investigators strongly insisted that VO software teams could also inflict damage upon credentials data (data theft, manipulation, and deletion) when provided access; hence to protect against misuse of access, monitoring and evaluating the employees' actions and team leaders should do usage through the regular interval. It impacts the manager-level or team leaders' responsibilities in VTs more than in traditional teams.

Lapates et al. (2019) examined the impact of the ICT upon the community aligned with the workplace, i.e., an extension unit of the CAS-IT department at Bukidnon State University. Through the study's investigation and analyses, the authors keenly observed that ICT also impacts the workplace community, where the stakeholders contribute to the organization and community through welfare schemes. The study also analyzed and concluded that integrating ICT in the workplace will impact the organization (managers, employees, and employers) towards sustainability and compete in the market with better opportunities.

Mesmer-Magnus et al. (2012) and Okechukwu et al. (2017) investigated the virtual management and the relationship between VTs and employee performance in the Lagos State of Nigeria based on specifically chosen e-businesses with 414 employees. Through their conclusion, it is apparent that e-commerce in the current generation is more reachable and easier to access than traditional commerce. Hence people globally adapt to online-based operations through developed applications. Software teams are the main players when creating, designing, and planning applications based on market necessity and trends. To achieve the demand, they should provide the clients with relevant yet innovative products and information. The study found that when teams work virtually (VT) in organizations, their performance increases compared to traditional teams, and team effectiveness is positive compared to traditional teams. Hence ICT impacts the employees positively in VTs.

Thus, through the obtained literature, it is explicable that ICT impacts the workplace both negatively and positively. However, when employee performance is focused prior, it is more likely that ICT in organizations impacts employee performance positively, especially in the VTs, since each employee works towards their success globally by challenging all the barriers (time, cost, location, communication/language, and access.) (Marlow et al., 2017). Though 'virtuality' (reality through virtual experience) cannot bring out reality and, it has its' own merits, where ease of access,

quicker deliveries, the interaction of individuals among the groups, no time or geographical restrictions, no boundaries like traditional teams are considered as positive impacts on the employees. Particularly the Software VTs where innovation, creation, uniqueness, and creativity are of utmost necessary (Hannif et al., 2013).

The usage of ICT tools in Software VTs thus impacts the employees' performance and growth, positively and negatively, as per the organizations' demand, processes, team effectiveness, and structure (Piccoli et al., 2004); however, through the studies, it has been identified that positive impact of ICT upon the Software VTs are increasing in the recent years.

Jolex and Tufa (2022) investigated the ICT impact on young Malawi based 317entrepreneurs (agripreneurs) in Africa. The study analyzed the ICT tools, their usage by the participants, and the availability of ICT tools in the business forum. With recent technological impact and information and communication advancements, the usage of ICT tools in various sectors has increased where the agriculture sector improvised from traditional media (print, radio, and television) to modern media (computers, laptops, tablets, satellites, mobile phones, e-mails, SMS: Short-Message-Services and other software-based applications). The study found that usage of ICT tools, especially modern ICT tools in education, businesses, and office environment were primarily (80%) by young people (15-34years) in developed countries like Eurasia and whereas in underdeveloped and developing countries like Nigeria, Uganda, Niger, Malawi, Tanzania, and Ethiopia it was a mere 21%. Furthermore, the authors have investigated the usage of the internet and ICT tools by young people globally, and they concluded that 30% of youngsters (15-24years) use ICT tools in underdeveloped countries; 67% in developing countries, and 94% in developed countries among which the business operation-based ICT tools use contributes 80%. Hence, it is safer to claim that ICT tools impact many sectors in the modern era and digital data users. However, the lack of technological advancements, availability of ICT tools, readiness for change, and lack of information services in underdeveloped countries hinders the sectors like financial management, software programming, IT, agriculture, education, and more. As a result, it decelerates a country's growth.

II.2 Impact of Team effectiveness in organization

The term "team effectiveness" with team performance has been studied recently and analyzed by researchers to assess the growth and development of both the individual and the

organization. For example, Tohidi (2010) studied team effectiveness and productivity by analyzing the factors: motivation, information technology, measurement, team size, wage, goals, leadership, training, and rewards. According to his opinion and research outcome, team effectiveness lies in individuals rather than analyzing the team as a whole. The authors stated that team effectiveness in an organization relies on communication, peer assistance, supervisors' and top management's involvement, and team leadership's attributes, skills, and characteristics. According to the author, Tohidi's team effectiveness reflects an individual's satisfaction and engagement in job and career development aspects; the author also aimed to analyze and examine the factors related to employee motivation, goals, team size, and how they are related to team effectiveness and performances. The findings through research by Tohidi revealed that rewarding employees and increasing pay as per productivity and development also impact their job satisfaction along with team effectiveness.

Rico et al. (2011) studied team effectiveness through an in-depth literature survey. According to outcomes and findings, they insisted that a "team" does not always provide organization and peer/ members with adequate knowledge, skills, attitude, and experiences. That is required contrarily the team members could lack in necessity characteristics (for instance strategic, creative/ innovative, and motivated.) that are utmost in the team to overcome challenges and issues when faced under critical situations. The authors provided findings and outcomes through SWOT analysis towards measuring the team effectiveness in organizations. Authors focused on studies from year1999-2009 as longitudinal research upon teamwork and team effectiveness. Most of the studies from the 90s stated that a "team" in organizations certainly makes an organization grow, develop, profit, and increase productivity. However, studies by authors Day et al. (2004), Mehra et al. (2006), and Carson et al. (2007) suggested that distributed leadership in a team, whether it is traditional or virtual, must be positive and effective for the productive team and if not the team under the distributed leadership will have a negative impact and outcomes that affect the organization.

Authors Fransen et al. (2013) examined the factors of team development and effectiveness in a computer-supported collaborative environment (learning and working). First, they examined the direct communication and indirect communication factors through online teaching and working as the mode of communication (i.e., virtual setup) and how the individuals as a team gain knowledge and experience, and how the virtual concept assists and impact individuals towards

attaining the goal and finally estimating the performance through team contribution and outcomes of their work as team effectiveness. Next, the authors found the differences between learning-team and work-team effectiveness, where (a) work-team in organizational context deals with performance, inventiveness, creativity, speed, accuracy, and collaboration, and (b) learning-team in teaching/ educational context deals with cognitive ability, learning style, practices and process of learning, activities, assignments, and group projects and finally outcomes of each individual in a group/ team. Though the study focused upon two broad aspects, "team effectiveness" was the primary focus, and they concluded that to improve the team effectiveness in both organization and teaching context, the leadership skills, attributes, and knowledge should be positive along with individual's satisfaction level, adaptability, team orientation, team cooperation, mutual understanding, and shared communication.

Sharif and Nahas (2013) also studied the educational context and how team effectiveness impacts individuals and organizations in reference to the UAE. According to their assessment and analyses, it could be understood from the research that it is of utmost necessity to adopt the right tools and techniques in weighing the team's effectiveness as per the field and respondents. The findings, along with results, pointed-out that team effectiveness is the sheer outcome of team performance in an organizational context, where the performance of team members could be assessed and evaluated through skills, innovativeness, creativity, involvement/ engagement, and individual performance, and decision making through strategic thinking. The study also found that an individual in the team or overall team in the organization must possess the following characteristics: clear purpose, distinct roles, appropriate culture, suitable leadership, adequate resources, performance feedback, relevant members, trust, flexibility, commitment, communication, coordination, cohesion, conflict management, decision making, and social relationships. When a team has the above characteristics in the organizational context, the study concludes that it is evident that an organization attains higher growth, development, sustainability, and profitability through positive team performances. Thus, the researchers concluded that team effectiveness is impacted by individual attributes, skills, behavior, experience, and knowledge.

Cooke and Hilton (2015) explained team effectiveness and process as professional development of shared experience and knowledge led by positive organizational leaders towards attaining organizational growth. Though the processes, practices, composition of the team and

leadership skills vary with every team in varied organizations, the fundamental requirement in gaining higher team performances and higher turnover lies with leadership skills and team collaboration. Team effectiveness is also impacted by psychological factors like motivation, organizational behavior, positive communication between team members, team's mental model, cognitive interaction, team climate, proper top-to-bottom communication channel, transactive memory, and psychological safety. The authors Cooke and Hilton focused on examining the purposes of team processes and how they could be enhanced through team effectiveness as a strategy and found that team performance and team processes are the only leverage access point toward team effectiveness. The study thus concluded that to experience growth and higher turnover, teams in organizations should focus on the "team process" and increase the team performances through monetary aspects (like rewards, awards, higher pay, etc.,), psychological aspects (like motivation, self-interest, organizational behavior, and processes). Thus, high team effectiveness must be provided to achieve growth and sustainability, which can also be identified as "collective-goal achievement."

Saraswat and Khandelwal (2015) studied about team building strategy as management tool in organizations that improves team collaboration, trust, assistance, and performances which in-turn provides higher team effectiveness. Team in organizational context is considered as “central element” that sticks the organizational operations together, not technology, not finance, not strategy but it is the people that hold the organization towards sustainable growth/ development. Henceforth investing in people/ employees the organization would gain profit and sustainability unlike the organizations that are concerned about products, services, and customer alone. The examination had evidently argued that team in organizations should comprise of people with similar social interests, goals, motivation, responsibilities, roles, tasks but with different skill sets and strategies so that they could manipulate the situation and handle the mishaps with action-plans and creative ideas that could either bring loss or affect the team and its members. Hence team building as an effective process is quite necessary to make the people/ members in team to rely upon each other, trust each-other, have smoother and stronger communication, bridge the gap in lack of knowledge through peer assistance and finally to have fun exercises as learning process

where they could simulate reality through games and events. Thus, a positive team in organizations impacts the organization goals, profit, performance, and its overall growth.

Indrajith and Pravitha (2017) studied factors that focus on and impact the resort environment-oriented team effectiveness in reference to Kerala, India. The study examined five factors of team effectiveness: well-defined goals, proper communication and problem sharing between team members, small teams-based tasks, peer support in decision making, and adequate resources among the team for proper functioning. They found through the investigation that team effectiveness is impacted by goals and followed by other factors like tasks, adequate resources, member/peer support, and sharing problems and knowledge. Through the outcomes, authors, Indrajith and Pravitha have denoted that mutual understanding, trust, mutual performance, and shared knowledge and communication lacked with the respondents as a team, and it could also be noted that leadership goals in the team are, however, higher that glues the team together. The study concluded that to provide more strength among the team members and to build trust to share knowledge and communication, team building is necessary to positively impact the team towards an effective outcome. The conclusion also insisted that to obtain higher team efficiency, the organization should invest in employee engagement factors and provide more advanced technological tools that could assist the employees in better communication.

Gautam (2018) studied the service sector of the Nepalese-based employee performance and team effectiveness. They found that team effectiveness's six dimensions (team skill, leadership, supportive environment, team cohesiveness, role clarity, and team reward) in an organization positively impacts the employees' performances both in the team and as individuals. Among the six dimensions, the authors found that role clarity and team skill were the most influential factors that impact the employees towards an engaged working environment and produce higher services than the other four dimensions. Significantly where team reward and leadership moderately influence the employees and their performances, the team cohesiveness and supportive environment were identified as the least influencing dimensions that impact employee performances. According to the conclusion and obtained results, the study implicates that team effectiveness in an organization evidently impacts employee performances, organizational management, and employees' cognitive ability and state. Henceforth, building a team with adequate skills and knowledge and relevant innovative and cognitive ability-oriented members

would lead an organization towards higher productivity and more profitability. However, the author also argued that management and employers should identify the skills, reward the employees efficiently, and maintain a higher employee retention ratio to attain organizational sustainability.

Prabhu et al. (2019) examined the current belief and assumptions about team effectiveness and how it impacts the employees. The study analyzed existing research in-depth towards gaining insight and opinions upon teams in the organization through team effectiveness factors and dimensions. Firstly, the authors deduced the antecedents of *composing or building a team* in an organizational context as:

i. Interior quadrants (consciousness, interpretative and hermeneutic).
ii. Exterior quadrants (form, positivistic/ empirical, and monological).
iii. Individual's interior constructs.
iv. Individual's exterior constructs.
v. Perceptual/ cognitive constructs (personality, big-five models' dimensions, emotional intelligence, members' abilities, and member preferences).
vi. Behavioral constructs (member diversity and member flexibility).
vii. Paradigm (exterior).
viii. In-house assumption (mix, size, interpersonal skills).
ix. Root-metaphor (more is not better in the team).
x. Field assumption (interpersonal skills are individually based),
xi. Collective exterior-oriented structural constructs (roles and size/ measure) and collective interior-based structural constructs.

Later the authors also deduced the team effectiveness into *context-based constructs, process-based* constructs, and work-design-based constructs. According to outcomes gained from the research, though team effectiveness has varied assumptions and meanings under different constructs, the purpose remained the same, "to reach the goal set by the management or the team leader." However, the study found several factors that altered the existing view of team effectiveness, such as cultural impacts on the leadership skills and knowledge, which could affect the team and employees or provide more workplace spirituality through positive behavioral decisions. In addition, Inside-out and outside-in views through team processes should be

communicated among the team members to avoid bias and interrupted communication; meaningfulness in experiences should be implied upon the team members instead of sole experienced person, and team structure and size should be minimized to avoid conflicts and lack of communication among the members. Thus, the study analyzed and evaluated the factors that impact employees and concluded with outcomes stating that culture, tools, leadership skills, management's decisions, and individuals' behavior in teams either affect or positively impact team effectiveness in the organization.

Berber et al. (2020) examined the relationship between the factors of team performance and perceived teamwork effectiveness in reference to the banking sector. They found outcomes relevant to the above literature, stating that team effectiveness certainly impacts team performances and thus organizational growth. The factors: of quality teamwork, workplace spirituality, trust, communication, innovation, positive behavior, and teamwork synergy were found to impact the team performance positively, whereas the factors of culture, size, measure, and adaptability negatively influence the team effectiveness. Though the study provided outcomes of measuring the team effectiveness and performance, it lacked in analyzing other factors and how they would have influenced the employees and their performances. The conclusion also proved that employees favor team effectiveness factors like leadership skills, advanced tools and techniques, knowledge sharing, problem sharing, decision making, backup behavior, constant monitoring of mutual performances, team results, and shared mental models than other factors.

Authors Batrilik et al. (2022) examined VTs on a global scale, where the MNCs (Multinational companies) are the targets and developed a' 36-item scale' to evaluate the respondents and frequencies. Their scale focused on responsibilities, coordination, authoritativeness, clarifications, feedback, attentiveness, language barriers, trust, interaction, consensus, rewards, praise, job clarifications, knowledge, privacy, secure-data transmission, knowledge-sharing, equality, observation skills, result-oriented members, individual satisfaction, problem-solving, difficulty and ability towards an object, and more characteristics of team leaders and employees. In addition, they found that among the ICT tools and uses, e-mails, video conferences, audio conferences, groupware, mobile communications (text-message, calls, video calling), and mainly the internet connects the virtual teams physically. Thus, digital data and information is transmitted and transferred through social-media access and ICT tools to provide

rapid communication. However, the lack of ICT tools and services hinders this communication resulting in project failures, delays, delays in launch schedule, and sometimes miscommunication. Henceforth, the authors concluded that proper and stable networking with ICT tools would enhance the project delivery in software development, especially among the VT employees, who rely purely upon the network, social media, internet, and ICT tools.

Research by Akkaya and Bagienska (2022) revealed that during pandemics, women leadership had driven the virtual teams in software programs and development towards a positive environment through trust-based rapport via communicativeness and empathy. Therefore, agile leadership was founded as the most effective leadership that increases interpersonal trust and skills among leaders and employees. In a team, leadership skills and a team leader's role are considered crucial in driving the organization towards sustainability. Among many factors that drive a team towards higher productivity, the communication with belief (i.e., trust) from a team leader towards their employees was found majorly (78%) effective and impactful in deciding an employee's dependence level, acceptance level, and flexibility, within a team. Authors thus focused upon leadership factors and trust as significant key players in a team that assisted both the leaders' and the employees' involvement and dedication towards organizational growth. The results concluded that for agile business, a leader's contribution and empathy as factors are identified as positive impactors, especially with women-lead based organizations, in Turkey and Poland.

Thus, team effectiveness in the organization could be narrowed down through evaluating performances and processes involved in the team where the individual goals and team goals through proper communication, trust, adaptability, and shared knowledge along with behavioral aspects of the employees and team leader(s).

Though several factors would affect the performances and effectiveness of teams in an organization, few studies have attempted to analyze and examine the factors to an extent. Henceforth, the studies that examined the factors and how they affect the organizations, especially the virtual team's pre, and post-Covid-19, have been focused here.

II.3 Factors that affect virtual teams in organizations prior, during and post Covid-19

Though there are several factors that would affect the performance and effectiveness of teams in an organization, only few studies have attempted to analyze and examine the factors to

an extent. Henceforth the studies that examined the factors and how it affects the organizations especially the virtual teams pre and post Covid-19 have been focused here majorly.

a) Virtual teams in organizations and team performances, pre Covid-19:

Nydegger and Nydegger (2010) examined the challenges and the issues in managing virtual teams in US-based organizations. According to the authors' findings and outcomes through the study, the virtual teams in organizations majorly face issues in launching, team disbanding, preparation, performance management, and team development. The study and authors also pointed out that virtual teams' most significant challenge and issue is "communication." Factors like lack of trust, involvement, and engagement of the members, face-to-face communication, lack of training, improper knowledge and information sharing and code-of-conduct, and more affects the team. The study, in general, concluded that communication is the utmost necessary factor that will affect the whole team, which would also hinder the team goal and processes; similarly, other factors like trust and team management in virtual teams in organizations also affect the organization hugely that results in loss and team- disbanding. Henceforth authors insisted that building a team with employees with experience, innovativeness, creativity, analytical and logical thinking, and one who has flexibility in working time and tasks are necessary for a virtual team.

Zeuge et al. (2020) studied the team leadership skills and management of virtual teams in organizations. Findings of examination show that to acquire higher performance organization should not only focus on teams and members rather should choose an appropriate and skillful team leader who could manage people, assist people, tackle technological situations, control team members, solves intra-team issues, and problems, strategic and active in communicating to-and-fro. When a team builds with many members, the team leaders should also be divided into groups within teams; if so, the results would be optimal and rapid solutions to challenges and issues will be planned and implied to obtain optimal performance and productivity. Though the organizations can allocate team leaders with similar experiences and knowledge within the same team, authors have argued that allocating team leaders with different mental health and work experiences would be influential, especially in virtual teams. Hence, analyzing the proper leadership style for teams (virtual teams) could minimize losses, heighten coordination, provide greater motivation, and sustain higher performance until the team is disbanded. The study concluded with literature that transformational leadership in virtual teamwork is proven to be effective towards team

effectiveness and thus provide higher team performances rather than individual performance. Transformational leadership is also viewed as an intelligent, original, creative, associative, and positive style that would impact the employees/ the team members in an organizational context.

Similarly, the Garro-Abarca et al. (2021) study also focused on virtual teams in organizations and how they are impacted by internal and external factors, especially technological aspects, to improve team performances and efficiency. Through statistical findings from 317software development companies, the authors studied the virtual team's post-pandemic situation. They found that among several factors that impact team performances and effectiveness in organizations' virtual teams, two major factors: a) communication towards tasks and b) trust towards cohesion, leadership, and empowerment, are witnessed as huge influencers in virtual teams. Though these are identified as significant key players in virtual teams, the study insisted that from the late 70s to 90s, communication and trust have been hugely affecting the organization's operations and pose a challenge in employee retention and employee management by the employers. Henceforth authors studied in-depth the key factors. They found that in software development, ICT plays a vital role in assisting the employees with varied tasks ranging from scheduling to delivering products and services; hence providing quality and frequency in communication is of utmost necessity in a virtual team. Likewise, in virtual teams, when a task is allocated to an employee, controlling them in every step of accessing files might discourage them from involvement. Furthermore, being overly cautious about being watched, hence providing space and distance in monitoring employees (access/login codes for entries into the portal, own ID, and password for access to retrieve data.) must be carried by the team leaders so that they could have the hold on monitoring the works and also could differentiate who does what, when necessary.

b) Virtual teams in organizations and team performances post Covid-19:

Feitosa and Salas (2019) examined the effect of the virtual teams in the US and found that factors affecting the management and the employees are: mutual trust, assessments of individuals in teamwork, process gain, and psychological safety based on foster inclusion. The authors analyzed the factors that impact the virtual teams post Covid-19 and found that generally, due to geographical location distances and communication during the lockdown. In addition, the employees' working-from-home faced challenges through network issues, external interruption of

the neighbors and family members, backup issues due to confidentiality, mutual understanding of each team member, language barriers, and team results.

According to authors Efimov et al. (2020), the significant factors that affect team performance in organizations post -Covid-19 are deuced into communication, trust, and mutual understanding. The study also examined the other factors and simultaneously found another important aspect that influences team effectiveness: "health-oriented" leadership behavior. The existing studies on leadership skills and team effectiveness have focused on their psychological impact on employees, team building, and management skills. However, the lack of studies on health-oriented leadership in organizations, especially in the medical and educational sector, affects the employees where physical health influences an individual's mental health. Henceforth providing physical activities in virtual teams should be focused on and executed by the team leaders for employee betterment. Though post-Covid-19 social gatherings and face-to-face conversations have been reduced and avoided for physical health, it is recommended that employees should relax their minds and body spiritually and physically to experience goodness and fitness through the pandemic. The authors also studied the major reviewed factors: trust, mutual understanding, peer support, supervision by management, problem sharing, and knowledge sharing factors. The outcomes showed that "mutual understanding" in a virtual team lacks trust, belief, and loyalty. Employees might feel distanced due to a lack of emotional and physical contact (direct communication, facial expressions, body signs, and discomfort.) experienced through traditional team activities and tasks. Henceforth authors relayed that, in virtual teams, team leaders should engage the employees/their team members in events and activities that could provide more trust among themselves through communication and sharing of information and knowledge as tools. However, it should be noted that, in virtual teams, sharing knowledge and information might be risky since employees/ members in teams could manipulate and might involve in malpractices to obtain individual monetary gains.

Wolor et al. (2020) studied the virtual team-based team's effectiveness in attaining optimal performance through the Covid-19 pandemic situation. They studied the impact of Covid-19 upon Indonesian-based organizations and provided six approaches as solutions towards higher performance through virtual teams in organizations. The approaches are like other studies; however, the difference lies within the process of applying the approaches to team building to

heighten effectiveness and productivity. Approaches mentioned in the study were: firstly the top management or the employer must identify the needs of the employees working in varied geographical locations and should provide managerial support; secondly, once the necessities are identified the management should provide better infrastructure since the current ICT tools are highly advanced and could reduce the cost for the organization in longer run; thirdly, post the setup of virtual teams in organizations are planned effectively and implied, new policies, regulation and code of conduct (i.e. rules made for virtual teams) should be communicated among the teams and its members and NDAs should also be provided individually prior sharing information and confidential sources; fourthly, scheduling the tasks and time for the members in teams according to their tasks and longitudinal distances; fifthly, communication channel, language barriers, tasks, feedback and trust among team members should be established by the leader and management to ensure employee engagement; sixthly the ICT tools and other technology applications which are necessary at both-ends (party a: team leader and management and party b: employees/ team members). Finally, once the approaches are implied and verified, the knowledge sharing at the end stage should be conducted and monitored through encrypted communication channels so that information is secured, and team members cannot steal data/ information. Thus, the authors ensured that optimal performance in the team through effective management could be achieved in virtual teams when "communication" and "trust" is implied effectively.

Caligiuri et al. (2020) researched international businesses and their HRM practices to identify the challenges and issues faced by organizations majorly across the borders of the UK and USA. The study focused mainly on IHRM issues and how the organizations tackled situations, especially with virtual teams across borders. The findings revealed that travel bans, international immobility/ reduced mobility, social distances, and also intra-firm distancing in organizations caused stress and another psychological impact on the HR personnel towards task allocation, recruitment, safety regulations, health-based activities, training, support-helps, employee selection under virtual interviews and discussions. Though the study aimed at the HRM practices and HR personnel issues in organizations post Covid-19, benefits through virtual teams were also addressed, such as new normal, adaptation of independent working style, and managing uncertainties through self-examination and experiences. However, the vast challenges experienced by the employees in virtual teams, especially across borders, were travel bans, physical assistance, communication channel, language barriers, face-to-face communication, social gatherings,

psychological distancing, and lack of mutual understanding that caused misunderstanding and miscommunication that resulted in project delay and low employee retention. Henceforth authors advised that to retain employees in organizations from different geographical locations, the organization should concentrate upon infrastructure and advanced ICT-based applications that would assist them with alternate solutions even if communication lags or delays, for instance, through encrypted and coded: internal-chats, official mails, e-documents.

Kniffin et al. (2020) have researched the issues, challenges, implications, insights, and future action and research on Covid-19 impact on organizations. The authors reviewed studies and research on the impact of Covid-19 on employee performances in organizations and how (psychological and physical impact) it influenced the employees, teams in virtual spaces, and traditional workplaces during and post Covid-19. The findings acquired through research also insisted that moderators like gender, personality, family status, race, age, ethnicity, and culture impact the team members working through virtual assistance.

Virtual team-based employee(s) post-Covid-19 suffer greater through psychological stress and loneliness than physical barriers and challenges. "Unemployment" post-Covid-19 has been found to be the more significant factor affecting employees across borders. The authors extensively examined the impact of the tools and technological implications in organizations towards assisting the teams and members in the virtual teams. They found that post-Covid-19, the team size, measurement, communication channel, and video conferences increased, which also caused a delay in networks, lags in communication, and other technical issues that were viewed as "virtual richness" prior to Covid-19. The queue for requests in online conferencing through public communication applications might be a fact that hinders with quality of communication, especially during and also post-pandemic situations. The conclusion made by researchers Kniffin et al. was that to optimize the team effectiveness in virtual teams, communication should be of higher quality, especially when the communication channel is opened between/ across borders. Also, the information shared through virtual teams should be encrypted and protected to maintain confidentiality. The risks in transferring documents and information should be assessed prior to sending them, even if it occurs during live team discussions and past discussions.

Morrison-Smith and Ruiz (2020) also reviewed the literature that studied virtual teams' challenges, issues, barriers, and hindrances. Though the study did not concentrate on Covid-19,

the authors intensively analyzed and researched the hindrances that occurred in the virtual teams. The findings of the research state that various factors hinder team members; however, the most common factors are technical infrastructure, common ground, alignment of goals and incentives, cooperative/ competitive culture, work nature, explicit management, trust, motivation, awareness of context and colleagues and finally technical competencies of members in a team. The authors secondarily focused on the organizational benefits of virtual teams. They found that virtual teams reduce costs (operational costs, coordination costs, training costs, location rent/ costs.) and the physical presence of the managers/ team leaders at different times and places.

Furthermore, the technological impact on virtual teams crosses geographical locations/ boundaries that are not approachable and gained through traditional teams in organizations. Finally, the authors pointed out a primary issue/ challenge faced by the team leaders in virtual teams where the members lack interest or engagement in their tasks which evidently results in project delay and loss to the management. Though there are several advantages to virtual teams, many organizations face hindrances in infrastructure, management support, team results, team survivability and disbandment, communication, and lack of assistance from top management. Henceforth when building virtual teams, the authors persist that identifying the members based on their social relations and their skills alone will not provide the organizations with optimal performances; instead, the management should choose members based on technical capability in virtual assistance under dire situations.

Contreras et al. (2020) also reviewed leadership, especially e-leadership and teleworking through virtual teams, as a primary objective. Post Covid-19, many organizations failed to retain employees from different geographical locations due to employees'" psychological, social, and family members" impact on their lifestyle and health. Though there are organizations that provide lodging and technological assistance, employees returned home due to travel bans and health-or-life sustainability risks. However, SMEs and MNCs, along with large organizations, adapted to a "new normal" where their employees could work from home, which was found to be a huge gain towards environmental, social, and economic gain for developing countries resulting from lesser pollution, lesser crowds in public areas and transportation and finally operational costs for organizations, respectively. These gains allowed the government to invest more in health-oriented action plans that provided the employees and organizations with flexible working methodologies.

Technological impact on organizations and teams has been studied frequently post Covid-19 due to the "new normal" phase where virtual teams in organizations have become a must, which changed the traditional processes and practices of teams in organizations. Though the pandemic change has impacted the operations and processes in organizations where social distancing is an effective Covid-19 preventive method and remote working, effective leadership has been identified as a better strategy for virtual team management. However, choosing the leadership style should be associated with "the "inclusive" style, which could combine the organization's vision, mission, and goals with the team's passion and vision. Thus, a leadership style influences the employees" performance and also the goals set by the organization. Henceforth when building a team (virtual or traditional), it should be noted that team leadership is as important as team members with skills and characteristics, which could either positively impact the organization's productivity with higher team performances or, on the contrary, could cause massive loss to the organization from poor team cooperation and coordination under poor leadership.

