Innovations

A cognitive mindset for leading virtual team and its system thinking perspectives: a systematic review

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Abstract

Current developments in technology have changed the way we socialize, communicate and work. Globalization, Information and Communication Technologies, digital culture and the increase in the amount of technology available for online communication mean that more organizations are implementing virtual teams. Leading virtual work settings have several challenges which need the application of system dynamics to enhance better performance. However, the leading virtual teams' studies in the context of systems thinking are incongruent, and needs a systematic review to integrate the current fragmented body of knowledge. This study employed a systematic review methodto examine earlier publications related to leading virtual teams and its system thinking perspectives.To achieve the study objective, this study used eight databases, such as Sage Online, Pubmed,Springer, JSTOR, Taylor and Wiley Online Library, Francis Online, Google Scholar, and Semantic Scholar. Initially, a total of 5,070 studies were found using a database search. Then, 30 articles are screened, summarized, and synthesized for discussion after considering different inclusion and exclusion criteria. Then, the main emphasis of existing research was examined. According to the finding of this study, communication technology, trust, intra-team relationship, and leadership activities are the most commonly identified positive factors in virtual team performance. The failure factors in virtual teams are mainly related to the effects of dispersion, cultural diversity, poor leadership qualities and bias. In this study the main topics of the existing research in the field are reviewed, and the main limitations, problems and existing gaps in research are presented.

Keywords *–Virtual team, Leading, system thinking, Systematic review, Leading virtual team*

1. Introduction

Natural and manmade crises like wars, disasters and epidemics have accelerated changes in all types of activities, including the ways we live and work. Currently, the COVID-19 outbreak is a global health challenge. Health authorities suggest that ''it is time for businesses, hospitals, schools and citizens to start preparing''. Many companies have chosen to reduce risks by using remote working or working from home to prevent employees from being in close contact and spreading the virus. Therefore, new ways of working are emerging as a result of different factors with the help of technological and digital systems. Advancements in information and communication technologies influence how we communicate and collaborate in virtual

organizations (Bishop et al., 2010). Physical distance is no longer matter for these kinds of virtual organizations. Leadership, communication, trust, task characteristics, empowerment, and cohesion all play an important role in the performance of a virtual organization (Pulsiri and Vatanan, 2018). These work groups operate with full potential only when their leaders can lead them with an optimal set of knowledge.

Understanding system thinking perspectives, which related to leading virtual organizations, can equip leaders with relevant knowledge and help them to achieve the teams' objectives effectively and efficiently.

In the last decade, several studies have been conducted on leading virtual teams and system thinking disjointedly (e.g., Flood, 2010; Adam and Savigny, 2012; Adams et al., 2016; Jackson et al., 2014; Karam et al., 2020; Van et al., 2017; Jaradat et al., 2019). Available publications regarding leading virtual teams and system thinking may create confusion if there is no effective and systematic process for organizing and associating their points of view. Furthermore, the fast growth of scholars will also produce much more publications, which will create more confusion. Therefore, conducting a systematic review on existing literature is required to manage the overloaded information and minimize the confusion. As a result, the current study's goal is to systematically review prior publications on leading virtual teams and identify perspectives of systems thinking that might be applicable in the context of leading virtual teams.

Research questions:

Q1. *What do the studies on cognitive mindset for leading a virtual team and its system-thinking perspectives look like from 2010 to 2021?*