Wang et al. (2021) studied the impact of remote working in China-based companies during and post Covid-19. They gathered inputs and facts from 522respondents (virtual team employees) through two surveys: one from team members based on their workloads, family support, management support, social support, monitoring, and job anatomy; the other from team leaders: self-discipline and results and performances of team members. The analysis and outcomes done through research provided significant outcomes stating that during the pandemic, the monitoring of team leaders and workload created stress and psychological impact upon the employees. In contrast, family, management, and social support were limited due to health and preventive measures. However, the same situation post-Covid-19 impacts the pressure, workload, and monitoring became lesser since the employees and teams were used to new practices, processes, regulations, and methods. The well-being of employees in organizations posts Covid-19 has been either studied lesser or partially examined along with virtual team's performances. The study's outcome insisted that well-being, team effectiveness, and team performance are interrelated and impact each other. When an organization seeks to attain sustainability and higher productivity post-Covid-19, focusing on employees" well-being and" "self-discipline" behavior in virtual teams is the new norm that would assist the team, leader, and the organization, towards higher performance. Positive behavior, self-discipline, low procrastination, and high work engagement

could be experienced under reliable leadership and supportive management that provide better technical support and social support for the employees,

Through reviewed literature, investigations, and research, it could be inferred and deduced that the team effectiveness in a virtual team is indeed impacted by Covid-19, especially the employees with lesser work experience and lack of technological knowledge and training. Henceforth providing assistance, training, and support to the virtual team members should be a priority to maintain their health and well-being, which could increase the team performance. Also, it is understandable from reviews and surveys upon existing research that ICT tools post Covid-19 identified as a new strategy that connects employees and employers where trust, communication, mutual understanding, and leadership skills should be positive. If not, team results, survivability, behavior issues, shared knowledge, and problems would be hindered, causing intra-problems and challenges that result in negative outcomes affecting organization goals.

c) Comparison of virtual software teams and virtual teams in the pandemic situation in organizations:

Thus, through the above reviews, it could be understood that prior to Covid-19, the team effectiveness in virtual teams relied solely on work experiences and team leadership as driving factors. However, post Covid-19 people from varied geographical locations had to work from home, where communication/ language barriers, experiences, ICT-tools knowledge with trainees, and usage of inadequate ICT-tools availability at home hindered their work. Furthermore, during the lockdown, people were unable to purchase new equipment or repair the faulty ones, which again caused delayed communications, project deliveries, network issues, and sorts. In software management organizations, timely team monitoring and assisting are crucial since they will affect the entire team, resulting in project delays. In IT organizations, virtual teams, especially the virtual teams in software management (project developers), it has been observed by authors (Agarwal et al., 2020; Morrison-Smith and Ruiz, 2020) to evaluate the most impacting factor that hinders team effectiveness and performances in VT. They concluded that temporal dispersion, language/ communication barrier, geographical/ longitudinal differences in work timings, diversity of employees and trust among team members, and knowledge sharing were major criteria that affected performances and effectiveness in VTs among the software engineers.

The virtual team in IT organizations (mainly software) as a mode of work was optional for employees who were unable to visit their organization located farther than their residence (geographical distribution) or for those who voluntarily chose the option rather than working in a physical team. However, post Covid-19, the mandatory virtual team was established in IT-based organizations globally, were factors negatively impacted employees. The factors are asynchronous communication (Yang et al., 2021), trust in leadership, cohesion and empowerment (Garro-Abarca et al., 2021), team engagement/ commitment (AlZaabi et al., 2021), inadequate decision-making, and lack of interpersonal skills with employees (Topaloglu and Anac, 2021) due to less training, lesser experiences in virtual assistances, less coordination/ collaboration, less team monitoring, less/ no conflict management, delay in scheduling a project and its completion along with huge motivation. That was effective in traditional team performances in organizations pre-Covid-19 (Klonek et al., 2021). Thus, post-transition of teams from traditional to virtual teams, it could be observed that the employees were showing lesser indication of adaptation than pre-Covid-19, where the individuals voluntarily were adaptive and self-motivated (Frost and Duan, 2020).

Garro-Abarca et al. (2021) investigated the software developers and their performance with virtual team effectiveness as the primary factor during Covid. They found the differences among the employees in virtual teams impact the "trust factor" (cohesion, leadership, and empowerment) majorly, and thus it creates poor communication (input, task, and output), which leads the team to result with poor performance. The study examined 1200software engineers and concluded that Team Effectiveness is a crucial factor in assessing an organization's growth, and in virtual teams, trust and communication are the next significant factors in procuring higher and positive performances. Though authors focused on software development based on virtual teams' performance during the pandemic, they also analyzed remote teamwork through ICT tools. They found that remote accessing and networking services and components like the internet, computer, laptop, and other communication-mode embedded devices (mobile, tablet, microphone, microphone, and camera) are necessary. However, more than the availability of the necessary hardware and communication components, the employees' involvement, confidence, and readiness to use the ICT tools and to trust the members in the virtual teams are considered (i.e., employee willingness and readiness) as more significant factors. Thus, the authors concluded that employees' satisfaction and acceptance, team trust, and availability of ICT tools in virtual teams are the key factors driving VTs towards higher performances and productivity.

Thus, virtual software teams are majorly impacted by trust, knowledge sharing, team assistance, and motivation, affecting team performances and effectiveness.

II.4 Psychological impact of Covid-19 upon employees that affects team effectiveness

The authors Sasaki et al. (2020) studied how Covid-19 affects the employees' mental health and well-being in organizations' post-pandemic situations and the psychological impact they experienced during the Covid-19 period. Finally, they assessed the impact on the employees' performances based on psychological impact. The study's primary purpose was to examine the relationship between stress as a psychological determinant against Covid-19's impact on an individual's performance and how it might affect the organization or the team. The study focused on the preventions and measures taken by the respondent's management to prevent the health and safety of employees during Covid-19 and found: social distancing to prevent employees from the risk of infection within the confined environment (namely: workplace, meetings, and discussions, canteen, and restrooms), circulations of safety regulations and information through digital media and print media, procedures and new rules for the people working-from-home through virtual teams, temporary paid-leaves or health insurance for the affected employees and staffs, prior information and monitoring regulations of high-risk based employees' accommodation under ravel bans, circulation of new information and unique resources to affected employees under organization's care and finally criteria and other preventive processes for employees awaiting results at home through clinical trials. Though the organization took every measure to prevent the employees from getting affected and cared for those who were affected, the organization failed to provide psychological counseling and overcome: stress, depression, loneliness, fear, anxiety, and anger that causes occupational hazard and distress in working performances. Thus, it is deduced through the investigation that, though physically an individual is cured, it is evident that the psychological impact upon the employees is the more significant factor that affects them, resulting in low productivity and low performance.

Authors Varshney et al. (2020) studied the Indian SMEs and companies that underwent change management and operational changes and how they impacted the employees psychologically. The study focused on psychological factors since the death rates, stress, and unemployment due to the Covid-19 pandemic increased from 2019 to 2020. However, the researchers noted that most investigations and studies were on either preventive measure from

Covid-19 within an organization or how the employees have been affected post-Covid-19, and only a few studies focused on psychological impacts that affected members. Authors found that psychological resilience among the masses in an organization (team, groups, departments.) was uncertain when compared with individuals' assessment of stress and fear. Though the lifestyle and necessities of the employees have changed drastically towards a "new normal" where distancing and independency are necessities within the organizational environment, this has negatively impacted the decision-making, lifestyle, performances, workplace engagement, and coordination. Henceforth, focusing on psychological factors will potentially increase the team performance, productivity, and results, which will positively impact organizational growth and goals.

Hamouche (2020) extensively analyzed and examined the false information and facts that impacted the employees in organizations and those seeking information/ resources from home. The findings and facts from Hamouche's examination stated that "infobesity" (information overload), whether positive or negative, could be more lethal than reality and could significantly affect individuals. In an organizational context, employees who opted for virtual team-based working-from-home opportunities rely upon social media and ICT tools for communication and resources. People who rely on "news" easily get conflicted with overloaded information, cannot differentiate right and wrong, and thus get affected psychologically. The study argued that Covid-19 psychologically impacts not only the employees affected by corona but also those with more fear, anxiety, curiosity, and panic disorders significantly impacted and suffer from depression, sadness, mood disorders, and negative emotions. The conclusion also insists that when individuals' well-being and mental health are aligned with a positive attitude and motivational factors, the individuals would be effective in performance and productivity, thus optimizing organizational growth. However, it is to be also noted that communication within the organization and among the team members should be transparent.

Meyer et al. (2021) examined the employees' well-being and psychological state of Germany-based organizations and how Covid-19 impacted them during the pandemic, analyzing the exhaustion, demands, and resource availability. According to findings, it is provided information that female employees in Germany went through huge distress, psychological impact, and stressors during and after the pandemic. The women's exhaustion as per the proposed outcomes could be classified into physical (job anatomy, lack of childcare availability, mitigating partner's

support during lockdown, chores, frequent contact, and visits from relatives) and psychological (stress, over workload, burden, irritation, anger, depression, social distancing). Unlike other research, authors Meyers focused on psychological impact through gender and found that female employees (women) are the most impacted by Covid-19 psychologically than male employees (men).

Investigators Saladino et al. (2020) studied social and psychological impact along with the well-being of the employees in organizations in Italy. The authors focused on factors like depression, fear, anxiety, and other post-traumatic disorders and symptoms that affect the employees' well-being. They found that technological impact, along with telepsychology perspective, has reduced negative impacts upon the employees' working from home as individuals and as a team. This study has also focused on the impact of technological tools and ICT during the Covid-19 and post-pandemic situations. Counseling, e-treatment through video sessions, and therapies have been majorly studied in this research by authors Saladino et al., and they found that psychological disorders should be treated through proper psychotherapy and telepsychology sessions as counseling where the employees' well-being is focused and treated towards increasing their workplace engagement, productivity, and performances. When employees are disengaged from the team and organizations and distanced from the workplace, they tend to be lethargic and disconnected from the workplace and regulations. However, the pandemic impacts the employees and organizations, which alters the operational perspective of companies to adapt to new norms to provide their employees with better technological applications, communication channels, and flexibility. Thus, to increase employees' performances, organizations should focus on helping their employees with a better environment and psychological therapies.

Giorgi et al. (2020) studied workplace stress in organizations post Covid-19 and how psychologically the employees are affected through social distancing and occupational hazard preventive measures through gender-based examination. The findings with statistical outcomes insisted that PTSD (post-traumatic stress disorder) in employees arises from unemployment, job insecurity, isolation, social distancing, and futuristic uncertainties, especially among recruits and younger employees who lack training and suicidal thought-oriented experiences. Contrarily the study also found that employees with more experience and lack of technological knowledge suffered greater psychological implications and thus were either forced to quit or change their job

preferences that require non-technical experiences and no higher knowledge of technology and applications.

Brooks et al. (2020) studied Covid-19 quarantine and how it impacted the employees with evidence from several existing research in cloud and literature databases on how the negative impact could be reduced. Findings from reviews stated that unemployment and PTSD from the corona pandemic increased employees' anger, depression, frustration, fear, anxiety, boredom, confusion, inadequate facts/ information, supplies, stigma, and fiscal losses. In addition, the study concluded that psychological impact lasts longer and affects the employees in the long run, which could also affect their future employment and opportunities.

Saraswathi et al. (2020) studied the psychological impact on individuals through longitudinal and cross-sectional approaches and ranked the most identified and influential factor. According to their analyses, family-oriented stress and social distancing affected the individuals during the Covid-19 lockdown, where people were forced to stay home to prevent health issues from corona issues. Findings expressed that unemployment, travel bans, job insecurity, and family distancing with individuals in cross-sectional and longitudinal approaches brought depression, anger, fear, anxiety, confusion, insecurity, loneliness, and sadness. These emotions are significant factors that influence individuals' performance and daily lifestyle and affect the teams' results. Furthermore, physical, and mental illnesses from psychological impacts like tiredness, poor sleep quality/ insomnia, less interaction with family members, and binge eating have been noted to be increased among the younger generation during lockdown than the adult, especially when they are unemployed or forced to quit during Covid-19. Thus, conclusions from the study insisted that the psychological impact of the Covid-19 outbreak (during and post) results in negative emotions and mental illness, especially in that who are prone to long-term based disorders or deaths which affects the individuals and thus, it is important for people to treat with proper medication and therapies to motivate themselves and to save themselves from psychological impact and physical illness post-Covid-19. Shimazu et al. (2020) also insisted that recovering from Covid-19's psychological impact (for instance: relaxation, exhaustion, coping) is the most necessary than other aspects like: social (for instance: communications, events, partying), behavioral (for instance: exercises, physical activities) and physiological (for instance: nutrition, sleep). Similarly, the impact of standard ICT tools and technological applications at home by the working-from-home employees

has made the individuals distance from family members, which results in anger, irritation, frustration, and coping issues that also affect their lifestyle and mental health that, increases stress and negative team results.

Ren et al. (2022) focused on and examined the top100 companies ranked in 2019Forbes digital company lists. They found that among the companies, cable and broadcasting, computer services, digital financial services, communications, and hardware equipment services, telecommunication services, and finally, the programming and software-based companies are the most impacted fields where the employees went through psychological-process changes that resulted in poor team effectiveness. The outcomes insisted that an employee's performance and thus team's outcome is "psychologically affected" through eight processes that impact both individuals and teams. They are effective processes like emotional imbalance, anxiety, depression, loneliness, anger, fear, anxiety, the impact of the social processes (male and female references, family, friends), perceptual processes (touch/feel, sound/hear, vision/see), cognitive processes (certainty, causation, differentiation, tentativeness, discrepancies, and insightfulness. In the same detail, drives (risks, power, affiliation, rewards/awards, achievement), relativity (time, motion, speed, and space), time orientations (future, present, and past focus, biological processes (sexual, body, health, and ingestion), informality (swearing, fillers, assent, net-speak, non-fluencies), and personal concerns (death, home, money, kids, leisure, work, religion) are also included in the process. Thus, psychological factors affect virtual teams more than traditional teams in the organization.

II.5 Summary

Thus through the review and literature investigations, it is clearly understandable that, the psychological impact namely, stress, fear, anxiety, depression, loneliness, anger, sadness, suicidal thoughts, confusion, insomnia, binge eating, boredom and more among the workers, staffs and employees in varied companies and organizations creates a negative impression in one’s lifestyle that could affect their future physical activities and lifestyle and also present physical lifestyle with illness and impaired decision making ability with poor judgement that results in lesser performance, less team coordination, poor productivity and finally financial losses affecting company’s turn over.

Similarly, among the factors that impact the virtual teams, communication, trust and team monitoring, leadership skills are the most significant factors identified through reviews. The team effectiveness evidently impacts the organizational growth. Finally, the impact of the ICT tools and services in organization is found through reviews as a positive impact. Hence, the research developed examines the association and impact of the factors with ICT tools usage of the virtual teams.

III CHAPTER 3: THEORY AND HYPOTHESIS DEVELOPMENT

The below diagram (figure 2) depicts the conceptual model giving the relationship between the usage of ICT Tools by virtual software teams working from home due to covid19 lockdown and team effectiveness of virtual teams of software development in US -based organizations.

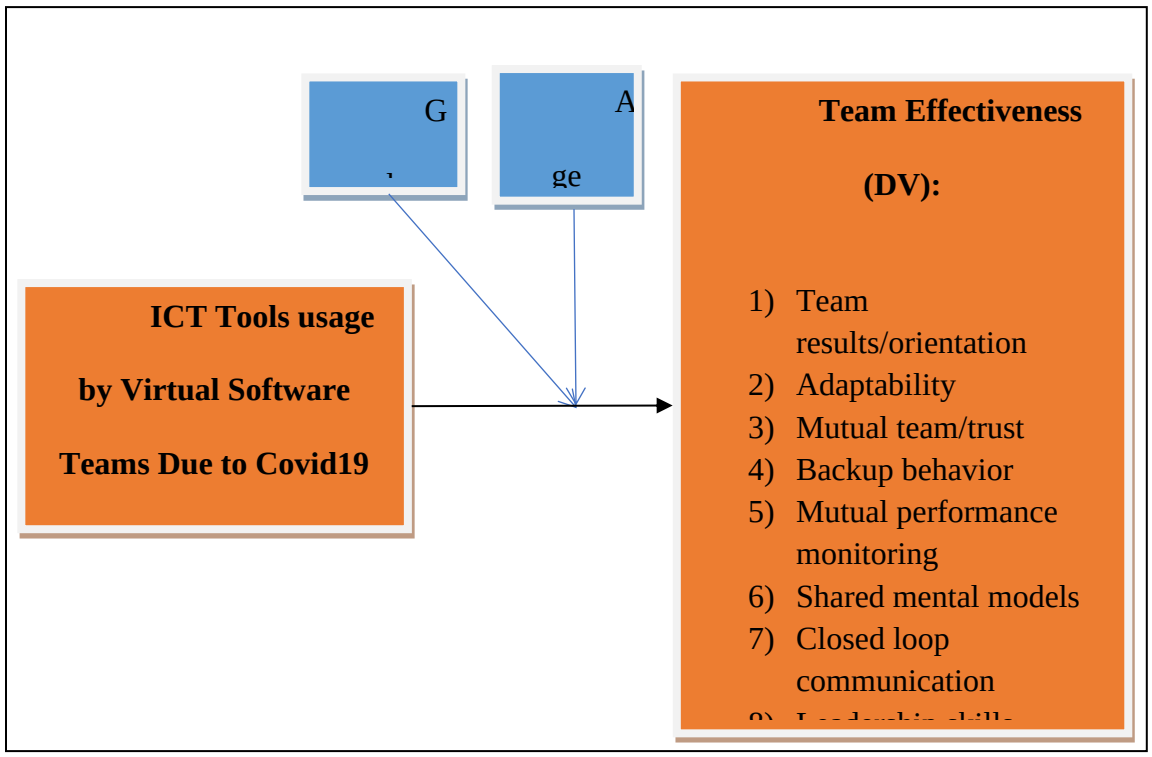

Figure 2: Conceptual Framework of ICT Tools usage and Team effectiveness in software

Adoption of variables - moderating, dependent, and independent variables

The study adopts the variables "Usage of ICT tools in virtual software teams due to Covid-19" as the independent variable and the constructs (team results/orientation, adaptability, mutual team/trust, backup behavior, mutual performance monitoring, shared mental models, closed-loop communication, and leadership skills) under the "team effectiveness" as the dependent variable. Moreover, it is moderated by gender and age as factors since employees with varied 'ages' and 'gender' in targeted virtual teams in software teams in organizations are impacted by their environment and surroundings. Though there are other factors like ethnicity, race, and geographical distribution, the most distinguishable factors are age and gender since it is observed earlier. Recent studies (Morris et al., 2005; Carlson et al., 2013; Bataresh et al., 2017' Garro-Abarca et al., 2021) showed that employees above 45-60 years are hesitant to use ICT tools and prefer

traditional communication, especially male employees; contrarily younger employees (below 45years) prefer unisex teams and are rather flexible and adaptable to ICT tools. Thus, age and gender have been chosen as moderators in the research since they are more reliable and valid for the research rationale.

The primary aim is to examine the impact of ICT tools on software employees in virtual teams due to lockdown in Covid-19, and thus it is developed as the independent variable. The dependent variable' team effectiveness' and its constructs have been examined by Espevik et al. (2021) towards assessing the teamwork of targeted 166 samples and found to be effective factors. Thus, the team effectiveness with constructs: team results/orientation, adaptability, mutual team/trust, backup behavior, mutual performance monitoring, shared mental models, closed-loop communication, and leadership skills are developed as the dependent variable.

III.1 Theory

Though there are varied themes/ theories of team effectiveness like the FSNPA Model by Tuckman: 1965; GRPI Model by Rubin, Plovnick, and Fry: 1977; Katzenbach and Smith's Model: 1993; T7 Team Effectiveness Model by Lombardo and Eitchinger: 1995; LaFasto and Larson's Model: 2001; Hackman's Model: 2002; Lencioni's Model: 2005; and more, there are quite a few theories on the effectiveness of VTs at workplaces. Henceforth, this study examines the Software VT's effectiveness in organizations towards utilizing ICT tools. Thus MST (Media Synchronicity Theory) effectively analyzes the VT effectiveness. However, the theory lacks in assessing the VT's individual's capacity within the group, and thus the study adopts the "Big-Five Teamwork Theory" by Salas et al. (2005) along with Hackman's Theory (2002).

Salas et al. (2005) developed the "Big-Five Teamwork Theory" (with five components, ten propositions, and three coordinating mechanisms) to assess the team effectiveness. In 2008 authors Dingsoyr and Moe utilized this theory to assess the "agile software development" of Scrum (Strode, 2015) and found that leadership and teamwork capabilities could be examined through this theory. Similarly, Hackman's Theory (which includes the factors of Salas et al.) was developed towards assessing the team effectiveness through three significant factors: team orientation (Roosmalen, 2012).

Thus, by adopting Hackman's and Salas et al. theories, this study would analyze the VTs in software development and their team effectiveness through adopting ICT tools. The existing studies ponder that team effectiveness could only be attained and assessed within organizations. VTs have more demerits (for instance: language barriers and trust issues) and henceforth by examining the relationship of the factors to prove that the use of ICT tools in VTs has impacted the global organizations to adopt VT as the primary source of income in their organizational structure rather than sticking with traditional teams or groups. The impact of Covid-19 has altered many global organizations to provide VTs with a better environment and training to reach their goal. The software development teams in organizations rely on ICT tools in their daily life, whether at the organization or within the VTs. Hence analyzing the usage of ICT-based tools in VTs would offer a better understanding between individual satisfaction, mutual trust, and organizational goals.

III.2 Research Hypotheses

Since the emergence of Covid-19, ICT-based tools' usage in organizations, especially by the Virtual Teams, has been rapidly increasing (Jain, 2020). Hackman's theory and Salas et al. theory describe that team effectiveness should be assessed by examining the team satisfaction towards organizational goals rather than solely on team orientation. Ideally, employees' teams should be evaluated in three different aspects: prior (individual-self), during (as a member of the team), and after (the organization disbanding the team). According to adopted theoretical aspects, ICT tools impact employees in their workplace; henceforth, to determine the level of impact of ICT-based tools in VT of software development, the study developed the following hypothesis:

"H1. Usage of ICT Tools by the team members of the virtual software teams due to covid19 lockdown creates an impact on the Team Effectiveness of the respective teams"

In a workplace, the team results and survivability (team orientation) are the primary criteria where the management should focus on retaining employees based on their loyalty, performance, individual commitment, and team commitment. Post Covid19 virtual teams across the globe have been identified as a challengeable task by the leaders of teams since the barriers through time, language, training, and knowledge sharing pose as "enforced issues" rather than adaptable talent (Waizenegger et al., 2020). Adaptability in a virtual team is quite challenging when the management is enforcing it upon employees due to calamity and other mishaps where knowledge sharing by individual employees affects the teams' outcome resulting in low survivability

(Davidaviciene et al., 2020). Thus, team results, the virtual team's adaptability, and the team's survivability rely upon the individuals' satisfaction, which directly impacts the organization's growth and profitability (Sima et al., 2020). Contrarily post Covid19 usage of ICT tools for aiding the employees and teams with longitudinal distances and communication issues, "digitalization" has been utilized for productivity.

Thus, hypotheses H1.1 and H1.2 are derived:

*H1.1: Usage of ICT Tools by the team members of the virtual software teams due to covid19 lockdown creates an impact on the **Team orientation** of the members of the respective teams.*

*H1.2: Usage of ICT Tools by the team members of the virtual software teams due to covid19 lockdown creates an impact on the **Adaptability** of the members of the respective teams.*

The ICT tools like pen-drive, hard disks, external hard disks, and cloud ICT, namely, servers, networks, storage, services, applications, and more, have been identified as a significant advantage and crucial components in the ICT-based devices and services (Frost, 2020). ICT usage has impacted many industries, mainly the IT field, where virtual teams across the globe depend on each other for better knowledge sharing and training through networking, cloud, applications, services, and storage for backup behaviors and confidential accesses (Mayo, 2020). However, the negative impact and reputations that the employers and the management have studied are that employees tend to illegally backup confidential data over ICT tools and transfer them for monetary gains or personal revenge (Zhou and Pazos, 2020). Henceforth it is evident that the backup behavior of employees is impacted through the ICT tools both positively (to store data for retrieval) and somewhat negatively (selling to competitors for personal and monetary gain).

Thus, the hypothesis H1.4 is derived:

*H1.3: Usage of ICT Tools by the team members of the virtual software teams due to covid19 lockdown creates an impact on the **Backup-behavior** of the members of the respective teams.*

Team performance and productivity rely upon “mutual” understanding of the team members, especially among the virtual-team members, since there is no direct contact between the

employees, which constantly hinders the understanding of employees' trust, confidentiality, and perception of peers (Sheng et al., 2010). Mutual understanding in a virtual team is formed through trusting other members in sharing information, aiding through training, knowledge sharing, expertise sharing, and virtually assisting and helping other team members under dire situations (Zalat et al., 2021). Though there are communication barriers, longitudinal/ geographical distancing ICT as tools have been impacting the employees positively by reducing the distance, time, and knowledge sharing burden when compared with traditional team performances (Parker et al., 2020). Hence it is inferable that traditional teams in a physical, organizational environment might have better face-to-face communication and interaction with direct leadership. However, through virtual assistance, even when a person is not physically available for monitoring and training, he might assist his employees through ICT tools and services (applications, services, networking.) As a result, each employee would willingly lend his/her experience, knowledge, and ideas to complete organizational goals as a team towards achieving higher productivity and performance (Vyas and Butakhieo, 2020). Thus, as a team, and an individual higher performance is gained with a positive reputation that evidently increases the trust among known peers and other virtual team members globally. Henceforth, mutual team orientation and trust being significant factors, along with monitoring employees' mutual performances in the virtual team by the leaders to achieve goals, are considered crucial aspects that result in organizational growth and sustainable development (Chen and Sriphon, 2021).

H1.4: Usage of ICT Tools by the team members of the virtual software teams due to covid19 lockdown creates an impact on the ***Mutual team/trust*** among the members of the respective teams

H1.5: Usage of ICT Tools by the team members of the virtual software teams due to covid19 lockdown creates an impact on the ***Mutual performance monitoring*** among members of the respective teams

The ICT tools by the team members in the workplace, be it virtual teams or traditional physical office-space usage of ICT tools, are essential to attain profit, growth, development, and efficiency. Action drivers, namely: the reputation of employees, predictability, risk, and self-preservation (Redlich et al., 2017); Perception-options, namely perceived: self-efficacy, credibility, benefits, practicality, sense of control, and effectiveness (Muller and Antoni, 2021) and

finally determinants of individuals like values, goals, emotional stability, beliefs, attitude, experience and knowledge (Hanna and Richards, 2018) are the main components that are focused towards shared mental models in an organization. Redlich et al. (2017) explained that in virtual team collaboration, the employees lack perceived options and focus on individual/ self-satisfaction by gaining knowledge rather than sharing knowledge. However, sharing knowledge, gained experience, and goals are necessary for an organization and virtual teams and groups to attain higher productivity. Therefore, it's inferred those shared mental models in virtual teams are directly impacted by psychological and physical factors of the organization especially post Covid19.

H1.6: Usage of ICT Tools by the team members of the virtual software teams due to covid19 lockdown creates an impact on the ***Shared mental models*** of the members of the respective teams

The closed-loop communication, especially in virtual teams, has been compared with traditional teams to gain insight into the impact of mental models and communication (Marlow et al., (2017). Organizations adopt closed-loop communication to validate and verify the information being successfully delivered to the receiver by the sender with feedback from the receiver-end. However, in ICT tools, there are drawbacks and advantages with closed-loop communication in virtual teams where the advantages are: it is faster, reliable, the sender acknowledges information with the receiver prior to processing, accurate and kept within short messages; the drawbacks are message in virtual-teams could be manipulated, misinterpreted, hacked, and sometimes monitored by third parties without secure networking (Morrison-Smith and Ruiz, 2020). Moreover, the enforced communication through virtual teams under rapid conditions like calamities (for instance: Covid19) negatively impacts employees psychologically, which affects their performance and results in poor productivity (Anna-Carin et al., 2021). Thus closed-loop communication should be kept secure, short, and closed by the sender for an effective communication system in organizations, especially for virtual-team management.

Thus H1.7 hypothesis was derived, which is:

H1.7: Usage of ICT Tools by the team members of the virtual software teams due to covid19 lockdown creates an impact on the ***Closed-loop communication*** among members of the respective teams.

Though, post Covid19, IT industries and telecommunication industries based organizations had transformed their HRM practices and their strategic models, there are SMEs and MNCs that adopted work-from-home practice where the ICT tools, applications, services, and more have been corporate into their operations that facilitated their organizations growth and productivity through team leaders to manage the team members (Newman et al., 2019). Leadership skills are generally classified as: good communicator, self-motivated, passionate, loyal, determinant leader, self-awareness, empathetic, logical, courageous, creative/ innovative, matured, logical, integrity, compassionate, gratitude, problem-solver, decision-maker, transparent leadership, honest, influencer, supportive and humanity (Mysirlaki and Paraskeva, 2020). Leadership skills in virtual teams as team leader should focus on traits namely: communication, organized, inspiring, mentoring/ coaching ability, monitoring, articulating goals and purposes of team and organization to the members, precise communication, technological skills, a trust builder, cultural intelligence, and logistic skills (Jain and Vijaya, 2019). When the team's leader lacks with skills or any other traits it might affect his assessment upon members and thus affect the rapport with the team. Henceforth communicating with team members especially in virtual-teams across globe, the leader should acquire necessary traits to monitor and manage the team effectively to gain higher performance. To evaluate each member in a team the team-leader should assess based on their common traits like, social, reliable, knowledge sharing, reputation and assisting peer/ team members, rather than individual talent assessment in team assessment.

Thus H1.8 derived from literatures as:

H1.8: Usage of ICT Tools by the team members of the virtual software teams due to covid19 lockdown creates an impact on the ***Leadership skills*** of the members of the respective teams.

Based on the literatures and studies, moderators' "gender" and "age" are studied and evaluated with the individual factors to know the impact upon the team effectiveness through ICT tools post Covid19.

The gender diversity in organizations had been strategically propositioned to manage the talents, innovativeness, readiness, and competitiveness by utilizing the individuals' capacity and performance to maximum optimization (Kelemen et al., 2020). Post Covid19 men have drastically dropped down with performance than women where women led states, countries and organizations

produced higher outcome than men (Windsor et al., 2020). The usage of ICT in organizations as tools however impacts the individuals in teams where the knowledge/ technological skills is necessary where gender impacts team effectiveness and study conducted by Prendes et al., (2020) found that, perceived intention and utility was found higher in men where they portrayed higher efficiency in hardware usage than women.

Similar to gender being moderator the study also examines the impact of 'age' and how its moderate association amid team effectiveness and usage of ICT-tools in organizations. Age as moderating factor affects the job satisfaction, performance, commitment, flexibility, and productivity (Davidescu et al., 2020). Authors Yang et al., (2019) and Skvarc et al., (2021) examined the psychological impact of the ICT-tool users and found that age impacts negatively upon the ICT-tool users where the age-group belongs to elder and 40-50years category where family members along with age negatively impacts the senior employees in organizations leading towards poor productivity.

Henceforth to examine the impact of ICT-tools upon the team employees' effectiveness the moderators 'age' and 'gender' are examined through hypothesis H2:

H2: The **Age** and **Gender** moderates the relationship between the ICT tools usage by Virtual Software Teams due to Covid19 Lockdown

III.3 Research Gap and Contribution

The existing literature and research work by authors Mow (2014) and Puente-Palacios et al. (2016) purely focuses on the "team effectiveness of virtual teams in top organizations." However, there is a lack of important information and data on the impact of team effectiveness in software, especially with ICT-based tools in virtual teams in organizations, for instance: the software development teams need assistance from peers and monitoring of superiors while developing software and need physical assistance more than virtual assistance (Grober and Baumol, 2017b). The software development through virtual assistance faces issues in interrupted communications, lack of clarity of information, leading the virtual team and assisting them and monitoring their performances with coordination and following timely project deliveries within the budget frame are the critical issues in ICT based, i.e., the virtual team in software. To eradicate the issues in the virtual assistance and monitoring the teams that work under the team managers,

the employees should maintain positive and good rapport so that communication is two-ways and smooth rather than single-sided.

The ICT-based tools not only assist the users in developing good rapport in communication but also provide 24-hour/7days opportunities to keep in touch with the team for faster and more efficient outcomes. The results were carefully analyzed by studies that examined virtual team effectiveness (Morley et al., 2015; Grober and Baumol, 2017a; Ghani et al., 2016). The studies found that virtual assistance in organizations seeks round-the-clock monitoring of supervisors for the team effectiveness of employees. Moreover, this significantly impacts the 'human body', employees' privacy (time-zone-differences, cultural differences), trust issues, insufficient training, technical issues, power consumption and power cut towards delay of projects, backup of data as trust issues again. Thus, the virtual team and their performances affect the project and the organization. To minimize these issues, monitoring the employees under a tight schedule and training them towards faster project deliveries are considered priority-based factors by the team managers rather than trusting based on instinct. Underwritten contract along with NOC, an employee enters an organization and is liable for any malpractices and leakage of information; however, when it happens online from different locations/ zones, it is harder for the employers to trace back the information-residue towards catching the culprit (Puente-Palacios et al., 2016). Hence applying the secure worksite timings and virtually monitoring the team is drastic and complex work compared to traditional team management.

ICT-based tools offer the employers a security-based working environment and the employees peer assistance that could help them efficiently deliver projects on time. The ICT also assists the teams in storing and accessing information and knowledge in a timely approach that keeps the team performing effectively (Dávideková and Hvorecky, 2017). By focusing on the chosen subject, the study contributes insight and information on the impact of ICT-based tools in virtual software teams and how effectively the developed model will heighten the teams' performances against the challenges and issues. Through the study's contribution, future researchers, investigators, and examiners might adopt the data upon relevant subject matter that would be highly beneficial and could assist them in a comparative study.

III.4 Summary

Initially, the first hypothesis formulated examines the association between the variables' usage of ICT tools of virtual teams in software development' (independent variable) and the 'team effectiveness' (dependent variable). The second hypothesis examines the moderator "age" and how it moderates the association between the independent and dependent variables. Finally, the hypothesis examines the moderator "age" and how it moderates the association between the independent and dependent variables.

IV CHAPTER 4: RESEARCH METHODOLOGY

IV.1 Paradigm

Paradigm by Blaikie (2007) is massively understood as beliefs and assumptions made vivaciously by researchers towards identifying and delivering refined strategic decisions that would channel fundamental principles and factors into one common goal through teamwork and assistance. Generally, a paradigm of varied research could differ as per purpose and be classified through three major assumptions: epistemology, ontology, and methodology. Once the research and purpose have been identified and defined well, paradigms such as methodological research techniques (tools, techniques, design) along with the ontology (purpose and aim of research) and epistemology (reality and facts) should be well explained to understand the research framework. For example, the proposed research examines the impact of Covid-19 on employee performances as team effectiveness is measured through analyzing the usage of ICT tools and how the employees are affected. The ontology here is the purpose/aim, whereas epistemology is the strategic tool (measuring employees' team effectiveness and usage of ICT tools) in examining the employees' team performances and effectiveness. The methodological paradigm in the study is the techniques, statistical analyses, tools, and software adopted. Briefly, the paradigm analyzes the purposes, facts, and truth behind the framework and the issues under research by utilizing reliable and appropriate tools, software, formulae, statistical approaches, and other valid tools (Krueger and Casey, 2014).

IV.2 Approach

The research approaches under methodology are classified according to the researchers' requirements. For example, qualitative research includes behavioral, assumptions, opinions, and other characteristics-based evaluations.

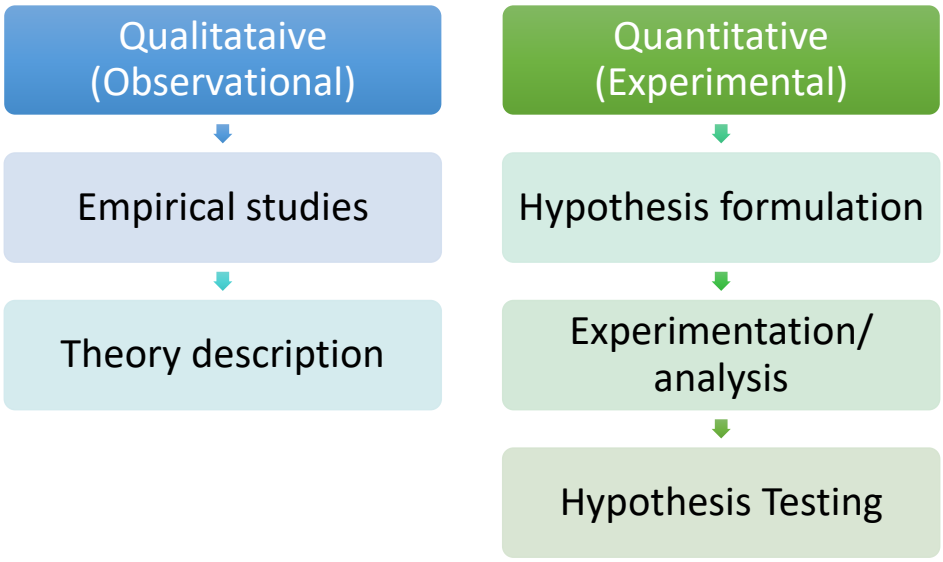

Figure 3: Research approach

Justifying the Approach and Paradigm adoption

The research approaches under methodology are classified according to the researchers' requirements. For example, qualitative research includes behavioral, assumptions, opinions, and other characteristics-based evaluations.

The research includes three approach categories, where the investigators opt according to their developed framework. Commonly, the approach is classified as a qualitative study when the researcher observes the outcomes and obtains results from empirical analysis and describing theories. In contrast, when a study is proposed to test a theory or to prove an expected outcome, it is classified as quantitative. Thus, quantifiable studies are adopted by investigators to prove formulated hypotheses, scientific and social experiments, and manipulated environment/ controlled environment-based studies where the investigators conduct a study towards proving the facts (refer to fig 3).

Quantitative research usually is presumed as deductive since they are statistically measurable, and qualitative research is presumed as inductive since they are more contextualized. Similarly, inductive studies are majorly bottom-up approaches (validating the expected conclusion through existing data and analyses), whereas deductive studies are top-down approaches (examining the data and facts and obtaining outcomes through analysis). However, Sileyew (2019)

argued that the approaches could vary according to the necessity and the research objective, and a quantitative study could also be a top-down approach.

Based on the goal, researcher's aim, and paradigm, the study's approach could vary; however, in keen observation by Kothari (2013), it has been found that the quantitative-based investigations are of positivism and qualitative could be of interpretivism, and it could be changed unless it is due to the nature of the study itself. The chosen study particularly focuses on investigating the impact of ICT-based tools on team effectiveness of virtual software teams. Hence, the study will adopt the positivism paradigm and quantitative (aka deductive) approach toward numerical analysis and acquiring reliable data.

IV.3 Design

The types of classification in research design can be identified as:

- *Descriptive* (studies that describe the nature, purpose, aim, and scope with facts and information from reliable sources and data).
- *Exploratory research (studies that seek systematic approaches and numerical outcomes to validate the existing research and to prove the proposed purpose through laboratory experimental findings).*
- *Causal research (that connects or relates the links between two factors or variables through the contribution of additional and new sources).*

Thus, a design in research varies based on the classification of experimental, exploratory, and conclusive (causal and descriptive) refer to fig 4.

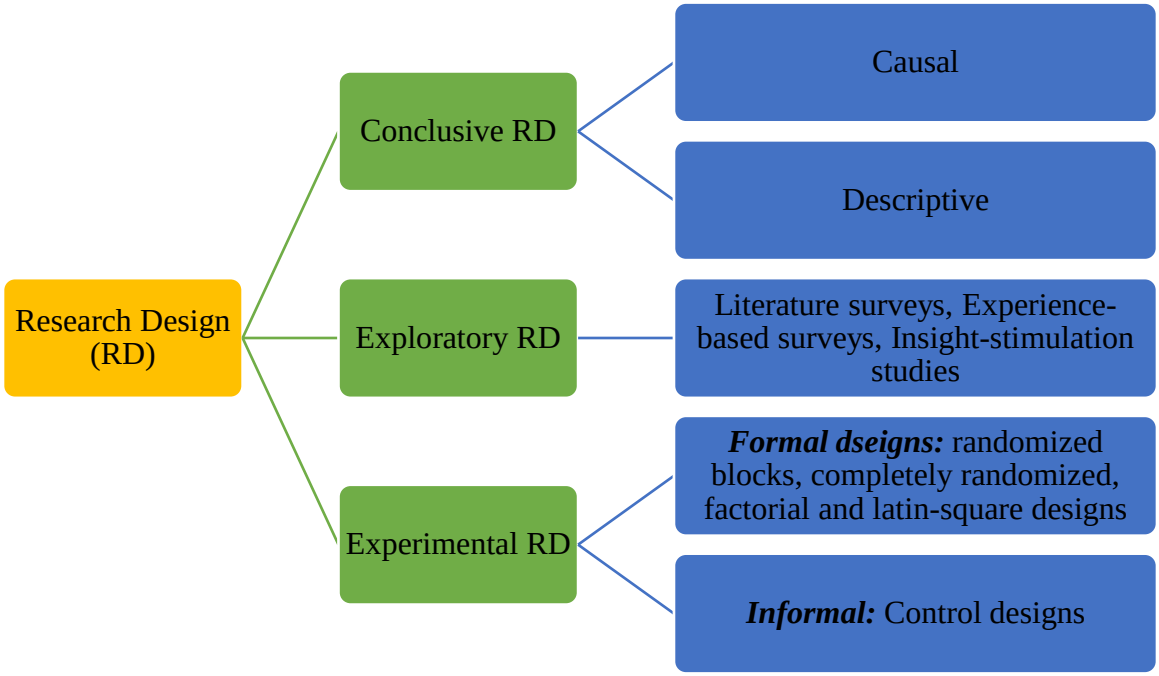

Figure 4: Research designs

Exploratory: Creswell (2014) explained that exploratory researchers use their insightfulness, hunches, and gut feeling to explore facts towards further desire and necessities. Exploratory studies seek additional information, facts, and more data through an investigator's sheer interest and curiosity. Thus, when the researcher does not have a formal or proposed plan, he adapts the exploratory design to obtain alternate outcomes. With the exploratory design, when the researchers acquire alternate solutions, they seek the best for their framework and conclude the research with evidential outcomes.

Experimental: These kinds of research are normally analytical, where researchers adopt statistical and numerical analyses to experiment and evaluate the facts and information. Experimental studies are normally categorized as an experiment, semi-experiment, and controlled/ manipulative. Scientific and pure data-analyses-based research are classified as experimental studies, and sometimes 'social experiments' are also carried out as semi-experiment research. Controlled/ manipulative environment-based studies are identified as 'stimulation' where the researchers either replicate the actual study and control the variables to obtain different outcomes or invalidate the actual outcome with similar variables. Thus, experimentation research is broadly identified as scientific-laboratory-based research and social experiment research.

Causal: Similar to experimental research, causal research explores the actual "cause and effect." Researchers obtain tangible, valid, and reliable outcomes that remain consistent in different environments through the causal method. Thus, the association of every single variable and variables' interrelationships is examined in causal design adaption.

Descriptive: When a researcher seeks more in-depth information through fact-finding techniques and data acquisition, he adapts the descriptive design (Thomas, 2010). This technique typically analyses the objective by examining 1H (how) and 7W's (where, what, whom, whose, why, when, and which). Also, quality-based and emotion-based data (product and people) in research by default falls under this design category since it analyses the people's experiences, assumptions, opinions, beliefs, and behavior along with product quality, services, issues, and more. Thus majorly, trend research, product-based research, people-based research, and market analyses fall under the descriptive design since it provides detailed information.

To carry out the research under the planned design, the researcher targets people with either similar characteristics or differences in their characteristics. However, the investigators intend to target populations with similar interests and characteristics for valid outcomes. Furthermore, since the research focused here explains the problems, challenges and issues, importance, and how to focus on issues strategically, it will be ***descriptive*** design by targeting the virtual software teams.

IV.4 Target population

Targets or the total populace in research mainly deals with two criteria: people/ respondents and area/ location targeted. Generally, many research intend to focus one particular field/ area for their purpose and thus reduce their targets within limited circumference or coverage to minimize the risk of calculations and analyses that could increase the time, budget, people, and transportation costs. When an investigator aims at gathering data from direct communication (indirect and direct interviews, face-to-face and group discussions, field studies, geographical data acquisition, etc.) or through direct survey techniques, they intentionally keep the targets within reachable area so that they could gather reliable sources within targeted time. however, if the study is based on global, longitudinal, cross-sectional, or historical based, the timeline, budget, people, and cost involved would always vary and could increase due to the mass and universe as its targets without limited people under focus. Henceforth vast researchers aim at particular targets to valid data and research unlike the global studies and surveys that could vary under different ethnic, race and country.

Thus, it is understandable that, targets could be small ranging from 300respondents towards huge/ large to examine; hence the researchers intend to focus towards “uncontrollable data” as their targets i.e., ‘the universe’ where time, budget, costs/ expenses, knowledge and also effort is huge in longitudinal, cross sectional and global surveys alone. Hence to minimize these issues, investigators adopt “sampling” as a process where the population is reduced under methodological calculations to provide accurate results and valid outcomes.

The targeted participants are the software developers, especially the members of the VTs. The population under focus is 1000participants. The irrelevant data, participants, repetitive data of same participants through e-mail, incomplete questionnaires, and other databased considerations to pre-process the data prior to analyzing data would be done through sampling techniques after responses from the target population are obtained.

IV.5 Sampling

Researchers adopt different sampling techniques under the sampling criteria in three main designs: size, unit, and technique. Commonly, the size in the sampling technique is estimated through sampling calculation, where the confidence interval at 95% and marginal error at +/-5% are determined. Once the size is determined, and samples from respondents are acquired, the relevant samples would be deduced, whereas the irrelevant samples, repetitive data, and data redundancy would be assessed and ignored (Edwards, 1997).

However, the minimal sampling or sample size from the total populace has limitations or constraints where the number should be 300+ towards the maximum size of 1000. In a few studies, the total populace exceeds the norms, i.e., if the size exceeds 1000+, it is considered unlimited sampling, where the sampling estimation norms need not be concerned. The whole population is considered sampling for research in examinations; contrarily, if the sampling is less than 300, the analyses might produce different outcomes under different techniques resulting in invalid or inconsistent data. Hence deciding on sample size through technical estimation is necessary to validate the research. The unit in sampling is decided as the filtered/ resident area of the targets chosen for the study.

The sampling techniques, according to Creswell (2014), are the major key where the sampling classifications are listed as non-probability/ non-random (panel sampling, quota sampling, snowball sampling, judgment sampling, convenience sampling) and probability/ random (systematic sampling, simple random sampling, cluster sampling, multi-stage sampling, area

sampling, and stratified sampling). Each sampling is adopted per the study's purpose and research design.

The target estimated was 1000+ respondents, and after the questionnaires were received, the response count resulted was 1018. With MoE (Margin of Error) at 5% and CIL (Confidence-Interval level) at 95%, the sample was calculated from the formula:

$$N = (zs^2(sd(1 - sd))/m^2)/1 + (zs^2(sd(1 - sd))/m^2P)$$

-where N represents the sample size, zs denotes z-score, m represents the margin of error, sd denotes standard deviation and P denotes total population.

For an unknown population, Cochran (1977) had developed a formula where the required sample size for unknown population should be considered as n=385 with 5% precision and 95% confidence rate. The formula is:

$$Z = \hat{t} \pm zs \times \sqrt{\frac{t(1-t)}{s}}$$

-where, t denotes population proportion, zs denotes z-score and s denotes total sample-size.

A pilot study was conducted with a sample size of 30 respondents for the validation of the tool developed.

Timeline for primary data acquisition:

The study examines the team effectiveness of the virtual teams in IT organizations employees with exposure to ICT tools usage during Covid19. Moreover, the timeline for the study is restricted to the period of the Covid19 pandemic. Therefore, the data from 2019-2021 will be focused profoundly and used as the primary data. Initially, from April 2021 to October 2021, the questionnaires were sent to 1000+ individuals (number of groups time total number of members in each group) through social media and Facebook groups, where 1018 responded.

However, there were participants of different cadres from various organizations with many irrelevant responses. Thus, the attempt was withdrawn from the analysis. Furthermore, the latter questionnaires were sent to a focused group with a required sample size of 300+.

The questionnaires were sent to approximately 400 Work-from-home-based IT employees through a link via mass e-mail as a study population. Among 392 participants, 351 responded to the survey, and the remaining did not participate. According to our assumptions, the respondents who were unable to participate in the survey either did not have time to respond because of

incomplete, delayed, and unavailability of staff during Covid19 or were not interested in participating in the survey. From 351 responses, it was found that 8 responses were incomplete; thus, the 343 completed surveys were considered the final cleansed data. By filtering the criteria of "virtual teams," "software developers," "currently working as an IT employee," and "project manager and team leader as designation," the final sample size was determined as 279.

It has been determined that 279 samples are sufficient for the research from the total responses of 351 to reflect the total population accurately. Therefore, the response rate for the research was found as 79.49%.

The sampling techniques of research include two categories. Former, which has a higher probability where every individual sample is considered for evaluation: probability sampling, and the latter 'non-probability sampling' has a lesser likelihood of being chosen. These categories include (refer to fig 5):

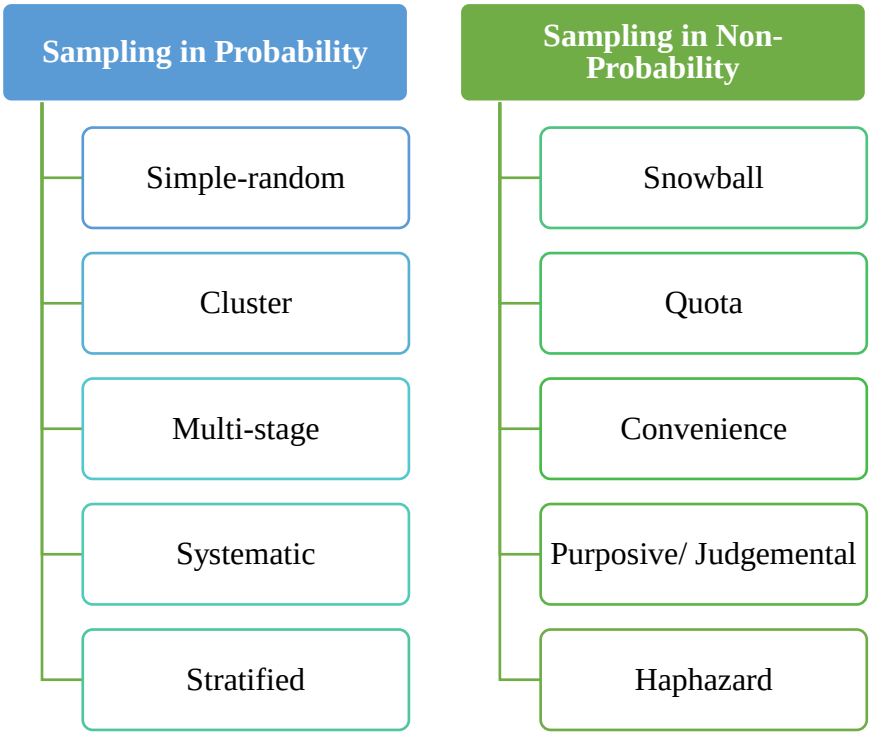

Figure 5: Sampling methods, Source: Author

The study has adapted cluster sampling with sampling size of n=279 participants.

IV.6 Pilot study

The research examined the ICT tools usage in increasing the team effectiveness of the software development-based virtual teams. The model developed had 11 factors which included Salas et al. (8 factors) and Hackman's Theory (additional 3 factors). The targets are software developers in virtual teams. After the deployment of pilot testing, the data gathered were evaluated. From the evaluation and analysis, the model was re-developed and reduced to Salas et al. based model with 8 factors relevant to the research.

The data collection has been conducted in two stages. A pilot study was conducted first based on which some questions were revised in the questionnaire. The period of collecting data for pilot study was between March 2021 to July 2020. The sample size was 186 participants. The questionnaire was posted via social media websites to gather preliminary feedback and test the questionnaire's effectiveness. A total of 136 responses were collected through this pilot study.

The purpose of the pilot study was to evaluate the questionnaire's clarity, understandability, and overall effectiveness in gathering relevant data. The responses received during the pilot study were carefully examined to identify any potential issues with the questionnaire structure, question wording, or response options. It was also helpful to assess the time required for respondents to complete the questionnaire and had taken note of any patterns or trends in the data.

Based on the feedback and insights gained from the pilot study, necessary adjustments were made to improve the questionnaire's quality and reliability. The responses were reviewed and identified any areas where respondents may have encountered difficulties or confusion. The questionnaire had been refined to ensure it captured the desired information accurately and efficiently.

The responses collected during the pilot study had not been included in the final dataset used for analysis. Instead, they had served as valuable feedback to enhance the questionnaire's validity and ensure the subsequent data collection process would yield more accurate and reliable results. The pilot study has been used as an opportunity to fine-tune the questionnaire, making it more suitable for the target respondents and research objectives. By conducting a pilot study with 136 responses collected through social media platforms, valuable insights was gained into the questionnaire's effectiveness and made necessary improvements. This approach strengthened the overall data collection process, increasing confidence in the subsequent data analysis and findings.

These proactive steps to address any limitations or issues identified during the pilot study resulted in a more robust and reliable final data collection process.

Post deployment of the pilot testing, the following factors were removed:

1. *Team survivability.*
2. *Individual satisfaction.*

However, the 'team results' was found as a common factor in Salas et al. (2005) and Hackman's Theory (2002) scale, and thus it was ignored. Finally, the factors from Hackman's Theory were rejected, and the factors from Salas et al. were adapted for the developed model alone.

Based on the rejected factors following questions were removed from the questionnaire tool:

In Team survivability:

- *Would you work with the same team again?*
- *Were you somehow frustrated post-completion of the teamwork?*
- *Was there any unity within the team?*
- *Did you ever get tired of other members in your team?*
- *Were you/other team members friendly enough with each-other?*
- *Does the members in your team like each-other?*
- *Was there any morale within the team?*
- *Did you somehow feel exhausted post-completion of the teamwork?*

In Individual satisfaction:

- *Did you acquire any knowledge from working with the current team?*
- *Did you receive any compliments/rewards for being a part of the teamwork?*
- *Did you develop any new talent as an outcome of team participation?*
- *Were you somehow satisfied than being frustrated after completing the teamwork?*
- *Did you gain any positive experience with your team in general?*
- *Would you be willing to work with a team again?*

IV.7 Data acquisition

Primary data: They are the sources for acquiring information directly from respondents through various tools and techniques. The sources for primary data could be classified

as interviews (telephonic, face-to-face, online interviews: video), discussions (group discussions and debates), surveys (field survey, online survey), and feedback. Though every research requires primary data, there are exemptions like historical studies, literature reviews, case studies, and laboratory experiments, which requires just secondary resources (books, research, literature, studies, investigations, e-books, e-journals, journals, articles, news articles, so on) (Kolb, 2008). Gaining data for investigations under primary resources are classified as the information acquired by researchers for the proposed research, and existing resources are classified as secondary resources.

The final data was collected via closed-end questionnaires that had been distributed over various social media websites, including Facebook groups, LinkedIn, and Twitter. The data collection process has been done during October 2021 to April 2022. The sample size was 392 participants. Only 351 participants responded to the survey and among those only 279 completed survey responses that were considered for final analysis.

Here is a detailed explanation of how the data was collected using this approach:

Questionnaire Design:

For the actual data gatherings, tools used for designing the questionnaire were Qualtrics and Google forms. Both forms of questionnaire were distributed randomly. A copy of the questionnaire is provided in the dissertation.

Selection of Social Media Platforms:

The relevant social media platforms were identified where software professionals who worked remotely during the COVID-19 lockdown were likely to be active. It has been taken into account the popularity and suitability of platforms such as Facebook, LinkedIn, and Twitter. Moreover, a few specific groups or communities have been selected based on the keywords such as research groups, data collection groups and data analysis group within these platforms that were focused on software development, remote work, or related topics. These groups had provided an ideal audience for distributing the questionnaire.

Engagement with the Social Media Community:

Prior to distributing the questionnaire, actively engaged with the social media communities. A considerable time has been spent to participate in discussions, share valuable content, and build relationships with the members. This approach had helped establish credibility and had increased the likelihood of respondents engaging with the questionnaire.

Introduction and Invitation:

When the questionnaire had been ready for distribution, it has been posted with a clear and concise introduction, explaining the purpose of the study and the significance of respondents' participation. The confidentiality and anonymity of the responses has been emphasized to encourage honest and open feedback. Gratitude had been expressed for the participants' time and contributions. An estimated time has also been indicated for completing the questionnaire to set respondents' expectations. Relevant hashtags had been included, key industry influencers had been mentioned, and requests had been made to group administrators to pin the questionnaire post for increased visibility. Additionally, participants had been encouraged to share the questionnaire link with their networks to expand the reach of the study.

Monitoring the Respondent Engagement:

Throughout the data collection period, it has been actively monitored on the social media platforms where the questionnaire had been distributed. Care has been taken to respond promptly and courteously to any questions or comments from respondents. Engaging with the participants had been a priority, and acknowledged their contributions, asked follow-up questions, and shared preliminary findings when possible. This continuous interaction had helped maintain respondents' interest and had encouraged others to participate.

Data Management and Analysis:

As the responses had started to come in, a systematic approach has been implemented to manage the data. The responses had been exported from the online questionnaire platform into a secure database or spreadsheet for analysis. To ensure confidentiality, the data had been anonymized and protected. The data analysis has been conducted using appropriate statistical techniques, such as descriptive statistics, cross-tabulations, or linear statistical analysis, based on the research objectives.

Ethical Considerations:

Throughout the data collection process, ethical guidelines had been adhered and had obtained any necessary permissions. It has been ensured that respondents' personal information remained confidential and was used solely for research purposes. Informed consent had been obtained from participants, clearly explaining the study's purpose and how their data would be used.

In conclusion, the data for this study had been collected through closed-end questionnaires distributed over various social media websites, including Facebook groups, LinkedIn, and Twitter. By engaging with the social media community, shared the questionnaire links, and actively monitored and engaged with respondents. The collected data had been managed securely and analyzed using appropriate statistical techniques. Appropriate measures have been taken to ensure the validity, reliability, and ethical considerations throughout the data collection process.

Secondary data here has been collected from review websites like Gartner and G2. In addition, real-time reviews of users from the IT industry who used tools like blogs, vlogs, and review websites during the Covid19 lockdown were used as a secondary data source. Around 350 reviews were collected between the period November 2021 and April 2022. The reviews were collected manually and coded in MS Excel. The secondary data excel has 5 columns: Sl No; Tool Name; Review; Date, and Source website. A screenshot of sample reviews collected is placed in Appendix 2.

IV.8 Analysis and Tools

Analyzing the data through research techniques/ tools like statistical, numerical, and software-based analyses assist the researchers with outcomes and findings that validate the purpose and identified problems. The software, machine learning techniques in research, and applications like SPSS, ANOVA, Microsoft word, Microsoft presentation, SEM, and Microsoft Excel, have been utilized to minimize errors during analysis and provide researchers with more time. Numerical and statistical analysis with formulae (percentage, regressions, factor analysis, ANOVA, and chi-square.) and ethical considerations are necessary to provide data with reliable results. Data validity, tool, and technique reliability should be verified and checked prior to analyzing. Researchers have adopted a questionnaire as a survey to gather information to gain insight into the respondents' opinions, assumptions, experiences, perceptions, and ideas in

considerable research to support the research. Thus, data is gathered through tools and analyzed through reliable techniques that provide good outcomes that could be used in future research to argue the researchers' statements and problems.

Data analysis is complex and yet a vital part of research since it is the proof of the researcher's gathered and processed information. Hence utilizing techniques and tools based on chosen methods, the study focuses on achieving the truth behind the facts. The analysis here will be done through two processes: a) software method: SPSS and b) statistical methods: Simple percentage, ANOVA, and Regression analysis; the study will also maintain ethical considerations throughout along with the validation techniques (reliability and validity).

Secondary data has been analyzed in an Excel sheet by classifying each review as either supporting, not supporting, or not relevant categories.

Individual count of each category type has been counted and based on total number success (supporting the thesis), Statistical T-test has been done. Moreover, the P value has been determined. If it was observed that the P value is less than 0.05, we comment that those reviews support this thesis's findings.

IV.9 Instrumentation

The factors in the questionnaire developed (Roosmalen, 2012) will be utilized here since the instrument covers up to eight teamwork factors (aka Big-Five of Teamwork) proposed by Salas et al. (2005) and three effectiveness factors proposed by Hackman (1990). However, in this investigation, the questionnaire will be developed with ten factors (refer to fig 2). The two constructs, namely leadership (social) and leadership (planning), have been combined into a single construct, namely leadership, thereby making ten constructs.

To justify the adapted questionnaire, an investigation focused on analyzing the studies that developed similar questionnaires as a tool and found that the same factors and constructs have been adapted and used for team effectiveness in software development investigation by Strode (2015).

Thus, it is justifiable that adapted questionnaire factors are appropriate for collecting data for the investigation.

The 8 constructs of the Team Effectiveness variables are,

- Team Orientation with 8 items.

- Adaptability with 5 items.
- Mutual team with 10 items.
- Backup behavior with 3 items.
- Mutual performance with 5 items.
- Shared models with 4 items.
- Closed Loop with 5 items.
- Leadership skills with 6 items.