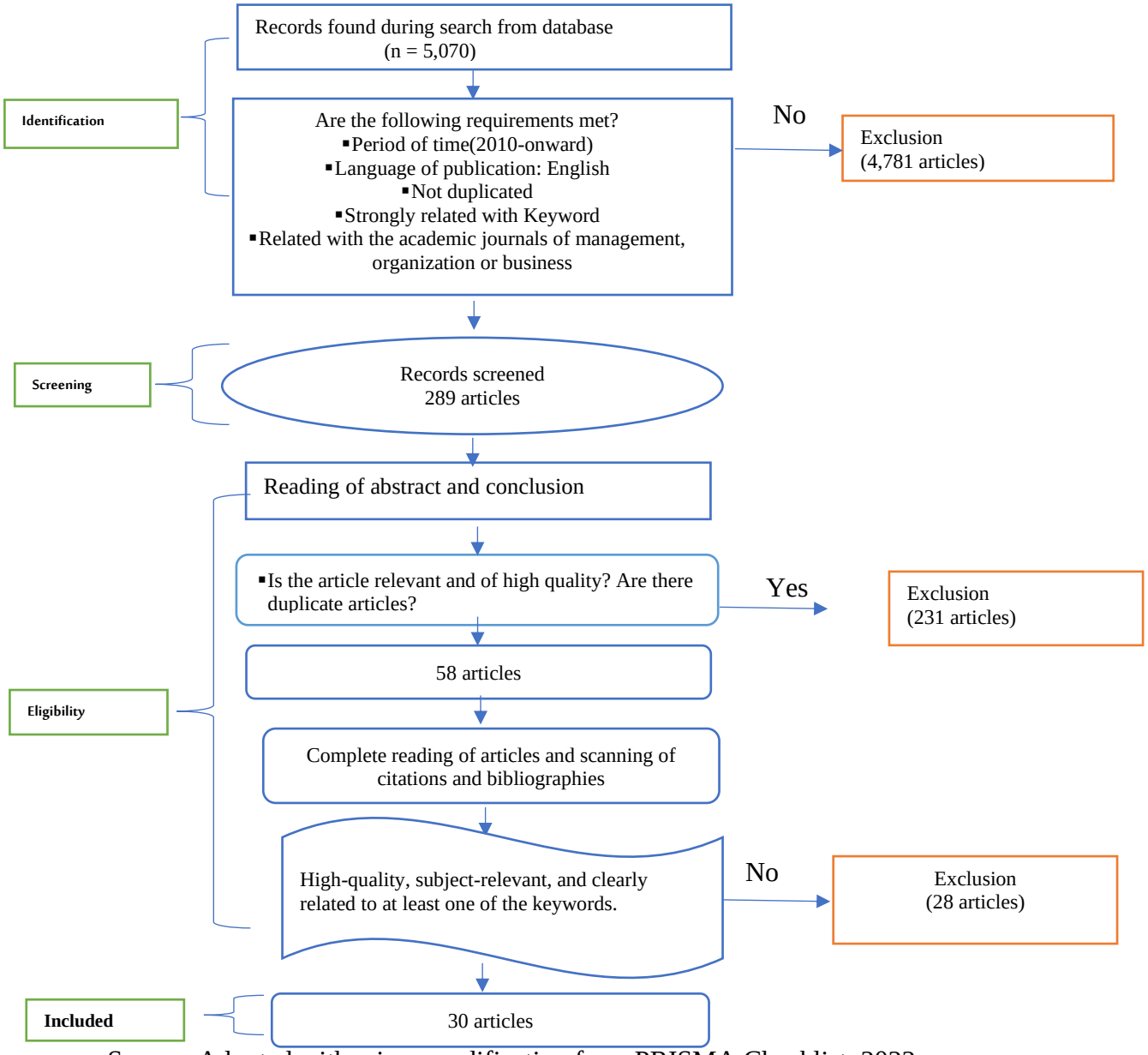
Q2. *What are the main issues discussed by researchers on leading virtual teams and their system thinking perspectives?*

Q3. What are the terms of system thinking that would be applicable in the scenario of leading virtual team?

2. Materials and methods

This study was started by setting an article screening flow diagram. The article selection flow diagram is summarized in the following Figure 1.

Figure 1: Article screening flow diagram



Source: Adopted with minor modification from PRISMA Checklist, 2022.

2.1. Selection of databases

Authors searched studies from eight databases such as Sage Online, Pubmed, Springer, JSTOR, Wiley Online Library, Google Scholar, Taylor & Francis Online, and Semantic Scholar. The search keywords used were: leading virtual team, mindset for leading virtual team, virtual teams, leading distributed teams, leading remote teams, leading computer-based teams, online teams' leadership, cross-site teams, big picture thinking, hierarchical thinking, holistic thinking, multidimensional thinking, systemic thinking, systems thinking and design thinking, and stems thinking and systems dynamics.