The questionnaire totaled 38 items-scale for TE. Similarly, the ICT tools usage measurement scale includes 7 factors-based questions, focusing upon usage of:

- E-resources,
- Editing tools,
- Social and media tools,
- Project management-based tools,
- Search engines and browsing,
- Blogs and vlogs and
- Podcasts.

V CHAPTER 5: DATA ANALYSIS AND INTERPRETATION

V.1 Introduction

The analysis techniques used here are the simple percentage analysis, ANOVA, regression, Carlson-Pearson correlation, and Hayes matrix. Additionally, gender, as moderators, has been examined with the variables, and the hypotheses formulated are tested and evaluated. The SPSS is the software for analyzing the data.

V.2 Descriptive statistics

Table 1: Descriptive statistics

	N		Mean	Median	Mode	Std. Deviation
	Valid	Missing				
Age	279	0	2.4444	2.0000	2.00	1.00518
Gender	279	0	1.5125	2.0000	2.00	.50074
Edu	279	0	1.8925	2.0000	2.00	.93450
Mart	279	0	1.6452	2.0000	1.00	.76777
A1	279	0	3.6703	4.0000	4.00	.73373
A2	279	0	3.7599	4.0000	4.00	.68622
A3	279	0	3.9104	4.0000	4.00	.68583
A4	279	0	3.8638	4.0000	4.00	.73167
A5	279	0	3.7025	4.0000	4.00	.77809
MTT1	279	0	3.7025	4.0000	4.00	.77809
MTT2	279	0	3.7276	4.0000	4.00	.71795
MTT3	279	0	3.9104	4.0000	4.00	.77450
MTT4	279	0	3.7921	4.0000	4.00	.72950
MTT5	279	0	3.2616	3.0000	3.00	.87717
MTT6	279	0	2.6237	2.0000	1.00	1.42117
MTT7	279	0	2.1075	2.0000	1.00	1.23320
MTT8	279	0	2.2079	2.0000	2.00	1.23781
MTT9	279	0	1.8351	2.0000	1.00	1.02910

MTT10	279	0	2.6165	2.0000	2.00	1.37548
BB1	279	0	2.2545	2.0000	2.00	.87518
BB2	279	0	2.3477	2.0000	2.00	.93930
BB3	279	0	2.2688	2.0000	2.00	.88724
MPM1	279	0	2.7957	3.0000	2.00	.88422
MPM2	279	0	2.8674	3.0000	2.00	.93703
MPM3	279	0	2.7957	3.0000	3.00	.91619
MPM4	279	0	3.0717	3.0000	3.00	.90674
MPM5	279	0	3.0573	3.0000	4.00	.96538
SMM1	279	0	4.0358	4.0000	4.00	.72380
SMM2	279	0	4.0215	4.0000	4.00	.70423
SMM3	279	0	4.0287	4.0000	4.00	.69884
SMM4	279	0	3.7455	4.0000	4.00	1.04732
CLC1	279	0	2.6703	3.0000	2.00	.99217
CLC2	279	0	3.2688	4.0000	4.00	.93846
CLC3	279	0	2.6201	2.0000	2.00	1.02439
CLC4	279	0	2.6918	2.0000	2.00	1.01338
CLC5	279	0	2.4839	2.0000	2.00	1.01371
LS1	279	0	2.7957	3.0000	2.00	.88422
LS2	279	0	2.8674	3.0000	2.00	.93703
LS3	279	0	2.7957	3.0000	3.00	.91619
LS4	279	0	3.0717	3.0000	3.00	.90674
LS5	279	0	3.0573	3.0000	4.00	.96538
LS6	279	0	3.0753	3.0000	4.00	.95099
T1	279	0	2.0108	2.0000	2.00	.75142
T2	279	0	1.5233	1.0000	1.00	.71871
T3	279	0	2.2760	2.0000	2.00	.50803
T4	279	0	2.5520	3.0000	3.00	.64873
T5	279	0	2.0466	2.0000	2.00	.52421

T6	279	0	1.7921	2.0000	1.00	.79101
T7	279	0	2.0430	2.0000	2.00	.64452
T8	279	0	2.0251	2.0000	2.00	.73657
T9	279	0	2.0215	2.0000	2.00	.79538
T10	279	0	2.1398	2.0000	2.00	.63910
T11	279	0	1.9534	2.0000	1.00	.87818
T12	279	0	2.0323	2.0000	2.00	.60783
T13	279	0	2.0896	2.0000	2.00	.72161
T14	279	0	1.9821	2.0000	2.00	.72695
T15	279	0	2.0251	2.0000	2.00	.72674
T16	279	0	2.1792	2.0000	2.00	.68656
T17	279	0	2.3799	3.0000	3.00	.72402
T18	279	0	2.0108	2.0000	2.00	.62030
T19	279	0	1.8996	2.0000	2.00	.74232

Interpretation

Table -1 represents the descriptive data analyzed, such as age, gender, marital status, and education. Apart from basic demographic details, the 8 constructs of the variables are examined: Team orientation-8 items, Adaptability-5 items, Mutual team-10 items, Backup behavior-3 items, Mutual performance-5 items, Shared models-4 items, Closed Loop Communication-5 items, and Leadership skills-6 items. The Mean, Median, and Mode with Standard-Deviation are calculated for the Team effectiveness variables and demographic data. It’s also observed through analysis that there are no outliers.

V.3 Principal component analysis

Table 2: Principal component analysis (PCA)

	Component							
	1	2	3	4	5	6	7	8
A1	.466							
A2	.630							
A3	.829							
A4	.843							
A5	.904							
MTT1		.903						
MTT2		.837						
MTT3		.604						
MTT4		.650						
MTT5		.596						
TO1			.772					
TO2			.669					
TO3			.809					
TO4			.534					
TO5			.592					
BB1				.949				
BB2				.876				
BB3				.931				
MPM1					.526			
MPM2					.791			
MPM3					.878			

MPM4					.917			
MPM5					.937			
SMM1						.765		
SMM2						.908		
SMM3						.884		
SMM4						.724		
CLC1							.802	
CLC2							.879	
CLC3							.746	
CLC4							.771	
CLC5							.723	
LS1								.522
LS2								.791
LS3								.878
LS4								.917
LS5								.937
LS6								.917

Extraction Method: Principal Component Analysis.

Rotation Method: Promax with Kaiser Normalization.

a. Rotation converged in 8 iterations.

PCA shows how well the constructs are correlated with each other in every iteration. Similarly, the PCA results provide researchers with the highest magnitude of a construct correlated to other components.

Table- 2 shows the PCA outcomes for ICT tools usage by the virtual teams and how the principal component analysis outcomes are correlated. They are:

i. For PCA-1, it is interpreted that a correlation of .949 shows backing-up behavior as the principal component, which is strongly correlated with other seven constructs.

ii. For PCA-2, it is interpreted that a correlation of .937 shows mutual performance monitoring as the second principal component, which is also strongly correlated.

iii. For PCA-3, it is interpreted that a correlation of .917 shows that leadership skills as a principal component are highly correlated.

iv. For PCA-4, it is interpreted that a correlation of .908 shows that shared mental models as a principal component are strongly correlated.

v. For PCA-5, it is interpreted that a correlation of .904 shows that an increase in adaptability decreases the mutual team trust.

vi. For PCA-6, it has been interpreted that a correlation of .879 shows that closed-loop communication is correlated to ICT tools usage.

vii. For PCA-7, it has been interpreted that a correlation of .903 shows that mutual team trust as a principal component is correlated with mutual team trust.

viii. For PCA-7, it has been interpreted that a correlation of .809 shows that team orientation as a principal component is correlated with mutual team trust.

V.4 Reliability test

For reliability testing, Cronbach's Alpha testing is adopted. There are no norms and marginal values standardized in Cronbach-Alpha. However, the higher the value, the greater the reliability, and the lesser the value (i.e., <6) lesser the reliability.

Table 3: Reliability analysis

S. No	Construct	Items	Cronbach alpha
1	Team orientation	8	.914
2	Adaptability	5	.853
3	Mutual team	10	.644
4	Backup behaviour	3	.924
5	Mutual performance	5	.909
6	Shared models	4	.847
7	Closed Loop	5	.776
8	Leadership skills	6	.923

Interpretation:

Table 3 denotes the reliability test under Cronbach's testing. From the obtained results of the alpha test, it is observed that all the 8 constructs are higher than 6; thus, the developed framework is reliable.

V.5 Demographic profile

The demographic data (age, gender, marital status, and education) are examined and represented through graphical representation.

Table 4: Age

	Frequency	Percent	Valid Percent	Cumulative Percent
18-29	57	20.4	20.4	20.4
30-39	90	32.3	32.3	52.7
40-49	83	29.7	29.7	82.4
50 plus	49	17.6	17.6	100.0
Total	279	100.0	100.0	

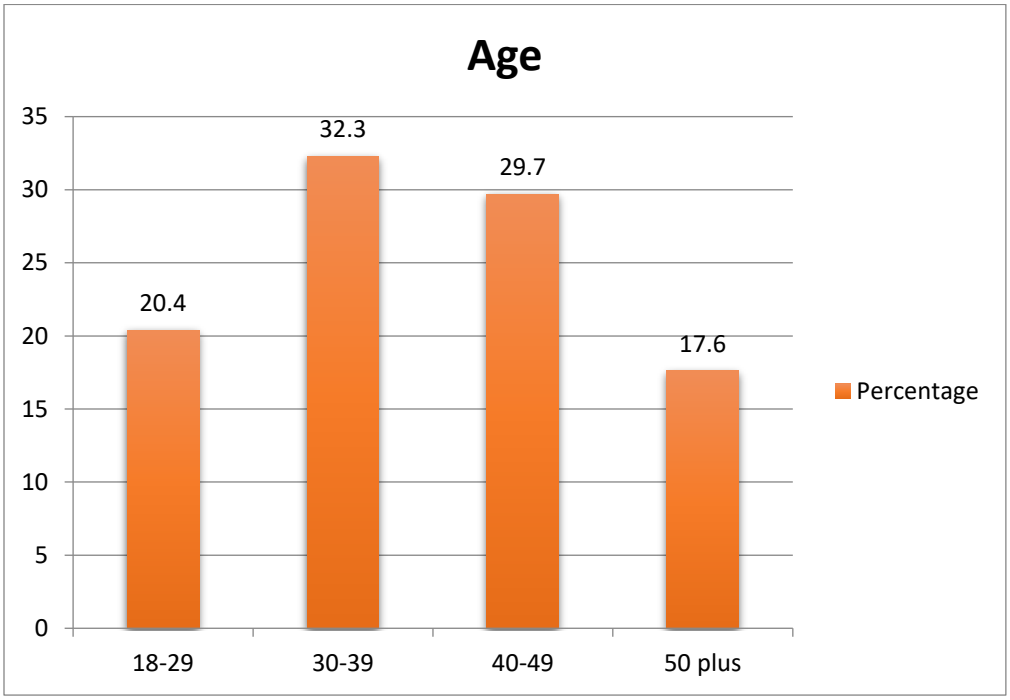

Figure 6: Age of the respondents

Table 5. Gender:

	Frequency	Percent	Valid Percent	Cumulative Percent

Male	136	48.7	48.7	48.7
Female	143	51.3	51.3	100.0
Total	279	100.0	100.0	

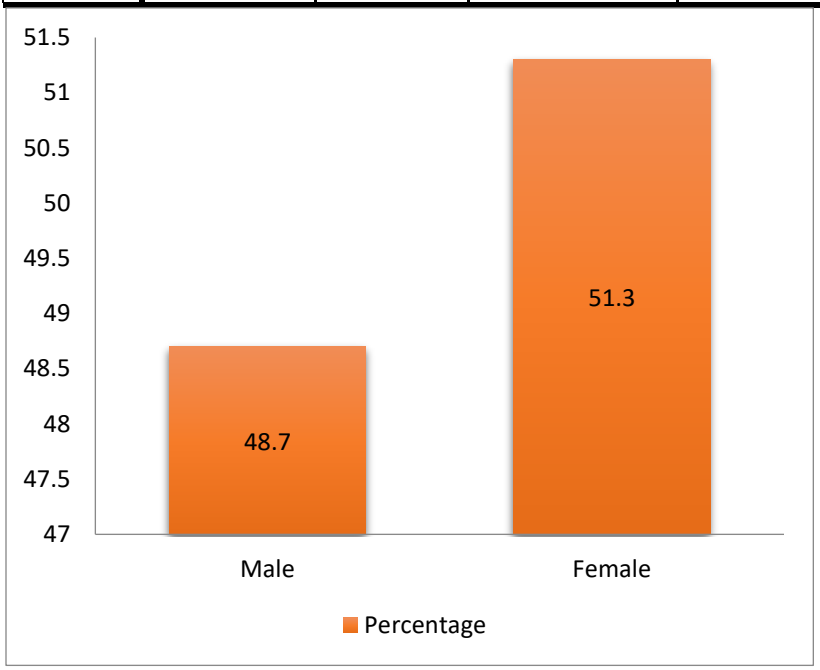

Figure 7: Gender

Table 6: Education:

	Frequency	Percent	Valid Percent	Cumulative Percent
Ug	104	37.3	37.3	37.3
Pg	135	48.4	48.4	85.7
Phfd	6	2.2	2.2	87.8
Others	34	12.2	12.2	100.0
Total	279	100.0	100.0	

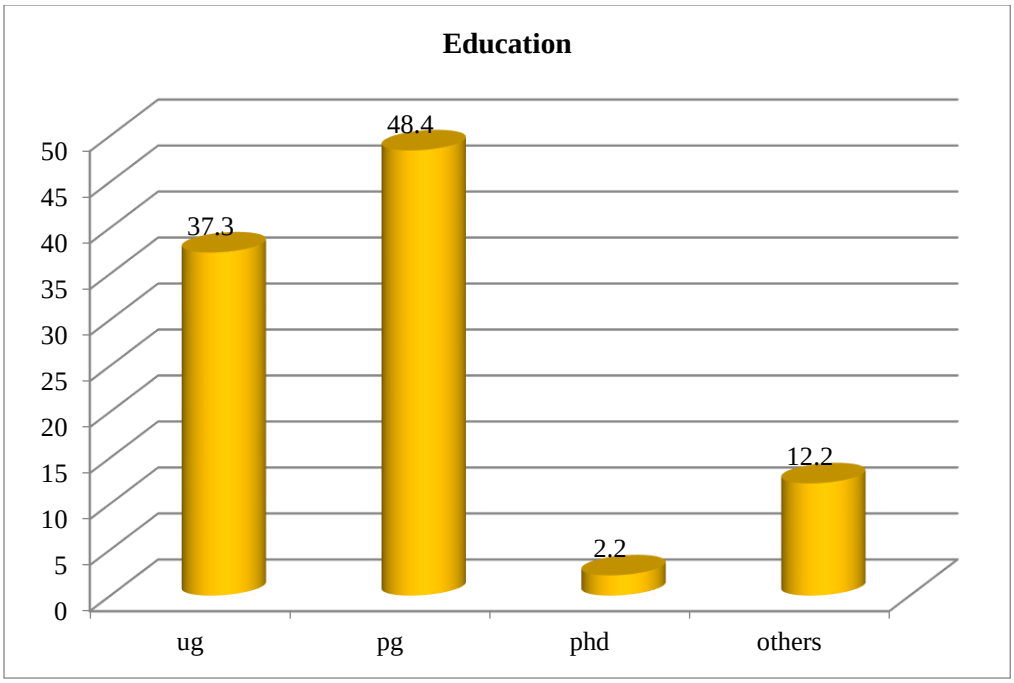

Figure 8: Education

Table 7. Marital Status:

	Frequency	Percent	Valid Percent	Cumulative Percent
Single	135	48.4	48.4	48.4
Married	122	43.7	43.7	92.1
Divorced	8	2.9	2.9	95.0
does not want to respond	14	5.0	5.0	100.0
Total	279	100.0	100.0	

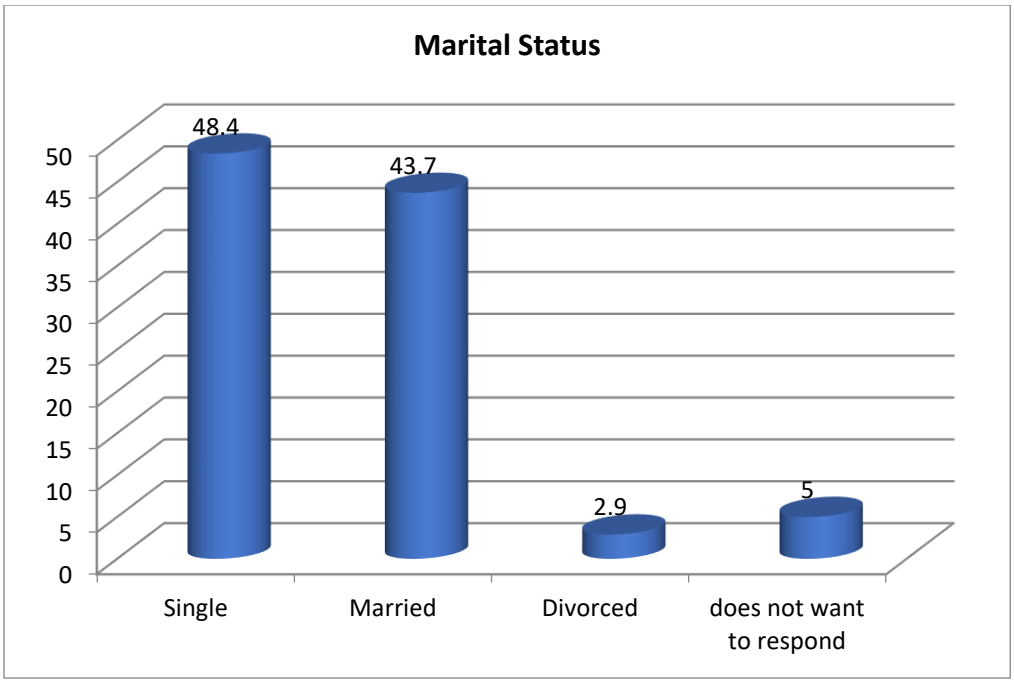

Figure 9: Marital Status

Interpretation:

Tables 4,5,6, and 7, along with figures 6, 7, 8, and 9, denote the demographic data where age, gender, education, and marital status are represented, respectively. From observed outcomes, it can be inferred that most of the employee participants belong to the age group 30-39years (32.3%), followed by the 40-49years (29.7%) group. Among the employees, the female was found to be major (51.3%), and the higher education level was found as post-Graduate with 48.4%. The higher marital status of the participants was observed as 'single' (48.4%), followed by married (43.7%). The remaining 5% and 2.9% of participants did not want to respond and divorced, respectively.

V.6 Team Effectiveness of Virtual Software Development Team

V.6.1 *Team results/orientation*

Table 8: Team results/orientation

Team Results/Orientation	Percentage of Responses				
Statements	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
The result of the teamwork successful	2.9	11.0	32.4	41.9	11.8
The team members agree that the result of the teamwork was successful	2.2	11.8	31.6	44.9	9.6
The team manage to stay within the time frame set aside for the teamwork	2.9	8.1	29.4	47.8	11.8
I got positive feedback on the work I had done	1.5	5.1	19.1	63.2	11.0
The team made good decisions	.7	14.0	33.1	43.4	8.8
I think the users of the product/ end results were satisfied	.7	8.8	26.5	52.2	11.8
The teamwork's result, lines in with or exceeded the organization's expectations/ goal for the teamwork	.7	8.1	23.5	52.2	15.4
The result of the teamwork, lines in with my expectations for the teamwork	0	5.9	8.8	75.0	10.3

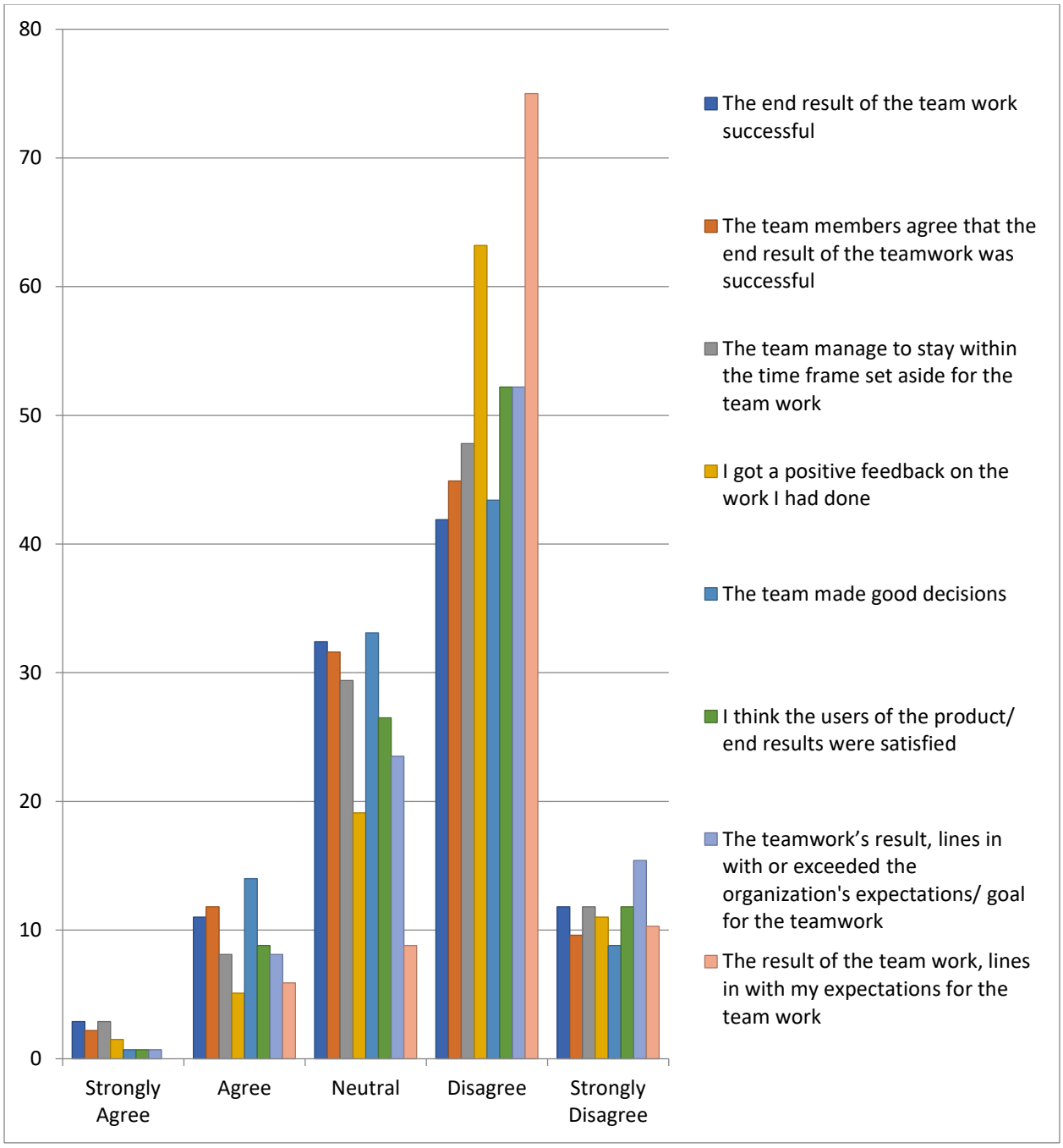

Figure 10: Team results/orientation

Interpretation:

Figure 10 and Table 8 represent the 'team orientation' construct of team effectiveness. Again, it is observed that the respondents majorly disagreed that 'there exists team orientation' or 'the team is result oriented.'

V.6.2 *Adaptability*

Table 9: Adaptability:

Adaptability	Percentage of Responses				
Statements	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
The team members were willing to adjust strategies because someone else on the team needed assistance	.7	4.3	31.5	54.1	9.3
The team was comfortable changing direction in a task during the work process if necessary	.7	4.3	21.1	65.9	7.9
I was flexible in new situations when they arose	.7	2.9	15.4	66.7	14.3
Everyone on the team was aware of the resources the team had at its disposal	.7	3.6	19.4	61.3	15.1
The team was willing to deal with unforeseen changes during the teamwork	1.4	5.7	23.7	59.5	9.7

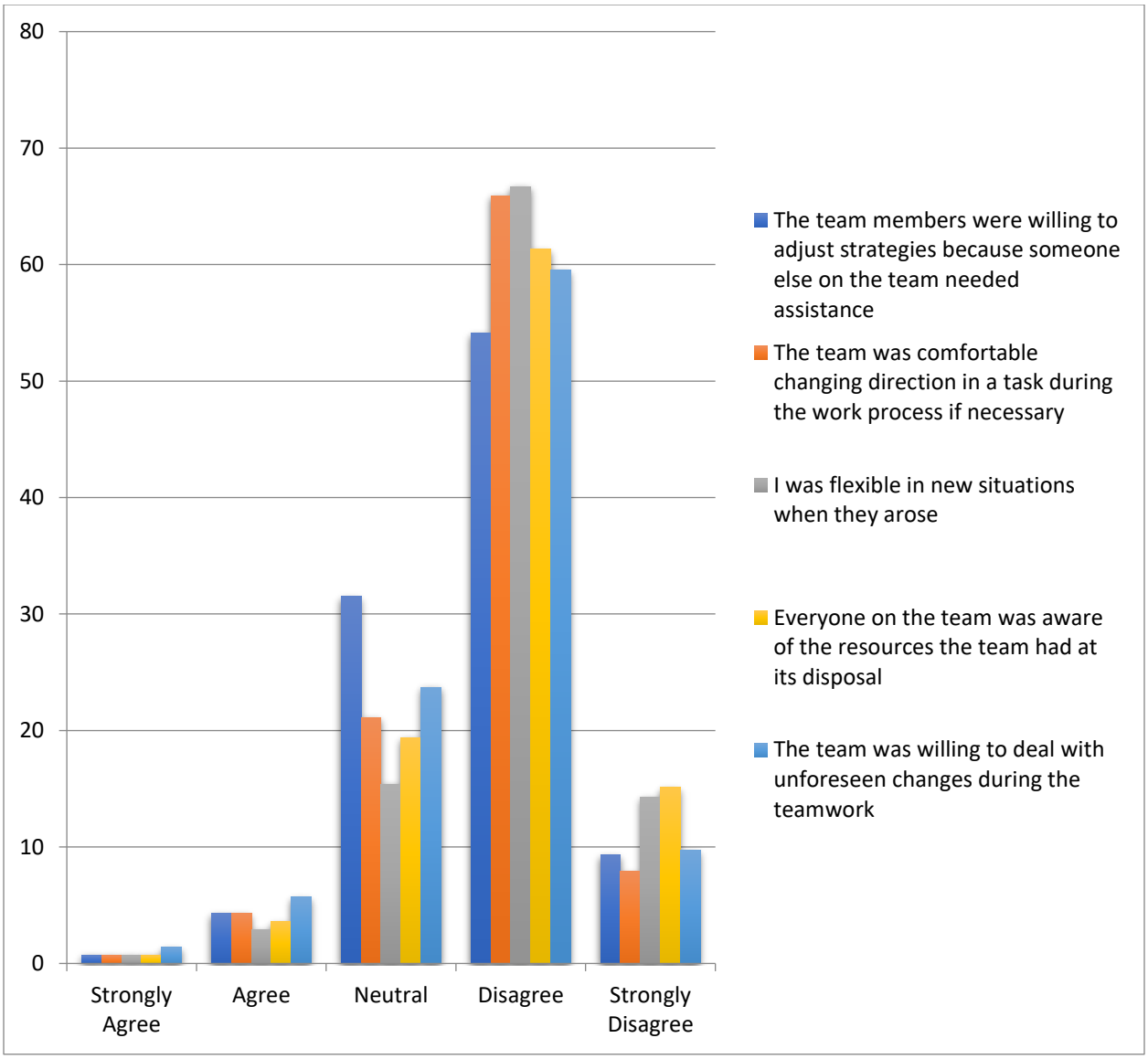

Figure 11: Adaptability

Interpretation:

Figure 11and table 9 represents 'adaptability' construct of team effectiveness. It's observed that, the respondents majorly disagreed to the fact that 'there exists adaptability within the team'.

V.6.3 *Mutual team/trust*

Table 10: Mutual team/trust

Mutual Team Trust	Percentage of Responses				
Statements	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
I trust the knowledge and abilities of the other team members	28	27.6	13.6	15.8	15.1
I trust the other team members to do what they said	39.4	34.8	8.6	10	7.2
All team members' contributions to the team were appreciated	33.3	39.1	9.3	10	8.2
I am sure that the other team members did their part	44.4	41.2	5	5	4.3
I trust that everyone on the team did their best to reach the goal	25.1	31.2	15.1	14.3	14.3

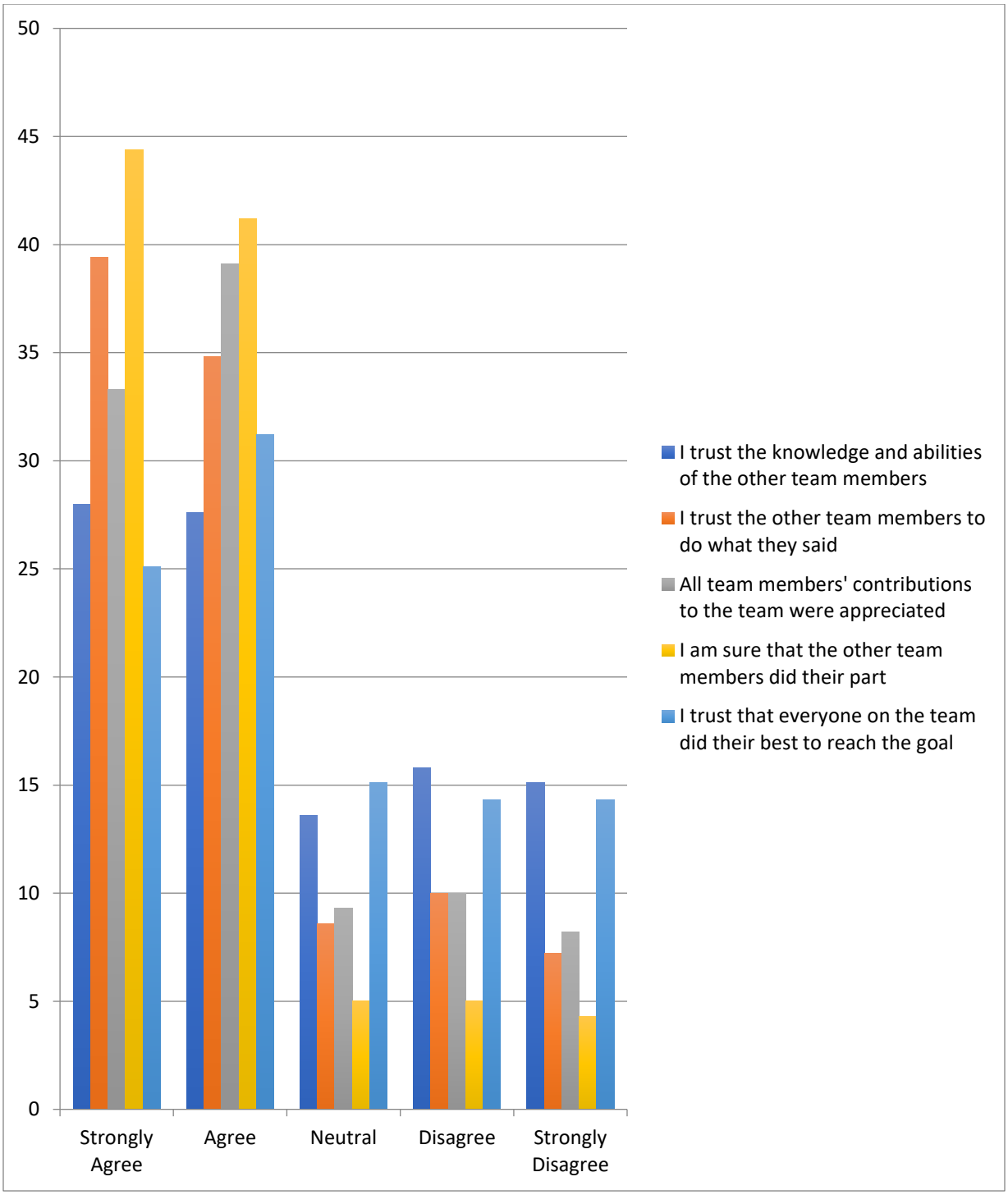

Figure 12: Mutual team/trust

Interpretation:

Figure 12 represents table 10 ‘mutual team/trust’ construct of team effectiveness. It’s observed that, the respondents majorly agreed to the fact that ‘there exists mutual trust among the team members in VT’.

V.6.4 *Backup behavior*

Table 11: Backup behavior

Backup behaviour	Percentage of Responses				
Statements	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
A team member would take over someone else's intended task if he/ she did not have time to complete the task himself/ herself?	14	59.5	15.4	9.3	1.8
I am comfortable in taking over the work of others if they needed help	13.6	55.2	15.8	13.6	1.8
The team members were willing to perform the tasks of other team members when necessary	13.3	60.2	15.4	8.6	2.5

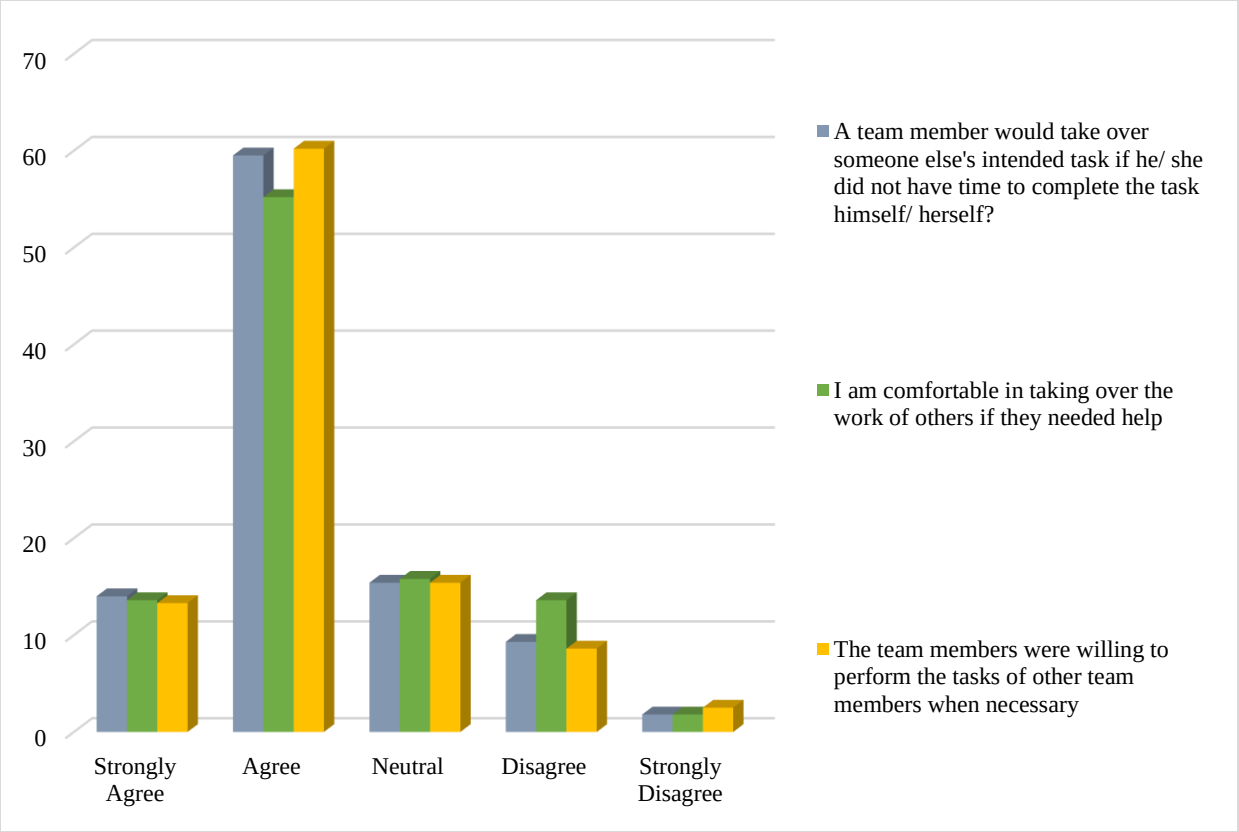

Figure 13: Backup behavior

Interpretation:

Figure 13 represents table 11 'backing-up behaviour' construct of team effectiveness. It's observed that, the respondents majorly agreed to the fact that 'there exists an ethicality and legal backing-up behaviour of data within the team members.

V.6.5 *Mutual performance monitoring*

Table 12: Mutual performance monitoring

Mutual performance monitoring	Percentage of Responses				
Statements	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
There was room to comment on the other team members' work tasks	3.6	38.4	35.1	20.8	2.2

It is acceptable to identify errors in the other team members' tasks	4.3	34.8	34.4	22.9	3.6
We give feedbacks on each other's' work	5.0	34.8	40.1	15.8	4.3
I Could ask for an explanation if the other team members did not perform the task as planned	2.9	26.2	34.8	33.3	2.9
I am willing to give feedback to other team members	3.6	28.7	30.5	33.0	4.3

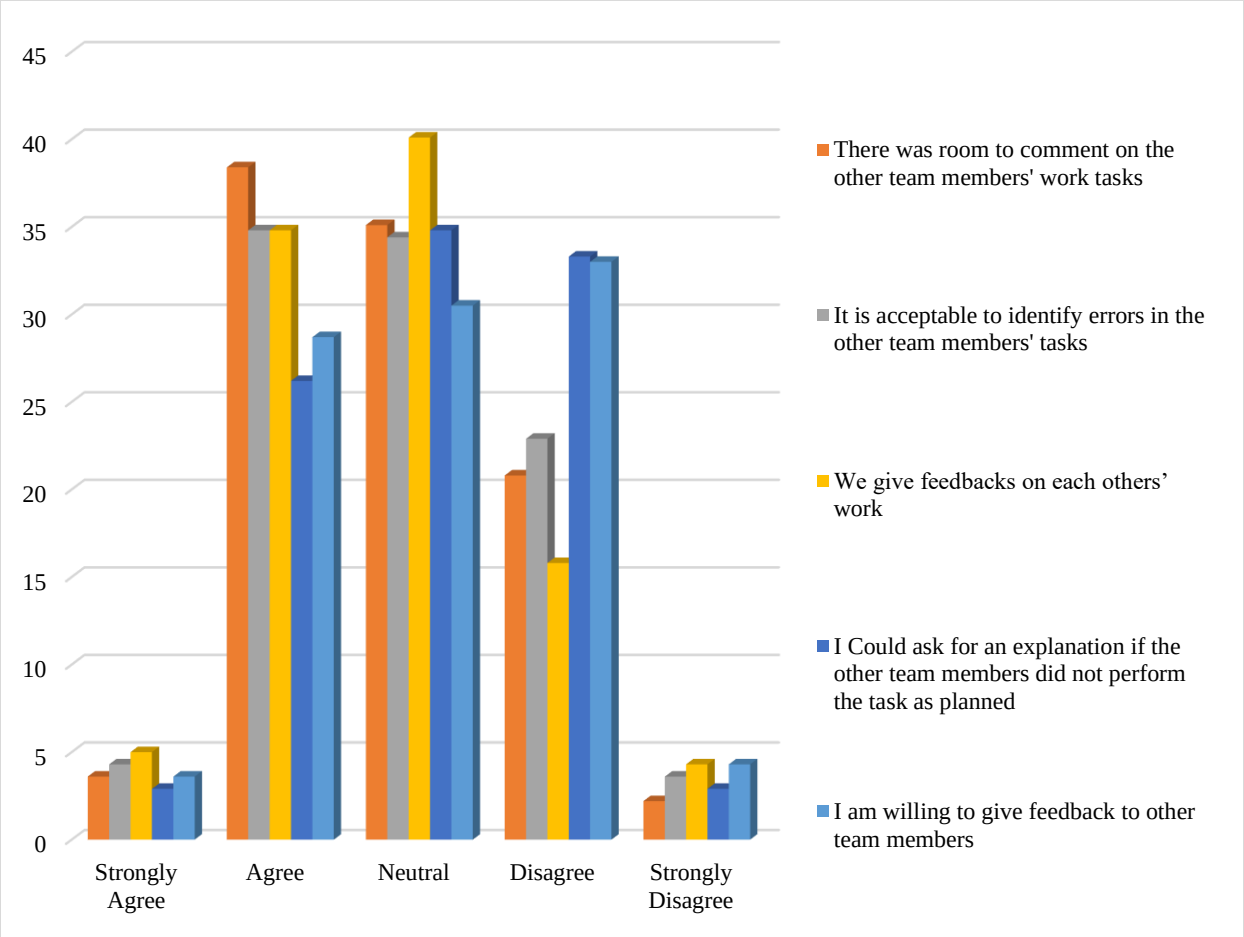

Figure 14: Mutual performance monitoring

Interpretation:

Figure 14 represents table 12 'mutual performance monitoring' construct of team effectiveness. It is observed that the respondents majorly agreed and remained neutral towards the fact that 'there is mutual performance monitoring in the VT.'

V.6.6 *Shared mental models*

Table 13: Shared mental models

Shared mental models	Percentage of Responses				
Statements	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
The team was willing to make changes in the work approach based on changes during the teamwork	.7	2.9	11.5	62.0	22.9
The team has a common understanding of its goals	.7	1.4	15.1	60.6	22.2
The team has a common understanding of the team's environment	.7	.7	16.5	59.1	22.9
The team members have a common goal with the teamwork	5.7	6.5	16.8	49.5	21.5

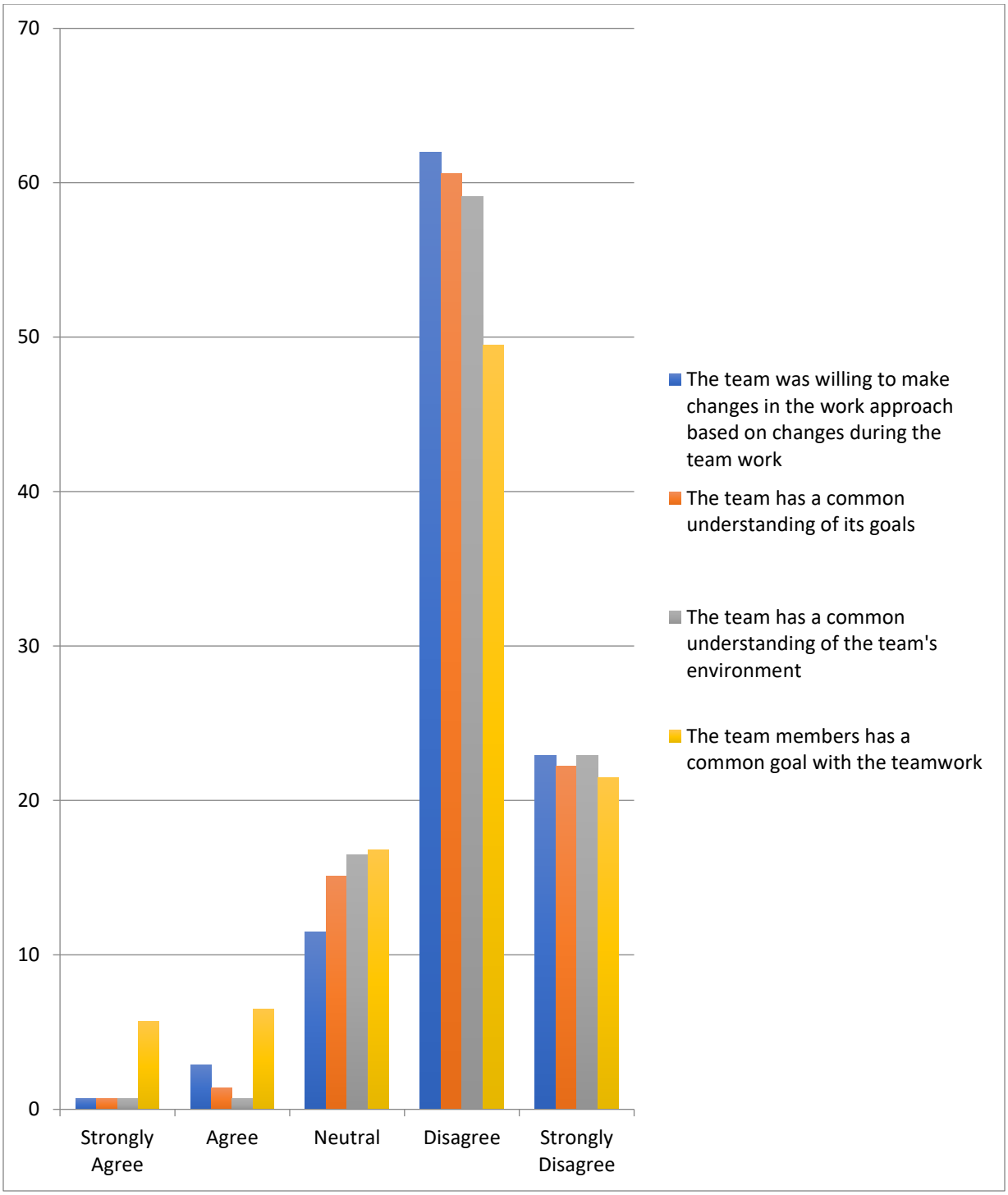

Figure 15: Shared mental models

Interpretation:

Figure 15 represents table 13 ‘shared mental models’ construct of team effectiveness. It’s observed that, the respondents majorly disagreed to the fact that ‘there is shared mental models practice among the VT members.

V.6.7 *Closed loop communication*

Table 14: Closed loop communication

Closed loop communication	Percentage of Responses				
Statements	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
I will give each other feedback that the messages were perceived	10.4	39.1	24.4	25.4	.7
I will give each other feedback if messages were understood	2.9	22.6	22.2	49.5	2.9
I will give each other feedback if messages were received	12.9	37.3	27.2	20.1	2.5
The information would reach me	8.6	44.1	18.3	27.6	1.4
The team members make sure that everyone had received important information	9.0	58.1	14.0	13.6	5.4

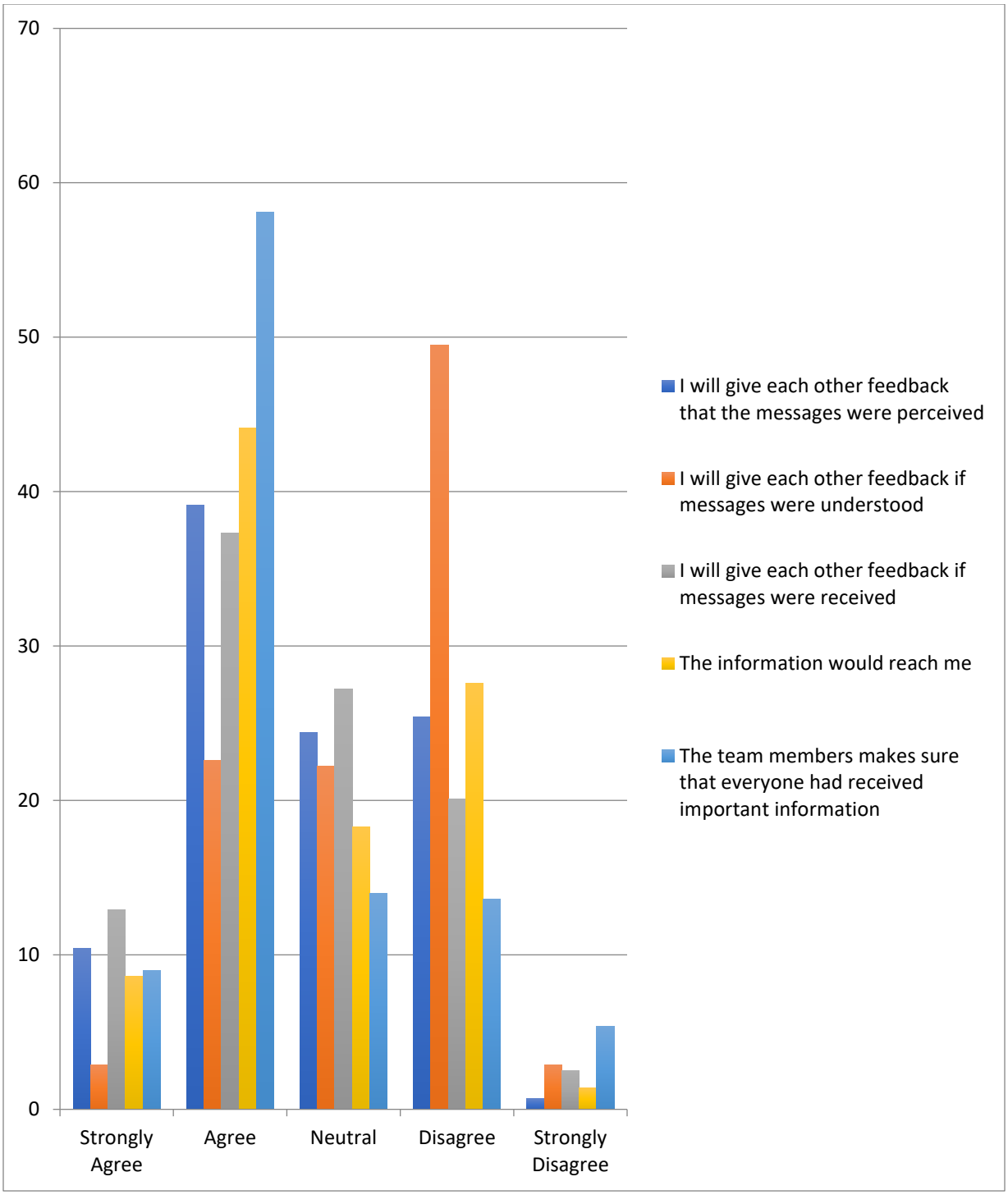

Figure 16: Closed loop communication

Interpretation:

Figure 16 represents table 14 ‘closed loop communication’ construct of team effectiveness. It’s observed that, the respondents majorly agreed to the fact that ‘there is closed loop communication between the team members in VT’.

V.6.8 *Leadership skills*

Table 15: Leadership skills:

Leadership Skills	Percentage of Responses				
Statements	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
Anyone on the team would take responsibility for making use of the team members' individual skills	3.6	38.4	35.1	20.8	2.2
The team members would praise me if I had made a good effort	4.3	34.8	34.4	22.9	3.6
The team members would willingly offer constructive feedbacks on the efforts of the team	5.0	34.8	40.1	15.8	4.3
There would be a team member who would plan the team's work process willingly	2.9	26.2	34.8	33.3	2.9
The team members would make sure that others stay on the right track, even though there were changes in the team situation	3.6	28.7	30.5	33.0	4.3
The team members would coordinate each other’s’ work tasks during the team process	2.9	28.7	30.8	33.3	4.3

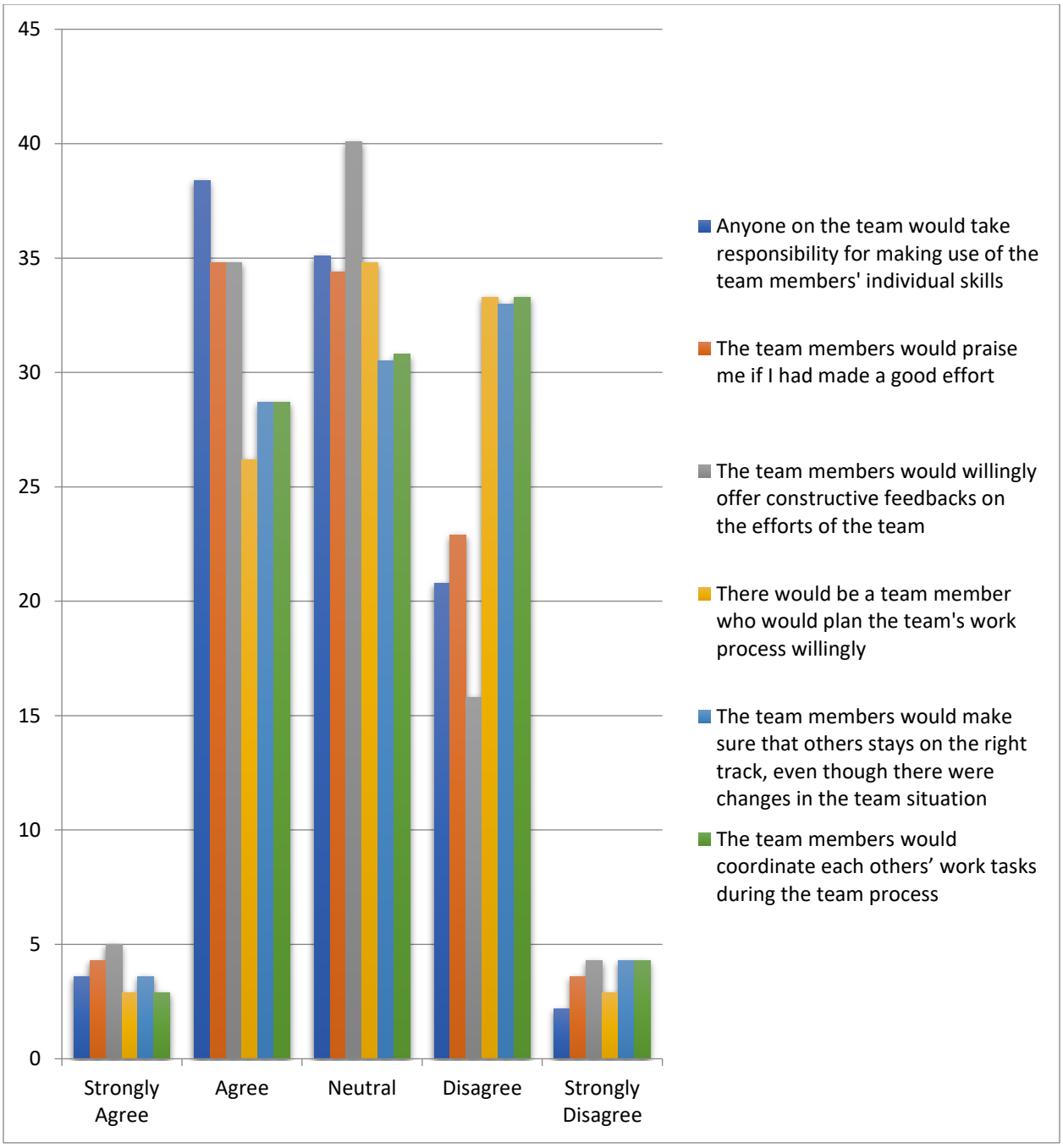

Figure 17: Leadership skills

Interpretation:

Figure 17 represents table 15 'leadership skills' construct of team effectiveness. It's observed that, the respondents majorly agreed and remained neutral about the fact that 'there exist the leadership skills within the VT'.

Inference:

Thus, from the findings, it is observed and deduced that the team effectiveness in VT is impacted by the constructs (closed loop communication, mutual team/trust, mutual performance monitoring, leadership skills, and backup behavior) focused on the study.

V.7 Usage of ICT Tools in Virtual Software Development Teams:

V.7.1 *E-Resources:*

Table 16: E-Resources:

E-resources	Percentage of Responses		
Statements	Never	Sometimes	Always
E-journals	27.6	25.1	47.3
Online storage	22.9	33.0	44.1

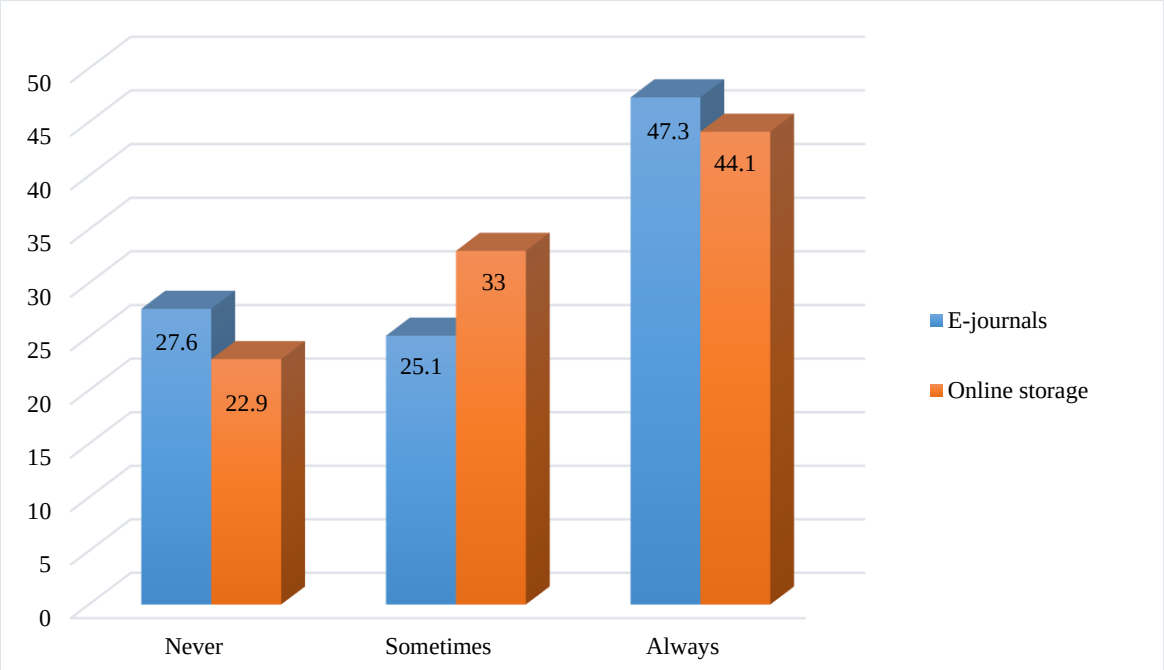

Figure 18: E-Resources

Interpretation:

Table 16 and figure 18 represent the 'E-resources' construct of ICT tools used. It's observed that, the respondents majorly agreed that they 'always' use the e-sources like e-journals with 47.3% and online storage with 44.1%.

V.7.2 *Editing tools:*

Table 17: Editing tools

Editing tools	Percentage of Responses		
Statements	Never	Sometimes	Always
E-mails	13.3	60.9	25.8
Note-taking software	25.4	27.2	47.3
Presentations	34.1	16.1	49.8

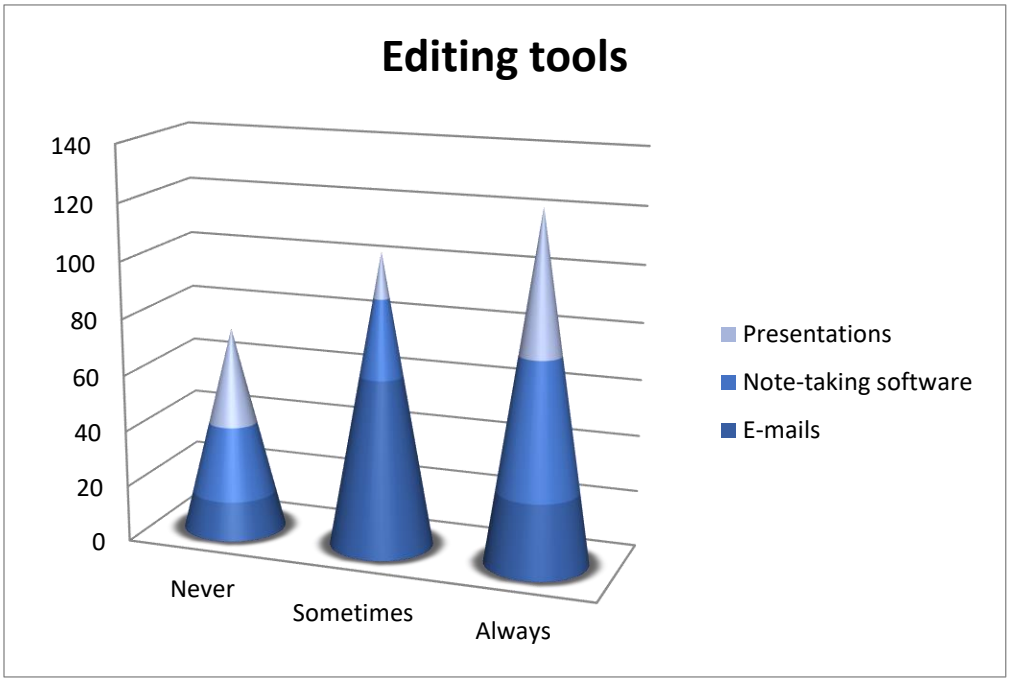

Figure 19: Editing tools

Interpretation:

Table 17 and figure 19 represent the 'Editing tools' construct of ICT tools used. It's observed that, the respondents majorly agreed that they 'always' use the editing tools like presentation (49.8%) and note-taking software (47.3%) and, 'sometimes' e-mails (60.9%).

V.7.3 *Social and media tools*

Table 18: Social and media tools

Social and media tools	Percentage of Responses		
Statements	Never	Sometimes	Always
Social Media	16.1	11.5	72.4
Audio/video chat (pl. Skype, Hangouts	28.3	25.8	45.9
Translators (e.g., Google translator)	30.8	21.9	47.3

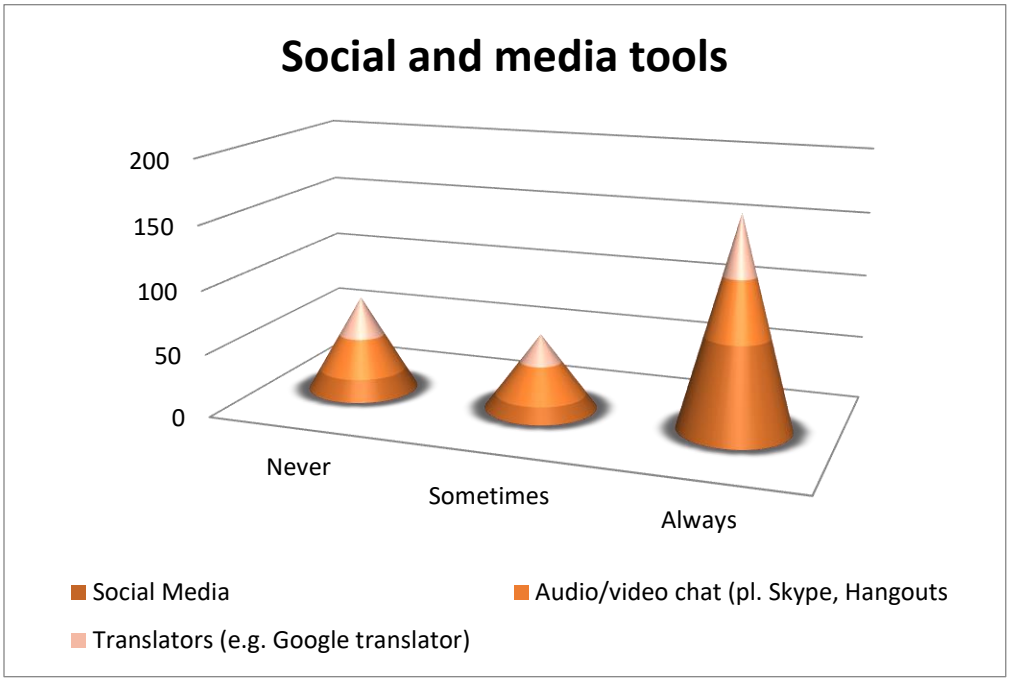

Figure 20: Social and media tools

Interpretation:

Table 18 and figure 20 represent the 'social and media tools' construct of ICT tools used. It's observed that the respondents majorly agreed that they 'always' use social media (72.4%), translators (47.3%), and audio/video chats (45.9%).

V.7.4 *Project management-based tools*

Table 19: Project management-based tools

Project management-based tools	Percentage of Responses		
Statements	Never	Sometimes	Always
Databases	27.6	43.7	28.7
Programming	30.5	2.9	66.7
Simulations	22.9	43.7	33.3
Excel	52.3	14.3	33.3

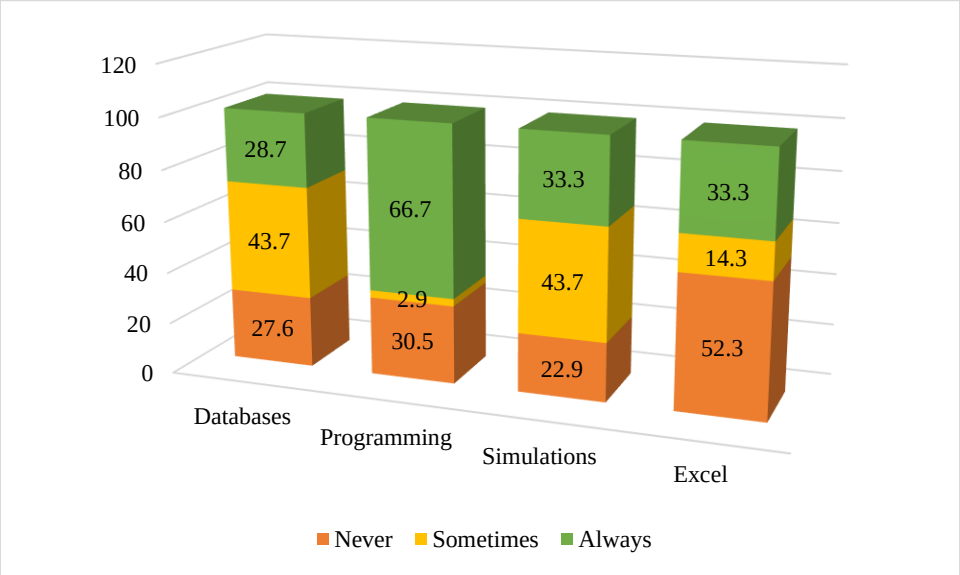

Figure 21: Project management-based tools

Interpretation:

Table 19 and figure 21 represent the 'project-management tools' construct of ICT tools used. It's observed that the respondents majorly agreed that they 'always' use the project-management tools like programming tools (66.7%); other tools like excel 'never' with 52.3%, and finally 'sometimes' the other tools like databases (43.7%) and simulations (43.7%) in software development based VTs.

V.7.5 *Search engines and browsing*

Table 20: Search engines and browsing

E-resources	Percentage of Responses		
Statements	Never	Sometimes	Always
Search engines (e.g., Google, Bing)	63.8	8.6	27.6
Internet browsers	36.2	40.9	22.9

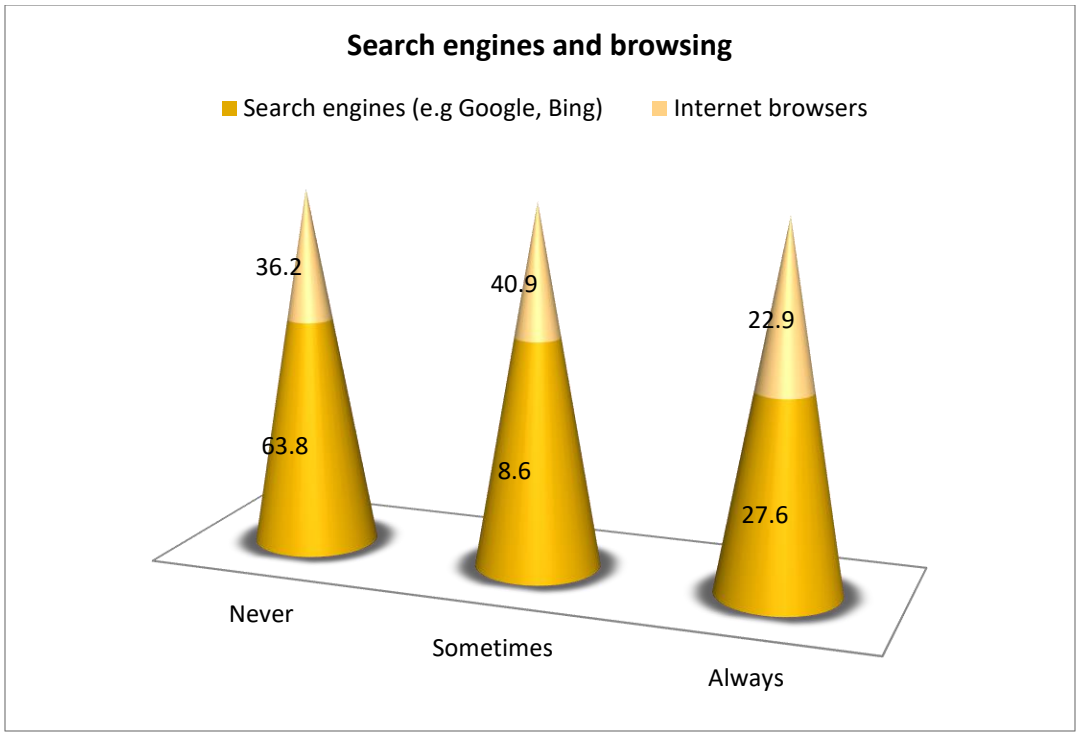

Figure 22: Search engines and browsing

Interpretation:

Table 20 and figure 22 represent the 'search-engines and browsing tools' construct of ICT tools used. It is observed that the respondents majorly agreed that they 'sometimes' use internet browsers (40.9%) and 'never' use search engines (63.8%) in software development-based VTs.

V.7.6 *Blogs and vlogs:*

Table 21: Blogs and vlogs:

Blogs and vlogs	Percentage of Responses		
Statements	Never	Sometimes	Always
Blogs and vlogs	22.9	18.6	58.4

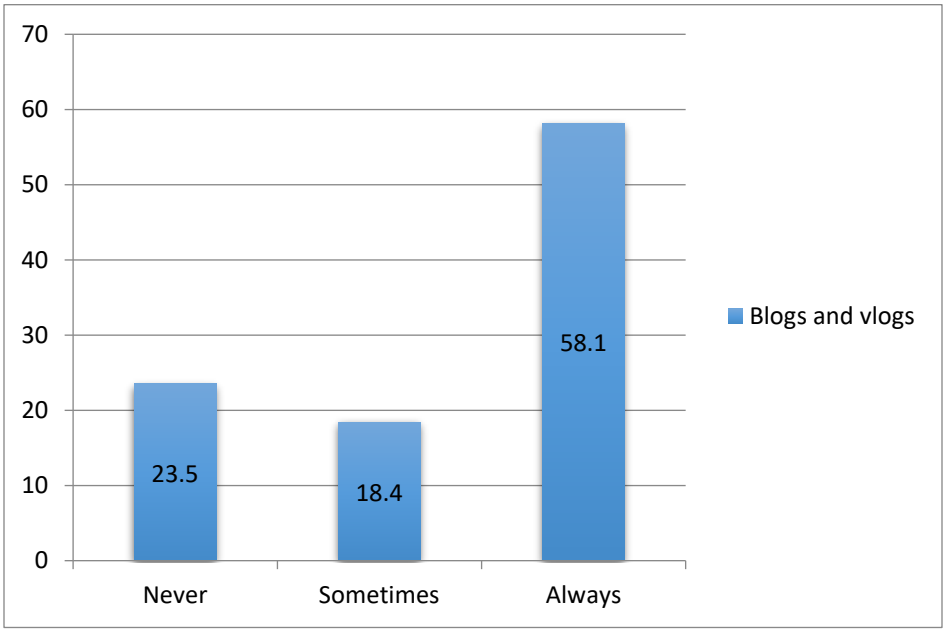

Figure 23: Blogs and vlogs

Interpretation:

Table 21 and figure 23 represent the 'blogs and vlogs' construct of ICT tools used. It is observed that the respondents majorly agreed that they 'always' use blogs and vlogs (58.1%) in software development-based VTs.

V.7.7 *Podcasts*

Table 22: Podcasts

Podcasts	Percentage of Responses		
Statements	Never	Sometimes	Always
Podcasts	19.7	18.6	61.6

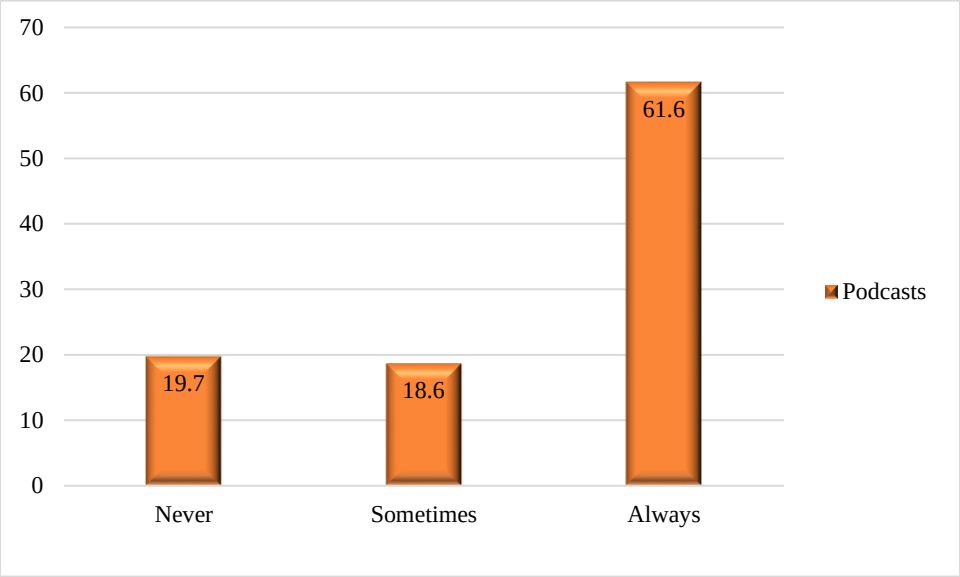

Figure 24: Podcasts

Interpretation:

Table 22 and figure 24 represent the 'podcasts' construct of ICT tools used. It is observed that the respondents majorly agreed that they 'always' use podcasts (61.6%) in software development based VTs.

Correlations[c]

		Mean	SD	Age	Edu	ATOT	TOTOT	MTTTOT	BTOT	MPMTOT	SMMTOT	CLCTOT	LSTOT	TTOT	TEEFF	AGETTOT	SEXTTO
Age	Pearson Correlation	2.4444	1.00518	--													
Edu	Pearson Correlation	1.8925	.93450	.036	--												
	Sig. (1-tailed)			.276													
ATOT	Pearson Correlation	18.9068	2.87108	.092	.007	--											
	Sig. (1-tailed)			.063	.454												
TOTOT	Pearson Correlation	18.3943	2.97509	.034	.009	**.828****	--										
	Sig. (1-tailed)			.287	.442	<.001											
MTTTOT	Pearson Correlation	11.3907	2.72242	.077	**.157****	-.041	-.016	--									

	Sig. (1-tailed)			.100	.004	.246	.392										
BTOT	Pearson Correlation	6.8710	2.51853	**.156****	.043	**.190****	**.218****	.087	--								
	Sig. (1-tailed)			.004	.237	<.001	<.001	.075									
MPMTOT	Pearson Correlation	14.5878	3.95096	**.105***	-.081	**.382****	**.426****	.052	**.423****	--							
	Sig. (1-tailed)			.040	.088	<.001	<.001	.191	<.001								
SMMTOT	Pearson Correlation	15.8315	2.67219	**.252****	.049	**.370****	**.391****	.067	**.239****	**.316****	--						
	Sig. (1-tailed)			<.001	.208	<.001	<.001	.131	<.001	<.001							
CLCTOT	Pearson Correlation	13.7348	3.62067	.024	.037	**.223****	**.255****	**.135***	**.502****	**.429****	**.202****	--					
	Sig. (1-tailed)			.347	.268	<.001	<.001	.012	<.001	<.001	<.001						
LSTOT	Pearson Correlation	17.6631	4.72797	.109*	-.075	**.380****	**.415****	.050	**.425****	**.992****	**.303****	**.430****	--				
	Sig. (1-tailed)			.035	.106	<.001	<.001	.203	<.001	<.001	<.001	<.001					

TTOT	Pearson Correlation	38.9821	2.68282	.043	-.087	**.122***	.093	**.195****	-.025	.066	.059	**-.105***	.083	--			
	Sig. (1-tailed)			.237	.074	.021	.060	<.001	.340	.135	.164	.040	.084				
TEEFF	Pearson Correlation	117.3799	17.07092	.156**	.010	**.633****	**.672****	**.228****	**.591****	**.856****	**.533****	**.639****	**.852****	.089	--		
	Sig. (1-tailed)			.005	.434	<.001	<.001	<.001	<.001	<.001	<.001	<.001	<.001	.069			
AGETTOT	Pearson Correlation	95.4050	40.56451	.983**	.024	.108*	.053	**.118***	.153**	.111*	**.253****	.005	.117*	**.216****	**.168****	--	
	Sig. (1-tailed)			<.001	.345	.036	.190	.025	.005	.032	<.001	.468	.025	<.001	.003		
SEXTTOT	Pearson Correlation	58.9534	19.97448	-.072	.092	.026	-.064	.034	.135*	-.041	.085	-.004	-.026	**.201****	.014	-.036	--
	Sig. (1-tailed)			.114	.062	.333	.144	.285	.012	.245	.078	.472	.332	<.001	.407	.274	

**. Correlation is significant at the 0.01 level (1-tailed).

*. Correlation is significant at the 0.05 level (1-tailed).

c. Listwise N=279

The table presented above provides valuable insights into the relationships between variables in the study through Pearson correlations and their corresponding significance values. It highlights the variables that exhibit significant correlations.

Analyzing the table, we observe that the independent variable TTOT (ICT Tools usage) displays significant correlations with three dependent variables: ATOT (Adaptability), MTTTOT (Mutual team trust), and CLCTOT (Closed-loop communication).

Moreover, the table also reveals significant correlations among some of the dependent variables, representing the eight team effectiveness characteristics. Notably, ATOT exhibits a strong correlation of 0.828 with TOTOT. This indicates that there is a substantial overlap between the eight characteristics identified in the existing literature. These correlations provide evidence of interconnectedness among the various dimensions of team effectiveness.

By examining these correlations and significance values, we gain valuable insights into the relationships among the variables under investigation. This information sets the foundation for further analysis and interpretation of the data, enabling a comprehensive understanding of the factors influencing team effectiveness and the interrelationships between different aspects of team performance.

V.8 Statistical analysis results

ANOVA and Regression are used to test the hypotheses formulated.

V.8.1 *Regression analysis*

After the preliminary descriptive analysis of the data and factor analysis, Regression was used to test the hypotheses about the relationship between ICT tools usage and the various aspects of team effectiveness.

This study aimed to investigate whether ICT Tools used by Virtual Software Teams due to the Covid19 Lockdown and Team Effectiveness (TE) have a positive relationship.

For this, the eight hypotheses labeled H1.1 to H1.8 are tested. Each of these eight hypotheses tests the relationship between ICT tool usage and one of the eight components of team effectiveness. Further, hypothesis 2 tests whether age and gender moderate the association between ICT tools usage and TE variables:

H1.1: There is a relationship between ICT Tools usage by Virtual Software Teams due to Covid-19 Lockdown and ***Team orientation***

Table 23: Regression Results H1.1 (Dependent Variable: TOTOT)

Effect	Estimate	SE	*95% CI*		*p*
			LL	UL	
Intercept	14.96	2.68	9.69	20.23	<0.001
Age	0.07	0.18	-0.28	0.42	0.70
Sex	-0.46	0.36	-1.17	0.24	0.20
TTOT	0.10	0.07	-0.03	0.23	0.13
Model R^2 : 0.02					

Inference:

Hypothesis 1.1 states that using ICT Tools by Virtual Software Teams would significantly affect the virtual team's team orientation. Specifically, the expectation was that using ICT tools would positively influence team orientation. The model shows the direct effects of ICT Tools on team orientation, controlling for Age and Sex, the p-value of 0.13 is greater than 0.05. Thus, H1.1 is not supported at the 5% level of significance. Therefore, we conclude that we do not have sufficient evidence to show a significant relationship between ICT tools usage by virtual software teams and team orientation.

Authors Waizenegger et al. (2020) found that though virtual teams during the Covid-19 lockdown faced many challenges and hurdles, despite the drawbacks and lags in communication, team orientation either impacts the individuals positively to work towards the organization's performance and goals efficiently or impacts negatively that affects the organization and individual goals. Based on the outcomes obtained through the regression analysis and the study results, we can see that using ICT tools may improve the communication within the team, but that does not necessarily influence the person to interact and contribute to the team's productivity. However, the individual's perspective of contributing towards achieving team goals may depend on the individual's psychological or any other aspect. Therefore, individuals' ability to contribute toward team goals may not be influenced just by providing better communication tools. The ICT tools can help those individuals who are willing to contribute and have no means of communication to express their thoughts with the team. However, if the person is not a team player and he/she wants

to finish the tasks by himself and not worry about contributing to overall team success, then the availability of ICT tools may not change the individual's perspective.

H1.2: There is a relationship between the ICT Tools usage by Virtual Software Teams Due to Covid19 Lockdown and ***Adaptability***

Table 24: Regression Results H1.2 (Dependent Variable: ATOT)

Effect	Estimate	SE	*95% CI*		*p*
			LL	UL	
Intercept	13.26	2.58	8.19	18.32	<0.001
Age	0.25	0.17	-0.09	0.59	0.145
Sex	0.07	0.34	-0.61	0.74	0.850
TTOT	0.13	0.06	0.01	0.25	0.048
Model R^2 : 0.02					

Inference:

Hypothesis 1.2 states that using ICT Tools by Virtual Software Teams would significantly affect the virtual team's adaptability. Specifically, the expectation was that using ICT tools would positively influence the team's adaptability. The model shows the direct effects of ICT Tools on Adaptability, controlling for Age and Sex, the p-value of 0.048 is less than 0.05. Thus, H1.2 is supported at the 5% level of significance. Therefore, we conclude that we have sufficient evidence to show a significant relationship between ICT tools usage by virtual software teams and adaptability. The model equation is as follows:

Predicted value of Adaptability = ***13.26+0.25 (Age)+0.07(Gender) + 0.13 (TTOT)***

Authors Sima et al. (2020) argued that during Covid19, the virtual teams in organizations struggled to meet their schedules with fewer team members, non-experienced employees, geographical differences, and more, where the adaptability of the individual employees in a team failed to achieve the organizational goal. Based on the research outcome, we can say that ICT tool usage may not be the only factor influencing the individual's adaptability. It may be the person's willingness to learn about the ICT tools usage, thereby making better use of it to communicate

well with the team resulting in better outcomes. If the person is not willing to learn the proper usage of the tool nor interested in proactive participation in team meetings and other team discussions, then the availability of ICT tools may not significantly affect the factor adaptability.

Thus, our findings are supported by the findings of the study by authors Sima et al. (2022).

H1.3*:** There is a relationship between ICT Tools usage by Virtual Software Teams Due to Covid19 Lockdown and ***Mutual trust

Table 25: Regression Results H1.3 (Dependent Variable : MTTTOT)

Effect	Estimate	SE	*95% CI*		*p*
			LL	UL	
Intercepts	18.30	3.54	11.34	25.26	<0.001
Age	0.26	0.24	-0.21	0.72	0.277
Sex	-0.45	0.47	-1.38	0.48	0.338
TTOT	0.30	0.09	0.12	0.47	0.001
Model R^2: 0.043					

Inference:

Hypothesis 1.3 states that using ICT Tools by Virtual Software Teams would significantly affect the virtual team's mutual trust. Specifically, the expectation was that using ICT tools would positively influence mutual trust. The model shows the direct effects of ICT Tools on mutual trust, controlling for Age and Sex, the p-value of 0.001 is less than 0.05. Thus, H1.3 is supported at the 5% level of significance. Therefore, we conclude that we have sufficient evidence to show a significant relationship between ICT tools usage by virtual software teams and mutual trust. The model is as follows:

Predicted value of Mutual Trust = *18.3+0.26 (Age)-0.45(Gender) + 0.30 (TTOT)*

The coefficient of 0.30 indicates a positive effect of TTOT on mutual trust. Specifically, it says that holding age and sex constants, on average, for a unit increase in the TTOT value, the value of the mutual trust increases by 0.30

In the studies developed by Sheng et al. (2010) and Zalat et al. (2021), it was observed and concluded that mutual understanding and trust among the individuals in a team, especially the virtual teams, rapidly progress the project deliveries and assist them to cooperate with other effectively. In the current research, mutual trust was found to be the highly significant construct

of the team effectiveness factor that aligns with the outcomes in the studies of Zalat et al. (2021) and Sheng et al. (2010) research. Due to Covid19, organizations had to transform their traditional teams into 'virtual teams' where the team members might not know each other due to the differences in their geographical location and experiences. Mainly, it was a drawback that negatively impacted the trust among the employees in a team. However, the result shows that using ICT tools in virtual teams is highly significant, and it positively impacts the mutual trust among employees by bridging the distance and communication.

Based on the analysis, it can be inferred that the developed Hypothesis 1.3 examined mutual trust and ICT tools usage positively affects team effectiveness. Therefore, we can assume that trust within the team would **increase** with increased interactions between team members. In addition, however, the more there would be communication among the team members, there would be little room for misunderstanding, which indirectly establishes greater trust among the team members. So, based on this analysis, we can say that ICT tools usage by virtual software teams influences mutual trust. Thus, supporting the findings by authors Zalat et al. (2021) and the findings derived by authors Sheng et al. (2010) stating that mutual trust is of utmost necessary in each team of an organization, whether it is a physical team or a virtual team.

H1.4: There is a relationship between ICT Tools usage by Virtual Software Teams Due to Covid-19 Lockdown and Backup behavior

Table 26: Regression Results H1.4 (Dependent Variable: BTOT)

Effect	Estimate	SE	*95% CI*		*p*
			LL	UL	
Intercept	5.67	2.22	1.30	10.04	0.011
Age	0.43	0.15	0.14	0.72	0.004
Sex	0.85	0.30	0.27	1.43	0.004
TTOT	-0.03	0.06	-0.14	0.08	0.597
Model R^2 : 0.054					

Inference:

Hypothesis H1.4 states that the ICT tools usage by virtual software teams due to the Covid-19 lockdown would significantly affect the virtual team's backup behavior. Specifically, the expectation was that using ICT tools would positively influence the team's backup behavior. However, studies by Mayo (2020) and Zhou and Pazos (2020) insisted that the backup behavior in virtual teams could be a boon, or a bane were backing up a member in a team impacts the team effectively and backing-up data illegally impacts the team negatively.

The p-value is 0.60 which is higher than 0.05. Because of higher p value greater than 0.05 signifies that we do not have sufficient evidence to show that the usage of ICT tools has significant effect on the backup behavior of individuals in virtual teams.

Based on the analysis, we cannot claim that ICT tools usage by virtual teams can significantly reduce the backup behavior of the individuals. There may be several facts based on which it can be inferred that regular communication with a team can break silos and make the employees express their thoughts openly. Employees show backup behavior when they do not trust other team members or managers. They tend to make excuses when they feel that other team members would not recognize their contribution. Having regular meetings, interacting with other team members on platforms like Slack or Skype, and attending daily team meetings can gradually reduce the backup behavior of the employees.

H1.5: There is a relationship between ICT Tools usage by Virtual Software Teams Due to Covid19 Lockdown and ***Mutual performance***

Table 27: Regression Results H1.5 (Dependent Variable: MPMTOT)

Effect	Estimate	SE	*95% CI*		*p*
			LL	UL	
Intercept	10.68	3.55	3.68	17.67	0.003
Age	0.39	0.24	-0.08	0.85	0.102
Sex	-0.38	0.47	-1.31	0.55	0.425
TTOT	0.09	0.09	-0.08	0.26	0.304
Model R^2 : 0.017					

Inference:

Hypothesis H1.5 states that the ICT tools usage by virtual software teams due to the Covid-19 lockdown would significantly affect the virtual team's mutual performance. Specifically, the expectation was that virtual software teams' use of ICT tools would positively influence the team's mutual performance. The model shows the direct effects of ICT Tools on mutual performance, controlling for Age and Sex the p-value of 0.30 is greater than 0.05. Thus, H1.5 is not supported at the 5% level of significance. Because of p value greater than 0.05, signifies that we do not have sufficient evidence to show that the usage of ICT tools has significant effect on the mutual performance of individuals in virtual teams.

H1.6: There is a relationship between ICT Tools usage by Virtual Software Teams Due to Covid19 Lockdown and ***Shared mental models***

Table 28: Regression Results H1.6(Dependent Variable: SMMTOT)

Effect	Estimate	SE	*95% CI*		*p*
			LL	UL	
Intercept	11.59	2.33	7.00	16.18	<0.001
Age	0.68	0.16	0.38	0.99	<0.001
Sex	0.46	0.31	-0.15	1.07	0.140
TTOT	0.05	0.06	-0.07	0.16	0.406

Model R^2 : 0.073

Inference:

Hypothesis H1.6 states that the ICT tools usage by virtual software teams due to the Covid-19 lockdown would significantly affect the virtual team's Shared mental models. Specifically, the expectation was that using ICT tools would positively influence the team's shared mental models.

The p-value of 0.40 is greater than 0.05. Thus, H1.6 is not significant at the 5% significance level. Because of p-value greater than 0.05 signifies that we do not have sufficient evidence to show that the usage of ICT tools has significant effect on the shared mental models of individuals in virtual teams.

H1.7: There is a relationship between ICT Tools usage by Virtual Software Teams Due to Covid19 Lockdown and ***Closed-loop communication***

Table 29: Regression Results H1.7 (Dependent Variable: CLCTOT)

Effect	Estimate	SE	*95% CI*		*p*
			LL	UL	
Intercept	18.86	3.26	12.44	25.28	<0.001
Age	0.11	0.22	-0.32	0.53	0.621
Sex	0.14	0.44	-0.72	1.00	0.746
TTOT	-0.14	0.08	-0.30	0.02	0.077

Model R^2 : 0.012

Inference:

Hypothesis H1.7 states that using ICT tools by virtual software teams due to the Covid-19 lockdown would significantly affect closed-loop communication. Specifically, the expectation was that using ICT tools would positively influence the team's closed-loop communication. The model shows that there is a direct effect of ICT tools usage on closed-loop communication, controlling for Age and Sex the p-value of 0.08 is greater than 0.05. Thus, hypothesis H1.7 is not supported at a 5% significance level. Because of higher p value greater than 0.05 signifies that we do not

have sufficient evidence to show that the usage of ICT tools has significant effect on the closed loop communication of individuals in virtual teams.

Authors Anna-Carin et al. (2021) insisted that poor communication and open communication always results in chaos in a team's productivity and performance. The issues in open communication were poor decision making, a longer time for decision making, non-cooperativeness, manipulation, misdirection of judgment by team leaders, and more. Based on our analysis, we can state that there may be other factors other than open communication and availability of ICT tools that can affect the individual or team's ability to work cohesively without misunderstandings. For example, maybe due to wrong perceptions and understanding, the team's individual can work towards achieving wrong targets, which can be fixed by proper confirmation and reiterating their understanding in open communication. There may also be other factors such as asynchronous communication where only one or two members talk and do not give a chance to all the team members to communicate their ideas openly can lead to team members working towards achieving incorrect goals.

H1.8: There is a relationship between ICT Tools usage by Virtual Software Teams Due to Covid19 Lockdown and ***Leadership skills***

Table 30: Regression Results H1.8 (Dependent Variable: LSTOT)

Effect	Estimate	SE	*95% CI*		*p*
			LL	UL	
Intercept	11.65	4.25	3.29	20.01	0.006
Age	0.48	0.28	-0.07	1.04	0.089
Sex	-0.34	0.57	-1.46	0.77	0.545
TTOT	0.14	0.11	-0.07	0.35	0.193
Model R^2 : 0.019					

Inference:

Hypothesis H1.8 states that using ICT tools by virtual software teams due to Covid-19 lockdown would significantly affect Leadership skills. Specifically, the expectation was that using ICT tools would positively influence the virtual team's leadership skills. The model shows that

there is a direct effect of ICT tools usage on leadership skills, controlling for Age and Sex. The p-value of 0.19 is greater than 0.05. Because of higher p value greater than 0.05 signifies that we do not have sufficient evidence to show that the usage of ICT tools has significant effect on the leadership skills of individuals in virtual teams.

The researchers Newman et al. (2019), Jain and Vijaya (2019), and Mysirlaki and Paraskeva (2020) studied leadership skills intensively in virtual teams in organizations. The significant outcome of these studies was that using ICT tools can negatively and positively impact leadership skills in virtual teams. It can show positive results when the team leaders maintain proper communication, monitoring, organized work, mentoring, insisting on team purpose, fair assessments, and building trust one-to-one as a positive outcome. On the contrary, it can show negative results when team leaders' express pressure on team members by over monitoring, pressure on project completion, power and authority misuse, and overbearing stress, which results in poor team performances. Constant monitoring in leadership was found negatively impact the team effectiveness in traditional monitoring by Mysirlaki and Paraskeva (2020) if the leaders could provide an environment where rewards, awards, motivation, and other positive approaches may result in the virtual team's productivity higher and on-time.

In contrast, constant monitoring would decrease productivity, and it can further delay the scheduled project due to hindrances from peers and team leaders. Also, other factors such as leadership qualities that a team leader possess may or may not be influenced by the use of ICT tools. For example, if the team leader is not good, providing ICT tools may not necessarily enhance his/her leadership skills.

H2: **Age** and **Gender** moderates the relationship between the ICT tools usage by Virtual Software Teams due to Covid19 Lockdown and team effectiveness

In order to determine the moderation effect of Age and Gender on the team effectiveness using ICT tools, eight possible models have been tested.

H2.1: Age and Gender moderates the relationship between the ICT tools usage by Virtual Software Teams due to Covid19 Lockdown and Adaptability.

Table 31: Regression Results (Model 1: TTOT, AGE ,SEX and SEXTTOT, AGETTOT as predicators)

Effect	Estimate	SE	*95% CI*		*p*
			LL	UL	
Intercept	-0.50	11.94	-23.99	22.99	0.97
Age	2.86	2.65	-2.35	8.07	0.280
Sex	4.51	5.14	-5.61	14.63	0.381
TTOT	0.48	0.31	-0.12	1.08	0.118
AGETTOT	-0.07	0.07	-0.19	.07	0.323
SEXTTOT	-0.11	0.13	-0.37	.15	0.387
Model R2 : 0.028 and P : 0.175					

(Dependent Variable : ATOT)

The empirical research findings suggest that: The relationship between the usage of the ICT tools by virtual software teams and adaptability was not moderated by Age and Sex. The p-value of 0.175 for the overall model is greater than 0.05 indicating that the overall model is not significant. Also, the p-values of 0.323 and 0.387 of the interaction terms are not statistically significant at a confidence interval of 95%. This indicates that there is no significant moderating effect of Age and sex on the relationship between the usage of ICT tools and adaptability. Thus, hypothesis H2.1 is not supported at the 5% level of significance.

H2.2: **Age** and **Gender** moderates the relationship between the ICT tools usage by Virtual Software Teams due to Covid19 Lockdown and Team Orientation

Table 32: Regression Results (Model 2: TTOT, AGE ,SEX and SEXTTOT, AGETTOT as predicators)

Effect	Estimate	SE	*95% CI*		*p*
			LL	UL	
Intercept	12.19	12.40	-12.23	36.61	0.327
Age	-1.82	2.75	-7.23	3.60	0.509
Sex	4.55	5.34	-5.97	15.07	0.396
TTOT	0.17	0.32	-0.45	0.80	0.583
AGETTOT	0.05	0.07	-0.09	0.19	0.493
SEXTTOT	-0.13	0.14	-0.40	0.14	0.348
Model R2 : 0.022 and P : 0.30					

(Dependent Variable : TOTOT)

The empirical research findings suggest that: The relationship between the usage of the ICT tools by virtual software teams and Team Orientation was not moderated by Age and Sex. The p-value of 0.30 for the overall model is greater than 0.05 indicating that the overall model is not significant. Also, the p-values of 0.493 and 0.348 of the interaction terms are not statistically significant at a confidence interval of 95%. This indicates that there is no significant moderating effect of Age and sex on the relationship between the usage of ICT tools and Team Orientation. Thus, model 2 hypothesis H2.2 is not supported at the 5% level of significance.

H2.3: **Age** and **Gender** moderates the relationship between the ICT tools usage by Virtual Software Teams due to Covid19 Lockdown and Mutual Team Trust

Table 33: Regression Results (Model 3a: TTOT, AGE ,SEX and SEXTTOT, AGETTOT as predicators)

Effect	Estimate	SE	*95% CI*		*p*
			LL	UL	
Intercept	19.59	11.12	-2.30	41.48	0.079
Age	-5.49	2.47	-10.35	-0.64	0.027
Sex	-0.82	4.79	-10.25	8.61	0.864
TTOT	-0.22	0.28	-0.78	0.34	0.440
AGETTOT	0.14	0.06	0.02	0.27	0.022
SEXTTOT	0.02	0.12	-0.22	0.26	0.862
Model R2 : 0.044 and P : 0.004					

(Dependent Variable :MTTTOT)

The overall model p-value of 0.004 is lower than 0.05 indicating that the overall model is statistically significant at a confidence interval of 95%. The p-values of 0.022 for AGETTOT is also less than 0.05, indicating that the interaction term between Age and the usage of ICT tools is significant. This implies that there is a moderating effect of Age on the relationship between Usage of ICT tools by Virtual Software Teams and Mutual Team Trust. However, the p-value of 0.862 for SEXTTOT is greater than 0.05, indicating that it is not statistically significant at a confidence interval of 95%. This implies that Sex does not moderate the relationship between the Usage of ICT tools by Virtual Software Teams and Mutual Team Trust.

Thus, hypothesis H2.3 is partially supported at the 5% level of significance. Age has a moderating effect while Sex does not. Given that the coefficient for AGETTOT is positive (+0.14), it means that as Age increases the effect of ICT tools usage on Mutual team trust also increases.

Since only Age and AGETTOT were significant in the model above, the regression was re-run after dropping the other variables that were insignificant. The results are shown in the table below.

Table 34: Regression Results (Model 3b: AGE, AGETTOT as predicators)

Effect	Estimate	SE	*95% CI*		*p*
			LL	UL	
Intercept	11.01	0.42	10.18	11.83	<0.001
Age	-3.04	0.85	-4.72	-1.36	<0.001
AGETTOT	0.082	0.02	0.04	0.12	<0.001
Model R^2 : 0.057 and P : <0.001					

(Dependent Variable :MTTTOT)

Based on this regression the model is as follows:

Predicted Mutual Team Trust = 11.01-3.04(Age)+ 0.082(AGETTOT)

As the model says, the effect of ICT tools usage on Mutual team trust is only visible through the moderating effect of Age.

H2.4: **Age** and **Gender** moderates the relationship between the ICT tools usage by Virtual Software Teams due to Covid19 Lockdown and Backup Behavior

Table 35: Regression Results (Model 4a: TTOT, AGE ,SEX and SEXTTOT, AGETTOT as predicators

Effect	Estimate	SE	*95% CI*		*p*
			LL	UL	
Intercept	-9.24	10.14	-29.21	10.73	0.363
Age	-1.19	2.25	-5.62	3.24	0.597
Sex	13.26	4.37	4.66	21.86	0.003
TTOT	0.35	0.26	-0.16	0.86	0.172
AGETTOT	0.04	0.06	-0.07	0.15	0.472
SEXTTOT	-0.32	0.11	-0.54	-0.09	0.005
Model R2 : 0.087 and P : <0.001					

(Dependent Variable : BTOT)

The overall model p-value of 0.001 is lower than 0.05 indicating that the overall model is statistically significant at a confidence interval of 95%. The p-values of 0.005 for SEXTTOT is also less than 0.05, indicating that the interaction term between Sex and the usage of ICT tools is significant. This implies that there is a moderating effect on the relationship between Usage of ICT

tools by Virtual Software Teams and Backup Behavior. However, the p-value of 0.472 for AGETTOT is greater than 0.05, indicating that it is not statistically significant at a confidence interval of 95%. This implies that Age does not moderate the relationship between the Usage of ICT tools by Virtual Software Teams and Backup Behavior.

Thus, model 4 hypothesis H2.4 is partially supported at the 5% level of significance. Sex has a moderating effect while Age does not. Given that the coefficient for SEXTTOT is negative (-0.32), it means that the Backup Behavior increase in Males with the use of ICT tools while it decreases in Females.

Since only Sex and SEXTTOT were significant in the model above, the regression was re-run after dropping the other variables that were insignificant. The results are shown in the table below.

Table 36: Regression Results (Model 4b: SEX, SEXTTOT as predicators)

Effect	Estimate	SE	*95% CI*		*p*
			LL	UL	
Intercept	5.69	0.48	4.76	6.63	<0.001
Sex	2.53	1.37	-0.16	5.23	0.065
SEXTTOT	-0.05	0.03	-0.11	0.02	0.190
Model R^2 : 0.030 and P : 0.015					

(Dependent Variable :BTOT)

Based on this regression the model is as follows:

Predicted Mutual Team Trust = 5.69+2.53(Sex)- 0.05(SEXTTOT)

As the model says, the effect of ICT tools usage on Backup Behavior is only visible through the moderating effect of Sex.

H2.5: **Age** and **Gender** moderates the relationship between the ICT tools usage by Virtual Software Teams due to Covid19 Lockdown and Mutual Performance

Table 37: Regression Results (Model 5: TTOT, AGE ,SEX and SEXTTOT, AGETTOT as predicators)

Effect	Estimate	SE	*95% CI*		*p*
			LL	UL	
Intercept	1.17	16.49	-31.30	33.64	0.944
Age	3.32	3.66	-3.88	10.52	0.365
Sex	0.77	7.11	-13.21	14.76	0.913
TTOT	0.33	0.42	-0.50	1.16	0.430
AGETTOT	0.08	0.09	-0.26	0.11	0.422
SEXTTOT	-0.03	0.18	-0.39	0.33	0.871
Model R2 : 0.019 and P : 0.369					

(Dependent Variable : MPMTOT)

The empirical research findings suggest that: The relationship between the usage of the ICT tools by virtual software teams and Mutual Performance was not moderated by Age and Sex. The p-value of 0.369 for the overall model is greater than 0.05 indicating that the overall model is not significant. Also, the p-values of 0.422 and 0.871 of the interaction terms are not statistically significant at a confidence interval of 95%. This indicates that there is no significant moderating effect of Age and sex on the relationship between the usage of ICT tools and Mutual Performance. Thus, model 5 hypothesis H2.5 is not supported at the 5% level of significance.

H2.6: **Age** and **Gender** moderates the relationship between the ICT tools usage by Virtual Software Teams due to Covid19 Lockdown and Shared Mental Model

Table 38: Regression Results (Model 6a: TTOT, AGE, SEX and SEXTTOT, AGETTOT as predicators)

Effect	Estimate	SE	*95% CI*		*p*
			LL	UL	
Intercept	29.45	10.71	8.35	50.54	0.006
Age	0.72	2.37	-3.96	5.40	0.761
Sex	-11.16	4.62	-20.25	-2.07	0.016
TTOT	-0.41	0.27	-0.95	0.13	0.135
AGETTOT	-0.001	0.06	-0.12	0.12	0.988
SEXTTOT	0.29	0.12	0.07	0.53	0.012
Model R2 : 0.095 and P : <0.001					

(Dependent Variable: SMMTOT)

The overall model p-value of 0.001 is lower than 0.05 indicating that the overall model is statistically significant at a confidence interval of 95%. The p-values of 0.012 for SEXTTOT is also less than 0.05, indicating that the interaction term between Sex and the usage of ICT tools is significant. This implies that there is a moderating effect of Sex on the relationship between Usage of ICT tools by Virtual Software Teams and Shared Mental Model. However, the p-value of 0.988 for AGETTOT is greater than 0.05, indicating that it is not statistically significant at a confidence interval of 95%. This implies that Age does not moderate the relationship between the Usage of ICT tools by Virtual Software Teams and Shared Mental Model.

Thus, hypothesis H2.6 is partially supported at the 5% level of significance. Sex has a moderating effect while Age does not. Given that the coefficient for SEXTTOT is positive (+0.12), it means that the Shared Mental Model increases more significantly in Females with the use of ICT tools while it is less significant in Males.

Since only Sex and SEXTTOT were significant in the model above, the regression was re-run after dropping the other variables that were insignificant. The results are shown in the table below.

Table 39: Regression Results (Model 6b: SEX, SEXTTOT as predicators)

Effect	Estimate	SE	*95% CI*		*p*
			LL	UL	
Intercept	15.30	0.51	14.30	16.30	<0.001
Sex	-2.08	1.46	-4.96	0.80	0.157
SEXTTOT	0.06	0.04	-0.01	0.13	0.091
Model R^2 : 0.014 and P : 0.134					

(Dependent Variable :SMMTOT)

Based on this regression the model is as follows:

Predicted Mutual Team Trust = 15.30-2.08(Sex)+0.06(SEXTTOT)

As the model says, the effect of ICT tools usage on Shared Mental Model is only visible through the moderating effect of Sex.

H2.7: **Age** and **Gender** moderates the relationship between the ICT tools usage by Virtual Software Teams due to Covid19 Lockdown and Closed Loop Communication

Table 40: Regression Results (Model 7: TTOT, AGE ,SEX and SEXTTOT, AGETTOT as predicators)

Effect	Estimate	SE	*95% CI*		*p*
			LL	UL	
Intercept	20.53	15.17	-9.33	50.39	0.177
Age	-0.10	3.36	-6.72	6.53	0.977
Sex	-0.59	6.53	-13.46	12.27	0.928
TTOT	-0.19	0.39	-0.95	0.56	0.631
AGETTOT	0.005	0.09	-0.16	0.17	0.952
SEXTTOT	0.02	0.17	-0.31	0.35	0.911
Model R2 : 0.012 and P : 0.639					

(Dependent Variable : CLCTOT)

The empirical research findings suggest that: The relationship between the usage of the ICT tools by virtual software teams and Closed Loop Communication was not moderated by Age and Sex. The p-value of 0.639 for the overall model is greater than 0.05 indicating that the overall model is not significant. Also, the p-values of 0.952 and 0.911 of the interaction terms are not

statistically significant at a confidence interval of 95%. This indicates that there is no significant moderating effect of Age and sex on the relationship between the usage of ICT tools and Closed Loop Communication. Thus, model 7 hypothesis H2.7 is not supported at the 5% level of significance.

H2.8: **Age** and **Gender** moderates the relationship between the ICT tools usage by Virtual Software Teams due to Covid19 Lockdown and Leadership Skills

Table 41: Regression Results (Model 8: TTOT, AGE ,SEX and SEXTTOT, AGETTOT as predicators)

Effect	Estimate	SE	*95% CI*		*p*
			LL	UL	
Intercept	3.08	19.71	-35.73	41.88	0.876
Age	4.06	4.37	-4.55	12.66	0.354
Sex	-0.89	8.49	-17.61	15.83	0.916
TTOT	0.36	0.50	-0.64	1.35	0.481
AGETTOT	-0.09	0.11	-0.31	0.13	0.413
SEXTTOT	0.01	0.22	-0.41	0.44	0.948
Model R2 : 0.022 and P : 0.299					

(Dependent Variable : LSTOT)

The empirical research findings suggest that: The relationship between the usage of the ICT tools by virtual software teams and Leadership Skills was not moderated by Age and Sex. The p-value of 0.299 for the overall model is greater than 0.05 indicating that the overall model is not significant. Also, the p-values of 0.413 and 0.948 of the interaction terms are not statistically significant at a confidence interval of 95%. This indicates that there is no significant moderating effect of Age and sex on the relationship between the usage of ICT tools and Leadership Skills. Thus, model 8 hypothesis H2.8 is not supported at the 5% level of significance.

Prendes et al. (2020), Davidescu et al. (2020), and Skvarc et al. (2021) examined how gender, age, and ICT tools are related to team effectiveness. The conclusion portrayed that employee belonging to the 25-45years category, single or living alone, especially women, were more highly motivated than men and positively impacted in virtual teams. When examining the using described criteria, the obtained results were compared, and it was found that "female"

employees were higher (51.3%) than male employees, and they disagreed that the ICT tools impacted them negatively where they had to work more hours than in traditional setup with no proper schedule. Though they had flexible working hours, they shared that traditional work times were firm and reliable, and they could share more time with family members. However, the work-from-home-based schedule hindered their time and mutual understanding with their family members, resulting in disappointments, the canceling of plans, and more stress, mainly for youngsters from the 20 years above category.

Thus, it can be inferred from the analysis that "Hypothesis H2.1 through H2.8 examined that the moderators, age and gender have a significant impact on the team effectiveness and ICT tools usage. Thus, supporting the findings in the study by Skvarc et al. (2021), age and gender positively impact team effectiveness in virtual teams.

V.9 Hypothesis testing

Table 42: Hypothesis testing outcomes for constructs of team effectiveness and ICT tools usage

S. No.	Hypothesis	Results
1	*H1.1.*There is a relationship between the Team orientation and ICT Tools	Not Significant
	*H1.2.*There is a relationship between the Adaptability and ICT Tools	Significant
	*H1.3.*There is a significant relationship between Mutual trust and ICT Tools	Significant
	*H1.4.*There is a relationship between the Backing behaviour and ICT tools	Not Significant
	*H1.5.*There is a relationship between Mutual performance and ICT Tools	Not Significant
	*H1.6.*There is a relationship between the Shared mental and ICT Tools	Not Significant
	*H1.7.*There is a relationship between Closed-loop communication and ICT tools	Not Significant
	*H1.8.*There is a relationship between Leadership orientation and ICT Tools	Not Significant

Table 43: Hypothesis testing outcomes of Moderating effect of Age and Gender for constructs of team effectiveness and ICT tools usage

S. No.	Hypothesis	Moderation Effect of Age	Moderation Effect of Sex
1	*H2.1:* Age and Gender moderates the relationship between the ICT tools usage by Virtual Software Teams due to Covid19 Lockdown and Adaptability	Not Significant	Not Significant
	H2.2: Age and Gender moderates the relationship between the ICT tools usage by Virtual Software Teams due to Covid19 Lockdown and Team Orientation	Not Significant	Significant
	H2.3: Age and Gender moderates the relationship between the ICT tools usage by Virtual Software Teams due to Covid19 Lockdown and Mutual Team Trust	Significant	Not Significant
	H2.4: Age and Gender moderates the relationship between the ICT tools usage by Virtual Software Teams due to Covid19 Lockdown and Backup Behavior	Not Significant	Significant
	H2.5: Age and Gender moderates the relationship between the ICT tools usage by Virtual Software Teams due to Covid19 Lockdown and Mutual Performance	Not Significant	Not Significant
	H2.6: Age and Gender moderates the relationship between the ICT tools usage by Virtual Software Teams due to Covid19 Lockdown and Shared Mental Model	Not Significant	Significant
	H2.7: Age and Gender moderates the relationship between the ICT tools usage by Virtual Software Teams due to Covid19 Lockdown and Closed Loop Communication	Not Significant	Not Significant
	H2.8: Age and Gender moderates the relationship between the ICT tools usage by Virtual Software Teams due to Covid19 Lockdown and Leadership Skills	Not Significant	Not Significant

Results:

From table 36, it is perceived that formulated hypotheses H1 and H2 are partially supported. Thus, some associations exist between the Virtual teams' usage of ICT tools during Covid19 and their team effectiveness. Similarly, the moderators' Age' and 'Gender' partially moderate the relationship between the ICT Tools usage by Virtual Software Teams Due to Covid19 Lockdown and Team Effectiveness.

V.10 Validity of the regression results

The association between the variables' team effectiveness and 'ICT tools' has been examined through regression. The result validation has been done by acquiring the reviews of the ICT tools usage as secondary resources from websites like trustradius.com, gartner.com, podbay.com, g2.com, chartable.com, softwareadvice.com, and capterra.com, and more. The author collected more than 350 reviews as secondary data resources from the above data resources. However, the research is based on examining the virtual team effectiveness of software developers during Covid; hence, the reviews collected during the last 2years (2019-2021) were particularly focused, and the reviews were filtered as 351 reviews according to the research purpose. These results have been classified into three categories "Supported," "Does not support," and "Not relevant ."The first category mentions that the review favours supporting this research, which means that ICT tools helped the individuals improve their performance. However, based on whatever information available in the text of the reviews, an attempt has been made to classify them into 8 different construct supporting review sections. The results are:

V.10.1 *Team Orientation and ICT tools:*

Team orientation is defined by Erkens et al. (2011) as the extent of involvement and positive attitude of individuals in the team towards working as a team. The hypothesis tested was that there is a positive relationship between ICT tools usage in virtual teams and Team Orientation. Based on the regression, no significant relationship was found between ICT tool usage and Team Orientation. In other words, usage of ICT tools did not seem to promote a more positive attitude about working in a team among its members.

Of the 351 reviews studied, 41 reviews were found to be relevant to team orientation. Out of these 41 relevant reviews, 36 reviews were positive and the rest of around 5 reviews were negative. A thorough examination of these 41 reviews revealed that several tools are available with features that make team meetings convenient and as effective as possible. For example, a review for JIRA, which is a portal for maintaining and assigning team tasks has been written as “Makes working virtually with my team so easy & time saving!” indicating that this tool encourages the team members to collaborate with each other to distribute the assigned tasks and update their work progress in its comments and status. A few more reviews for same tool, “Necessary for big teams. Correct setup saves a lot of time”, “Best tool to create, measure, monitor

tasks" and "The one size fits all tool for your team work" also refers to the importance of this tool in connecting big teams spread over different geographical regions. In addition to these, we found negative reviews such as "Interactive elements, working with your team, is too hard to use" & "OneDrive is not a great tool to collaborate with members on your team". These reviews indicate that the difficulty in using these tools may also impact a particular team member demotivated to contribute within team environment.

While regression results did not support the hypothesis, these positive reviews may seem to contradict the regression results. However, based on above few examples, we can say that ICT tools usage can enhance the efficiency of the team and not necessarily team orientation among the team members. Similarly, other ICT tools, namely, project management tools (Proofhub, Conceptboard, Slack, Redbooth, and JIRA), social media tools (Google meet and zoom), and E-resource tool (OneDrive) are useful to make the team productive. However, team orientation, or a positive attitude toward working in a team, is perhaps dependent on factors other than ICT tools. The secondary data in this case did not directly help in either validating or invalidating the regression results.

V.10.2 *Adaptability and ICT tools:*

According to Abankwa et al. (2019), team adaptability is defined as the flexibility and acceptance of changes in a team under any situation toward attaining their organizational goal.

The hypothesis tested was that there is a positive relationship between ICT tools usage in virtual teams and Adaptability. Based on the regression, a significant relationship was found between ICT tool usage and Adaptability. In other words, usage of ICT tools did seem to improve the adaptability of the team.

Of the 351 reviews studied, 34 reviews were found to be relevant to Adaptability. These reviews were considered based on the keywords search such as "Simple", "Easy" & "Collaboration", and were found to indicate support to team adaptability by the usage of the ICT tools. Out of these 34 relevant reviews, 13 reviews were found negative and remaining 21 reviews were positive. A thorough examination of these 34 reviews revealed that there are several tools that can be easily adaptable by employees, such as project management tool (Connect team), social media tools (Zoom), E-resource tool (Google drive and dropbox), browsing and search engine (Yahoo), editing tools (MS Power-point, Piktochart, Biteable, and Animaker), and Vlogs and Blogs (WordPress and Blogger). For example, a review "Simple, Easy, Strong collaboration tool"

for the ICT tool, ZOOM, refers to the ease with which the team can adapt easily to the ICT tool which can result in better team performance. Similarly, few other reviews such as “Easy software to work with to host meetings”, “Easy to use and so necessary”, “Easy to use conferencing” & “Easy and Simple to use for chat and conferencing” support the adaptability of the ICT tools by the virtual teams. However, there were few negative reviews that also mention that few employees face difficulty adapting to these tools. For example, reviews for ICT tool, JIRA “Confusing Navigation, everything is a link”, “Particular and hard to work with various functions of orgs”, and “Using Jira is not Agile” indicate that this tool is too complex and confusing, hence making it heard to learn and adapt to this tool. Even though there are few negative reviews, we see many positive reviews indicating that there is a higher probability of adapting to ICT tools usage to communicate within team thereby increasing the overall team performance.

Based on above analysis, the adaptability of usage of ICT tools by virtual teams is higher depending on the simplicity of the usage of tools. Thus, it supports the hypothesis that there is a relationship between ICT tools usage in virtual teams and Adaptability. The text analysis of some of these reviews also support the regression results that there is a significant relationship found between ICT tool usage and Adaptability.

V.10.3 *Mutual Trust and ICT tools:*

Mutual trust, as defined by Cheung et al. (2017), is a confidence level and belief of an individual in a team upon other members and his/her supervisor towards fulfilling their obligations and establishing better communication. The hypothesis tested was that there is a positive relationship between ICT tools usage in virtual teams and Mutual Trust among team members. Based on the regression, a significant relationship was found between ICT tool usage and Mutual Trust. In other words, usage of ICT tools did help among the team members to communicate continuously thereby developing trust among team members.

Of the 351 reviews studied, 61 reviews observed were found to be relatively showing that there is a relationship between the team’s mutual trust and the usage of the ICT tools. Out of 61 reviews, 6 reviews were negative and remaining 55 reviews were positive. A thorough examination of these 61 reviews revealed that by using ICT tools, there maybe chance of developing better team trust among team members by transparent communication. For example, a few positive reviews on zoom tool “Zoom is one of the most reliable meetings tool out there”, “Reliable & Robust Tool of Communication” indicate that such ICT tools help to establish trust

among team members by meeting with each other virtually on a regular basis. It can be inferred that the communication may not be as effective as it will be in person environment but to some extent this virtual meetings with video conferencing option can help the team member to express their emotions clearly. Hence, we can say that effective communication can establish trust among team members. Similarly, a review "Extremely reliable for conferences" for tool skype also indicates same message that team members can rely on these ICT tools to communicate with fellow team members thereby establishing trust among them. However, we do find few negative reviews that may not directly effect team communication because of some other external factors. For example, a review on ICT tool, Conceptboard "Interactive elements, working with your team, is too hard to use" indicate that even though the employees are willing to communicate with each other for transparency, the complexity of the tool can sometimes discourage the employees to work within teams. Similarly, another negative review on ICT tool, JIRA "Particular and hard to work with various functions of orgs" indicate that this tool is sometimes hard to remember the dropdowns and use it effectively. Hence, even though there are few negative reviews but the majority of reviews were positive indicating that these ICT tools are helping the virtual team members to establish better trust within team members.

Based on above analysis, that mutual trust in teams is accomplished with the ICT tools usage, namely, project management tools (Proof hub, Conceptboard, Slack, Redbooth, and JIRA), social media tools (Google meet, Skype and Zoom), E-resource tools (OneDrive, Dropbox, Apple iCloud, and McGraw-Hill), Vlogs and Blogs (WordPress and Blogger) and Podcasts (Risky business and Hansel minutes). Thus, it supports the hypothesis that there is a relationship between ICT tools usage in virtual teams and Mutual team trust. The text analysis of some of these reviews also supports the regression results that there is a significant relationship found between ICT tool usage and Mutual team trust.

V.10.4 *Backing-up behavior and ICT tools:*

Backing-up behavior of an individual in teamwork is defined by Kude et al. (2019) as a method where team members help others towards achieving the team goal. This process is considered critical yet effective in increasing team performance. The hypothesis tested was that there is a positive relationship between ICT tools usage in virtual teams and Backing-up behavior in a team member. Based on the regression, no significant relationship was found between ICT tool usage and Backing-up behavior. In other words, usage of ICT tools did not seem to promote

an environment where individual would feel more comfortable working with the team without giving any excuses.

Of the 351 reviews studied, 21 reviews were found to be relevant to backing-up behavior. Out of these 21 relevant reviews, 4 reviews are negative and rest 17 reviews are positive. These reviews shows that there is a relationship between the backing-up behavior and the usage of ICT tools. For example, few positive reviews such as “The tool helped us reduce the complexity of remote work for our cross-functional teams” for the ICT tool Proofhub and “This is one collaboration tool that facilitates team meetings and helps teams effectively hold meetings during a pandemic” for the ICT tool Conceptboard say that with the usage of these type of ICT tools, team members were able to effectively communicate with each other and support each other. And few negative reviews such as “Jira is an excellent bug tracking software but its hard to use” and “Onedrive is not a great tool to collaborate with members on your team” indicate that due to complexity of understand how to use these tools, some of the team members may not be able to help others even though they are willing to help. Similarly, there are other tools that help to increase backing-up behavior among team members, namely, project management tool (Slack), E-resource tool (Google Drive and Apple iCloud), and Blogs and Vlogs (Blogger). However, effective communication with each other does not indicate that the team members would be willing to help each other. It may just mean that individuals communicate effectively to collect the information to complete their tasks on time. Willingness to help other team members solely depends on individual’s choice.

Based on above analysis, the Backing-up behavior of team member may not be dependent on the usage of ICT tools by virtual teams. Thus, it does not support the hypothesis that there is a relationship between ICT tools usage in virtual teams and Backing-up behavior. The text analysis of some of these reviews is consistent with the regression results that there is no significant relationship found between ICT tool usage and Backing-up behavior.

V.10.5 *Mutual performance monitoring and ICT tools:*

Mutual performance monitoring is defined by (Bjornberg, 2014) as a process where the whole team is monitored and assisted by fellow members and an immediate supervisor/ leader. In this process, a team leader checks his team for their performance, capacity, capability, outcome, involvement, and communication, and assists if the team requires guidance. Similarly, each team member monitors other members and assists them when help is needed towards reaching the goal.

The hypothesis tested was that there is a relationship between ICT tools usage in virtual teams and Mutual Performance among team members. Based on the regression, no significant relationship was found between ICT tool usage and Mutual Performance. In other words, usage of ICT tools did not seem to promote a more collaboration between team members.

Of the 351 reviews studied, 12 reviews are relevant to mutual team performance. Of these 12 reviews, we found 9 reviews are positive and 3 reviews are negative. This indicates that mutual performance monitoring is accomplished with the usage of ICT tools, namely, project management tools (Proof hub, Redbooth, CloudMonix, Datadog, and JIRA), E-resource tool (McGraw-Hill), and Browser and Search Engine (Google). For example, a few positive reviews such as "A great management tool to improve your day-to-day activities" & "A powerful product for better project management" for ICT tool, JIRA indicates that these tools help the team members to manage their tasks in a better way such as based on priority or complexity of the task. However, a few negative reviews such as "Jira is an excellent bug tracking software but its hard to use" for ICT tool JIRA and a review "Interactive elements, working with your team, is hard to use" for ICT tool Conceptboard indicate that even though the team members want to collaborate with each other to collectively achieve better goals, few challenges in adapting and using these tools may hinder their ability to collaborate. However, the reviews do not indicate that by using these ICT tools, team members can monitor each other's tasks. The willingness of a team member to help each other is an individual factor which may not be influenced by using ICT tools. Therefore, we can say that these reviews do not show significant evidence to support the hypothesis.

Based on the above analysis, the Mutual performance monitoring of team members may not be affected by the usage of ICT tools by virtual teams. Due to the lackness of in-person visibility, it may not be clearly possible to monitor other team members' performance. Thus, it does not support the hypothesis that there is a relationship between ICT tools usage in virtual teams and Mutual performance monitoring. The text analysis of some of these reviews also indicates that there is a possibility of monitoring team members' tasks using ICT tools but may not be effective as compared to in person environment. Thus, it is consistent with the regression results that there is no significant relationship between ICT tool usage and Mutual performance monitoring.

V.10.6 *Shared mental models and ICT tools:*

The shared mental model in teamwork is defined by Kude et al. (2019) as a concept in the team where a better understanding of team members about other members' capacity, knowledge, and adaptability in varied situations. The hypothesis tested was that there is a positive relationship between ICT tools usage in virtual teams and Shared mental models among team members. Based on the regression, no significant relationship was found between ICT tool usage and Shared Mental Models. In other words, usage of ICT tools did not seem to promote a common understanding to work in the team.

Of the 351 reviews studied, 18 reviews were found to be relevant to shared mental model. Out of these 18 reviews, we found 4 negative reviews and rest of 14 positive reviews. These positive reviews show that there is a significant improvement in team performance by sharing their ideas and knowledge with the team members with the usage of ICT. Some of these tools that help to communicate effectively are project management tool (Conceptboard), E-resource tool (OneDrive), Blogs, and Vlogs (Blogger), and Podcast (risky business). For example, a few positive reviews for OneDrive, “With Microsoft one drive we can share our documents across multiple devices and OS.”, “An easy way to share files” & a review for Blogger, “The tool helped us reduce the complexity of remote work for our cross-functional teams.” Indicates that by using these ICT tools can help individuals to complete their assigned task on time. Similarly, a few negative reviews such as “Interactive elements, working with your team, is too hard to use” for ICT tool Conceptboard and another review “Not user friendly at all” for ICT tool JIRA, indicate that even though team members want to interact with each other and share their ideas, sometimes using or adapting to these tools could be challenging due to which they may not be able to collaborate with other team members. It does not mean that team members can use these tools to share knowledge among team members but merely providing tools does not help to establish bonding among team members to share their knowledge with each other.

Based on the above analysis, the team members may or may not be much influenced by the usage of ICT tools to share their thoughts and work collaboratively with other team members. These tools may help the team members to communicate effectively but there is no clear indication that ICT tools can enhance the bonding among team members to share their ideas and workload. Thus, it does not support the hypothesis that there is a relationship between ICT tools usage in virtual teams and Shared Mental Model. However, a few reviews do indicate that ICT tools help

the team members to communicate effectively when needed. Thus, there is no clear indication from these reviews that these ICT tools enhance Shared Mental Model among team members.

V.10.7 *Closed-loop communication and ICT tools*

Closed-loop communication in a team, especially in virtual teams, is a concept where a better communication channel is established between the team members to avoid misunderstandings through providing feedback for messages received (receiver) by the member from the sender of the team (El-Shafy et al., 2017). The hypothesis tested was that there is a positive relationship between ICT tools usage in virtual teams and Closed Loop communication among team members. The regression does not show significant relationship between ICT tool usage and Closed Loop communication. In other words, usage of ICT tools did not seem to clear misunderstandings and wrong perceptions to work in the team.

Of the 351 reviews studied, 19 reviews were found to be relevant to Closed-loop communication. Out of the 19 reviews, 5 reviews were found to be negative and rest 14 reviews were positive. They show that closed-loop communication can increase team performance with the usage of ICT tools. There are two major ICT tools, namely, project management tool (Slack) and social media tools (Skype and Zoom) that are mainly used for continuously communicating with team members as well as setting up meetings or call directly each other to talk. For example, reviews such as “Best overall communications software” and “Excellent collaboration and meetings” for Skype indicate that these tools are helping the team members to collaborate with each other. Whereas few negative reviews such as “Interactive elements, working with your team, is too hard to use”, “Not a fan of too many drown downs of info needed”, and “Phone service needs improvement”, indicate that due to either difficulty in using the tool can considerably impact the employees ability to communicate constantly. This can create gap among team members, thereby decreasing overall teams performance. However, just having access to the ICT tools does not mean it can help communicate effectively with team members. Because an individual may try to connect with other team members but due to time zone difference or other reasons, the other individual may not be available to join the call on time to communicate effectively.

V.10.8 *Leadership skills and ICT tools:*

Sohmen (2013) defined Leadership, as a crucial yet successful component of teamwork, as a process encompassing traits, skills, behavior, attitude, characteristics, experiences, and a

relationship between team members and team leader. The hypothesis tested was that there is a relationship between ICT tools usage in virtual teams and Leadership skills among team members. Regression result does not show significant relationship between ICT tool usage and Leadership skills. In other words, usage of ICT tools did not seem to develop leadership skills among team members.

Of the 351 reviews studied, 15 reviews were found relevant to leadership skills. Out of these 15 reviews, 3 reviews were negative and remaining 12 reviews were positive. A thorough examination of 15 reviews shows that leadership skill can be improved among team members with the usage of ICT tools, namely, project management tools (Asana, Connect team, and Proof hub) and Browser and search engine (Google). For example, reviews for ICT tool Concept board, "This is one collaboration tool that facilitates team meetings and helps teams effectively hold meetings during a pandemic." & "Enables us to brainstorm ideas in one place through boards which is more fun with video calling capability." Indicates that by using this tool, team members were able to organize their team meetings based on their needs without depending on project manager or scrum master to setup calls for them. However, we do see 3 negative reviews "Skype is a thing of past", "Skype is a thing of past", and "Skype-something good that was ruined". This is an indication that these ICT tools may be helpful to the team members but it does not necessarily mean that the individuals would be able to influence others in a team to follow their lead. Hence, we can say that ICT tools usage may not increase teams leadership skills.

V.10.9 *Regression Summary:*

Through results from the validation of regression tests, it is evident that ICT tools and Team effectiveness are indeed positively related, and the ICT tools assist and increase team effectiveness in virtual teams of software developers. However, it is not clear about their situation before the usage of ICT tools. Such as what kind of communication challenges did they face? Or what type of performance issue did they face? Because of the limited information in the review, we could not classify them exactly as to which construct that review supports.

V.11 Summary

The regression and ANOVA techniques were utilized in conducting the analysis using SPSS software. The results of the analysis indicated some kinds of connection between the usage of ICT tools and team effectiveness. Notably, Adaptability and mutual trust emerged as significant

factors within virtual software development teams. Additionally, the study revealed a close association between ICT tools and the performance of virtual software development teams. This association positively influenced team effectiveness, ultimately contributing to the overall growth and performance of the organization.

VI Chapter 6: Discussion and Conclusion

VI.1 Discussion

The proposed research examined 'team effectiveness' as the dependent variable and 'virtual teams in software development due to Covid lockdown' as the independent variable. The constructs under team effectiveness are team orientation, adaptability, mutual trust, mutual performance monitoring, closed-loop communication, leadership skills, backing-up behavior, and shared mental models. Communication in a virtual team is crucial since it is the only source of information exchange between the members. For effective communication, the virtual teams use the Internet as the main mode and mobile phones/ smartphones as a secondary mode. For information related to work, individuals seek facts and data from e-resources like search engines rather than internet browsers. For facts, numeric data, and other programming-related knowledge-based information, the employees use e-journals more than online storage.

Similarly, many editing tools are available online, whereas programming must be selected according to necessity. For instance, coding-based and model development-based software development uses python language and network architecture models. Contrarily, company employees use presentation tools and note-taking software to project trends and market analysis. Other administrative employees majorly use e-mails for communication. Thus, through analysis, it was found that in software development, employees in virtual teams rely on presentation tools and note-taking tools rather than e-mails for editing.

Companies highly prohibit social media during work time. However, employees seek information through social media as tools and utilize the same effectively. The software developers do not often use other online tools (audio/ video chatting) and translating tools. For meetings, group discussions, feedback, and other team results and individual result-based outcomes, the team managers arrange for audio/video calls (hangouts, skype, google meet) with employees. The primary ICT tool for software developers is the project management tools like programming tools, databases, excel, and simulations. However, the software developers (66.7%) use the programming tools alone, and the rest of the databases, simulations and excel are used least. It was found that Among the browsing and search engines as tools, in other areas/fields (education, banking, financial management, hospitality services, hospital management), internet browsing usage is higher. In software development, search engines and internet browsing tools are rarely used, along

with e-mails when needed. Contrarily, blogs and vlogs with podcasts are often used by the employees in the virtual team's software development teams.

The constructs of the team's effectiveness in using the ICT tools were evaluated, and it was found that Adaptability and mutual trust were primary impacted components. In comparison, shared mental models, backup behavior, closed-loop communication, leadership skills, team results/orientation, and mutual performance monitoring were secondary components impacted by the ICT tools usage in virtual teams.

VI.2 Findings of the secondary data analysis

The results from secondary data show that, among the tools being examined, the software developers majorly utilized the project management tools, social media tools, editing tools, blogs and vlogs, podcasts, e-resourcing, and web browsers are the least utilized tools. The analyses found that software developers utilize podcasts and project management tools more than any other tools. Social media is also majorly used by software developers since it provides numerous information and knowledge to be shared with peers in the virtual teams and keeps them connected. The data analysis from the research also provided the same outcome, where search engines and web browsers were the least used tools, and the targeted respondents mostly utilized social media and project management tools. The analysis clearly shows that the outcomes are valid and reliable.

The developed research's secondary data includes resources such as g2.com, trustradius.com, gartner.com, chartable.com, podbay.com, capterra.com, softwareadvice.com, and more. In addition, reviews from more than 200 reviews/feedback as the secondary resource from the users (i.e., virtual team-based IT employees) via Google forms were also obtained for the research as survey analysis. Since the research examines the IT employees' team performances in a virtual team with the usage of ICT tools during Covid19, only the years 2019-2021 were predominantly observed. The virtual teams mostly used an informative tool like the Internet for resource acquisition. The software developers preferred constructive tools like Mindstorm, MS Word, PowerPoint, and more in virtual teams. The communicative tool "E-mail" was preferred less, whereas tools like note-taking software, presentation, and more were preferred more.

VI.3 Conclusion

The study aimed to examine the impact of using ICT tools in virtual teams by employees and how effective the team is. The study targeted the virtual teams of top Indian companies. The

targets are the software developers. The team's effectiveness was evaluated by analyzing the 8 constructs using ICT tools. The study calculated the sampling to be n=279. Statistical tools ANOVA, Regression, Principal component, and simple percentage are utilized. As the software, SPSS was used. Cluster sampling was used since the investigator could use the targets according to their job profile and geographic locations (virtual team software developers). The tool to acquire data was decided as a questionnaire. The questionnaire was designed to be closed-end with a 5-rating scale. Secondary data was also used through relevant studies and journals.

Through regression, the 8 constructs in the team effectiveness variable and virtual team in software development are evaluated for the association. Among the team effectiveness constructs, Adaptability and mutual trust are highly correlated with ICT tool e-resources and project management tools. The other team effectiveness constructs backup behavior, and shared mental models, closed-loop communication, team orientation, leadership skills and mutual performance monitoring are also correlated but at a low significance level. The ICT tools, blogs and vlogs, podcasts, and editing tools were found to be highly effective in impacting the employees' decisions and communication in the team. Thus, the team effectiveness evaluation research is concluded by stating that trust, communication, knowledge of ICT tools, and shared mental models are significant for an effective and agile virtual team. Similarly, a virtual team's adaptability, team orientation, and legal backing-up behavior are crucial.

VI.4 Theoretical and Managerial Implications

Theoretical implications: This research developed an analysis of the factors, and it was found that the ICT tools in an organizational context impact the virtual team members positively, especially in the software development field. The reviews insisted that trust, communication, leadership skills, and mutual team performance were significant factors that aid the individuals in teams in attaining the goals. It was firmly established through analysis that leadership skills, team trust/ orientation, and mutual team performance-based monitoring were the top three factors among the eight factors assessed. Similarly, through the research findings, it could be contributed that shared mental models as a team effectiveness factor should be focused on since existing studies focused heavily upon trust, communication, leadership skills, and mutual performance as factors impacting team effectiveness.

Through the research, it could also be implied that new and additional software developed exclusively for the virtual teams could aim to eradicate the issues with communication, assessment,

performance appraisal, performance monitoring, and knowledge sharing. Miscommunication and misinterpretation of information cause huge misunderstandings between the members and disrupt the team coordination, resulting in loss and opposing team reputation (Morrison-Smith and Ruiz, 2020).

Theoretically, ethical differences in the working environment, personal connection lag, delegation issues, poor communication channels, and team monitoring issues have been analyzed and examined to eradicate the negative implications of virtual teams in companies. However, the challenges could be overcome strategically, through

- A clear understanding of the communicated information,
- Making personal connections and time for listening to peer members' feedback and suggestions,
- Mutual interaction and clarity between the communicators with trust and
- Finally, recognizing the point person in and out (skills, knowledge, experience, attitude, behavior, and capability).

Through this strategic approach, a virtual team member will be flexible, adaptable, and easy-going with others, where connection, trust, mutual understanding, and rapport will be higher. Theories on virtual teams and team performance in organizations, like Group Dynamics theory (Kurt Lewin's in Cartwright: 1951, Bruce Tuckman: 1965), Capability theory (Sen, 1985b), Trust theory (Meyerson et al., 1996), Media synchronization theories (Dennis et al., 2008), Leadershiptheories: Great-Man theory (McGregor, 2003), Trait theory (Ekvall and Arvonen, 1991), Contingency theory (Greenleaf, 1977), Behavior and Style theory (Feidler and House, 1994), Process-leadership theory (Greenleaf, 1996), Transactional theory (House and Shamir, 1993), Transformational theory (Maslow, 1954); Trust Organ and Front theory (Kramer and Tyler, 1998), and more explains that implying the strategic approach in a team, especially in virtual teams, heightens the performances, mutual trust, and communication of the team members along with solid leadership skills. The leadership theory explains that the attitude and characteristics of a leader in a team should include a 365 degree vision upon employee's project completion, team adaptation, communication, skills, behavior, flexibility, and involvement and not just by assessing their performance alone. Thus, through theoretical implications and existing theories, it is thus acknowledged that a strong leadership skill possessed by the team members and

practical leadership characteristics of a leader in a team will highly impact the team members and their performances.

Managerial implications: The existing team effectiveness models by researchers Hackman and Salas et al. are generally focused on traditional teams, whereas the research is exclusively developed to increase virtual team effectiveness in software development. Through literature reviews, the researcher found that miscommunication, illegal backing-up behavior, no mutual trust, and 'laisse fairer style of leadership skills negatively impact the virtual teams. Henceforth, to significantly impact the virtual teams, agile management by leaders or the team managers, proper communication channel between the team members (formal communication) through stable ICT tools and services, and establishment of trust (via knowledge sharing, exchanging feedback, accepting feedbacks, lending time and help when needed and rectifying errors) are identified as crucial factors. In the future, studies could focus on other secondary factors such as trust, communication, and Leadership skills to prove that they are equally significant in increasing team effectiveness, especially in virtual teams.

Practically, implying theories and strategies that worked for other companies will not work for every company (Morrison-Smith and Ruiz, 2020). The strategies will vary as per the company's impact, employees, employers, and external environment. For instance, adopting social media-based tools for hospitality management is strategically effective; however, in software development companies, project management tools and editing tools should play an equal role with social media. In software development companies implying strategic management theories and leadership theories for effective team monitoring will be suitable. Similarly, to increase team effectiveness, implying strategies that smoothen the communication like designing groupware software to build trust, share knowledge, and have proper and non-interrupted communication in virtual teams among team members and their leader.

Managerial implications in software development companies include the team members being adaptable and possessing readiness towards change management under emergency circumstances. During Covid-19, many SMEs in the USA and other underdeveloped and developing countries had to shut down due to improper implications of technological advancements. Organizations that adopted technological advancements and transformed traditional teams into virtual teams survived than those organizations that remained conventional (Robles, 2020). Though the managers and team leaders in software companies were challenged

and suffered with change management, the outcome greatly impacted the teams and employees. The software developers' role practically does not end with writing algorithms and codes; instead, they have to manage and consider variables like the project cost, software development budget, project schedule, resource allotments, planning and designing, quality management, risks, and disaster management (Alt et al., 2020). During Covid-19, the software developers faced enormous organizational transformation and change management challenges. Hence, to make employees ready for change and adapt, factors like trust, communication, and mutual understanding towards achieving individual and organizational goals are a must.

In an organization, especially in software development companies implying the theoretical strategies based on the team's capability and skills-set would be rather effective. Based on the analysis, the research targets seemed adaptable and flexible with their team members during Covid-19. However, the research findings showed that a lack of shared mental models and closed-loop communication makes the virtual members hesitate to provide and accept feedback on their work and peers' work in the team. To eradicate this issue, the researcher suggests a practical solution that implies standards in a team where 'acknowledgment' is necessary among team members when information is passed through. However, if a team member fails to revert post communication, it should be considered as the team member is not connected virtually with the team. Thus, two-way communication is achieved. Similarly, a team member's understanding of the others in a team varies according to the situation; reverting when the team member is unclear about others' opinions will eradicate the same issue. Thus, feedback for communication resolves many challenges and issues in virtual teams of software developers.

VI.5 Limitations

The research focuses broadly on finding and examining the facts, truths, and information about virtual teams in software; it certainly has limitations under the focused aim and objectives. The limitations are as follows:

1. The research is strictly restricted to gaining insights into virtual teams in software and does not waver around other areas.
2. The research focuses on team effectiveness and have not studied other aspects and factors beyond this.
3. The impact of ICT based tools would be studied and examined upon team effectiveness in the software teams alone.

4. The respondents are restricted to software professionals working from home, in other words, virtually, because of the Covid19 lockdown situation.

The study would be conducted upon US-based top companies from the manager and senior level employees as targets alone.

VI.6 Summary

It is concluded from extensive analysis and findings that usage of the ICT tools, namely E-journals as E-resource, presentations as an editing tool, social media as a media tool, programming as a project management tool, internet browser as a browsing tool, podcasts, blogs, and vlogs significantly impacts the team effectiveness in virtual teams. Similarly, among the factors examined, mutual team trust, backing-up behaviour, and shared mental models were found as majorly impacting factors than team orientation, adaptability, mutual team performance, leadership skills, and closed-loop communication have been found to have not shown significant effect on team effectiveness in virtual teams by usage of ICT tools..

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APPENDICES

Appendix A: Questionnaire for Collecting Primary Quantitative Data

"Investigating the impact of ICT based tools on Team Effectiveness of Virtual Software Teams"

Part A: Demographic profile

A. Demographic Profile:

[1] Name (Optional): _____ _____

[2] Age:

☐ 18 – 29

☐ 30 – 39

☐ 40 – 49

☐ 50+

[3] Sex:

☐ Female

☐ Male

[4] Education:

☐ UG

☐ PG

☐ PhD

☐ Other (Specify) _____

[5] Marital Status:

☐ Single

☐ Married

☐ Divorced

☐ Does not want to respond

Part B Team Effectiveness of Virtual Software Development Team

[1] In this first part, we want you to relate your experience during the teamwork process.

S. No	Please rate the following statements:	SA (5)	A (4)	N (3)	D (2)	SD (1)
1	There was room to comment on the other team members' work tasks					
2	It is acceptable to identify errors in the other team members' tasks					
3	We give feedbacks on each other's work					
4	I Could ask for an explanation if the other team members did not perform the task as planned					
5	A team member would take over someone else's intended task if he/ she did not have time to complete the task himself/ herself?					
6	I am comfortable in taking over the work of others if they needed help					
7	The team members were willing to perform the tasks of other team members when necessary					
8	I am willing to give feedback to other team members					
9	The team members were willing to adjust strategies because someone else on the team needed assistance					
10	The team was comfortable changing direction in a task during the work process if necessary					
11	I was flexible in new situations when they arose					
12	Everyone on the team was aware of the resources the team had at its disposal					
13	The team was willing to deal with unforeseen changes during the teamwork					

14	The team was willing to make changes in the work approach based on changes during the teamwork					
15	The team's goals were more important than individual goals					
16	I enjoy working with each other					
17	Working with other team members improves my own performance					
18	The team members were positive about the teamwork during the work process					
19	The tasks were solved better together by the team members than if it had been solved by one person alone					
20	The team has a common understanding of its goals					
21	The team has a common understanding of the team's environment					
22	The team members have a common goal with the teamwork					
23	I trust the knowledge and abilities of the other team members					
24	I trust the other team members to do what they said					
25	All team members' contributions to the team were appreciated					
26	I am sure that the other team members did their part					
27	I trust that everyone on the team did their best to reach the goal					

28	I will give each other feedback that the messages were perceived					
29	I will give each other feedback if messages were understood					
30	I will give each other feedback if messages were received					
31	The information would reach me					
32	The team members make sure that everyone had received important information					
33	Anyone on the team would take responsibility for making use of the team members' individual skills					
34	The team members would praise me if I had made a good effort					
35	The team members would willingly offer constructive feedbacks on the efforts of the team					
36	There would be a team member who would plan the team's work process willingly					
37	The team members would make sure that others stay on the right track, even though there were changes in the team situation					
38	The team members would coordinate each other’s work tasks during the team process					

Part C: Usage of ICT Tools in Virtual Software Development Teams

[3] ***Please, tell us how frequently you use the following tools:***

S. No	ICT Tools	*Never*	*Sometimes*	*Always*
1	Databases			
2	E-mails			
3	Programming			
4	Search Engines			
5	Social Media (e.g., Twitter, Facebook)			
6	Simulations			
7	Vlogs and Blogs			
8	Audio/ Video Chat (e.g., Skype, Google)			
9	Smart phones and Tablets			
10	Instant messaging/ Text Chat (e.g., Facebook, Hangouts, Messenger, WhatsApp)			
11	Internet browsers			
12	Printers and Scanners			
13	Translators (e.g., Google translator)			
14	Note-taking software (e.g., Onenote, Evernote)			
15	Smartphone Apps			
16	Presentations (e.g., Prezi, Powerpoint)			
17	Excel			
18	Podcasts			
19	Online storage (e.g., Dropbox, Google Drive)			

[1] Others ***(Specify):***

_____

_____

_____

..... Thank You!!! .....

Date: _____ **Place: _____**

- Part B: Interpretations of the Team Effectiveness:

The Salas et al. (2005) items:

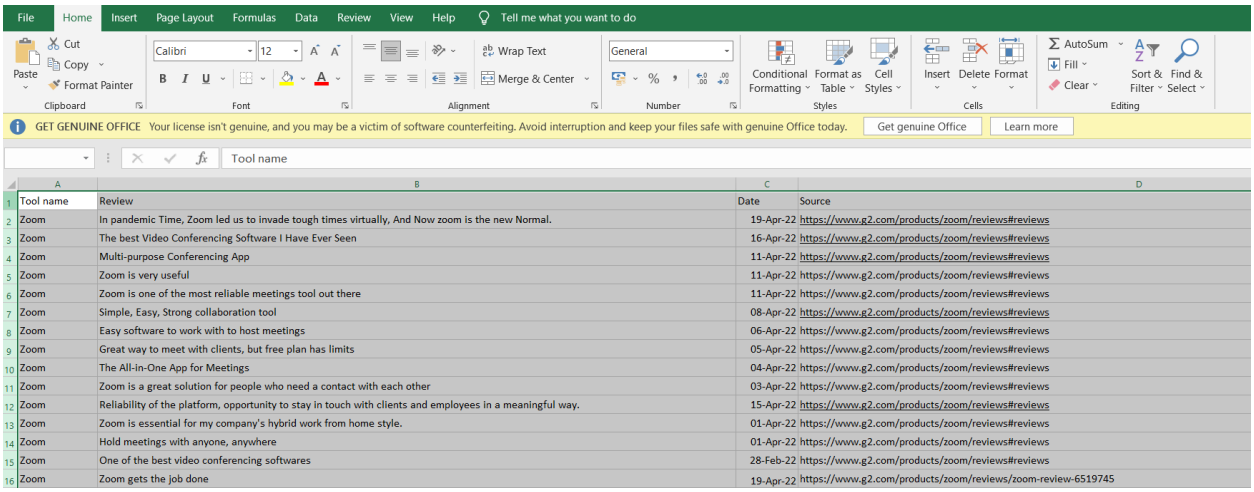
S. No	Factors	Statements
1	Team result/ orientation: factor 1	15, 16, 17, 18, 19.
2	Leadership orientation, planning and social (leadership, planning, social): factor 2	33, 34, 35, 36, 37, 38.
3	Mutual performance monitoring: factor 3	1, 2, 3, 4, 8.
4	Adaptability: factor 4	9, 10, 11, 12, 13.
5	Closed loop communication: factor 5	28, 29, 30, 31, 32.
6	Shared mental models: factor 6	14, 20, 21, 22.
7	Backing up behaviour: factor 7	5, 6, 7.
8	Mutual trust/ team: factor 8	23, 24, 25, 26, 27.

Part C: Interpretations of the Use of ICT tools (Nagy & Habok, 2018) 19-items

Factors	Tools
E-resources	E-journals; Online storage (e.g., Google Drive, Dropbox)
Editing tools	Presentations (e.g., PowerPoint, Prezi); Text editing; E-mail
Social and media tools	Social media (e.g., Facebook). Translation software (e.g., Google Translate); Audio/video chat (pl. Skype, Hangouts);
Project management-based tools	Programming; Simulations; Excel; Databases

Search engines and browsing	Search engines (e.g., Google, Bing); Internet browsers
Blogs and vlogs	Blogs; Vlogs
Podcasts	Podcasts

Appendix B: Secondary Data collection sample (User Reviews)



File Home Insert Page Layout Formulas Data Review View Help Tell me what you want to do

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Tool name

	A	B	C	D
1	Tool name	Review	Date	Source
2	Zoom	In pandemic Time, Zoom led us to invade tough times virtually, And Now zoom is the new Normal.	19-Apr-22	https://www.g2.com/products/zoom/reviews#reviews
3	Zoom	The best Video Conferencing Software I Have Ever Seen	16-Apr-22	https://www.g2.com/products/zoom/reviews#reviews
4	Zoom	Multi-purpose Conferencing App	11-Apr-22	https://www.g2.com/products/zoom/reviews#reviews
5	Zoom	Zoom is very useful	11-Apr-22	https://www.g2.com/products/zoom/reviews#reviews
6	Zoom	Zoom is one of the most reliable meetings tool out there	11-Apr-22	https://www.g2.com/products/zoom/reviews#reviews
7	Zoom	Simple, Easy, Strong collaboration tool	08-Apr-22	https://www.g2.com/products/zoom/reviews#reviews
8	Zoom	Easy software to work with to host meetings	06-Apr-22	https://www.g2.com/products/zoom/reviews#reviews
9	Zoom	Great way to meet with clients, but free plan has limits	05-Apr-22	https://www.g2.com/products/zoom/reviews#reviews
10	Zoom	The All-in-One App for Meetings	04-Apr-22	https://www.g2.com/products/zoom/reviews#reviews
11	Zoom	Zoom is a great solution for people who need a contact with each other	03-Apr-22	https://www.g2.com/products/zoom/reviews#reviews
12	Zoom	Reliability of the platform, opportunity to stay in touch with clients and employees in a meaningful way.	15-Apr-22	https://www.g2.com/products/zoom/reviews#reviews
13	Zoom	Zoom is essential for my company's hybrid work from home style.	01-Apr-22	https://www.g2.com/products/zoom/reviews#reviews
14	Zoom	Hold meetings with anyone, anywhere	01-Apr-22	https://www.g2.com/products/zoom/reviews#reviews
15	Zoom	One of the best video conferencing softwares	28-Feb-22	https://www.g2.com/products/zoom/reviews#reviews
16	Zoom	Zoom gets the job done	19-Apr-22	https://www.g2.com/products/zoom/reviews/zoom-review-6519745

VITA

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