Table 1: Search results by keywords (from the year 2010 to 2021)

Search keywords	***Search result (number of papers)***
Leading virtual team	181
Mindset for leading a virtual team	19
Virtual teams	250
Leading distributed teams	150
Leading remote teams	125
Leading computer-based teams	109
Online teams' leadership	310
Leading Cross-site teams	419
Big picture thinking	482
Hierarchical thinking	100
Holistic thinking	520
Multidimensional thinking	467
Systemic thinking	773
Systems thinking and design thinking	979
Stems thinking and systems dynamics	186
Total	5070

Source: Own search result,2022

2.2. Inclusion and exclusion criteria

To achieve the study's goal, researchers used four criteria as inclusion and three criteria as exclusion. The *search boundary, time of publication, language,* and *search string* are used as inclusion criteria. The search boundary is determined by focusing on academic journals that are related to the field of management and organization. Only articles published from January 2010 to December 2021 were included in the search. The year 2010 was chosen as the earliest date of interest because, in that year, leading the virtual team and system thinking emerged as the most dominant in the field of organization and management due to the advancement of sophisticated technology (Palandrani, 2020). The search for studies was limited to English-language articles. Finally, the search string was used as inclusion criteria to select relevant topics related to cognitive mindset for leading the virtual team and its system thinkingperspectives. The exclusion criteria include duplication, relevance, and quality. It is donevia the reading of abstracts and conclusions of downloaded articles from different databases. The relevance was determined by deciding whether articles fit keywords and their quality. The study excluded unpublished articles, working papers, and conference papers. Moreover, the duplicated articles are excluded by assigning identification codes to each article and by through manual detection.

2.3. Data Analysis

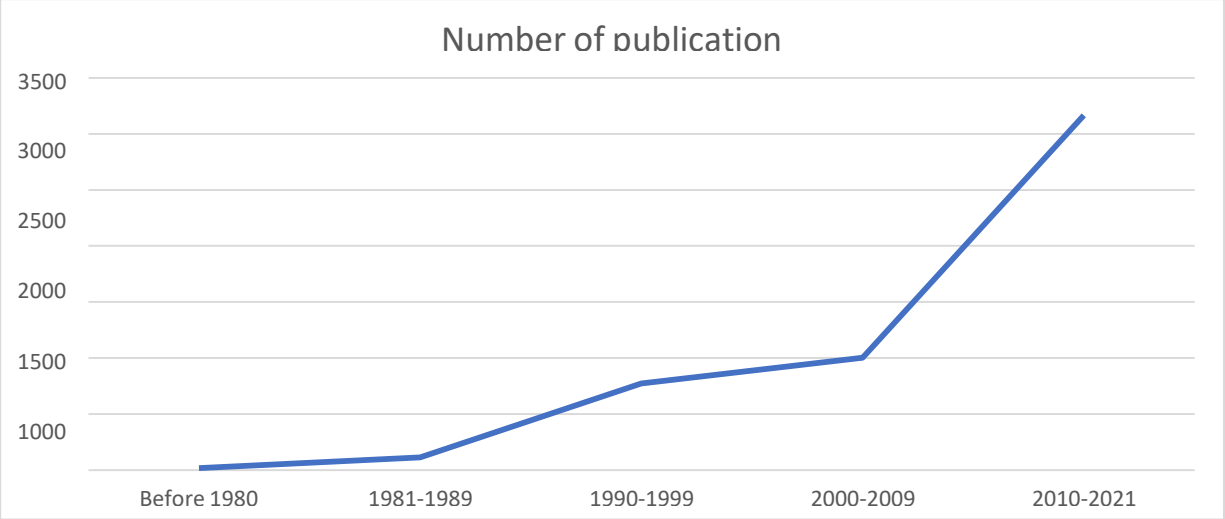
This study employed a descriptive data analysis process. The descriptive analysis was conducted through diagrammatical representation and tabulation, which was particularly used for discussing study characteristics (Tranfield*et al.,* 2003). Moreover, content analysis was used as a method of data analysis. The researcher first manually encodes issues addressed in

the articles, and then an interpretative method was used to examine the results of the studies. Then, type, purpose, finding, implication, and limitation were systematically extracted from the articles.

3. Results and Discussion

3.1. Article growth

Figure 2: Growth of articles on virtual leadership and system thinking

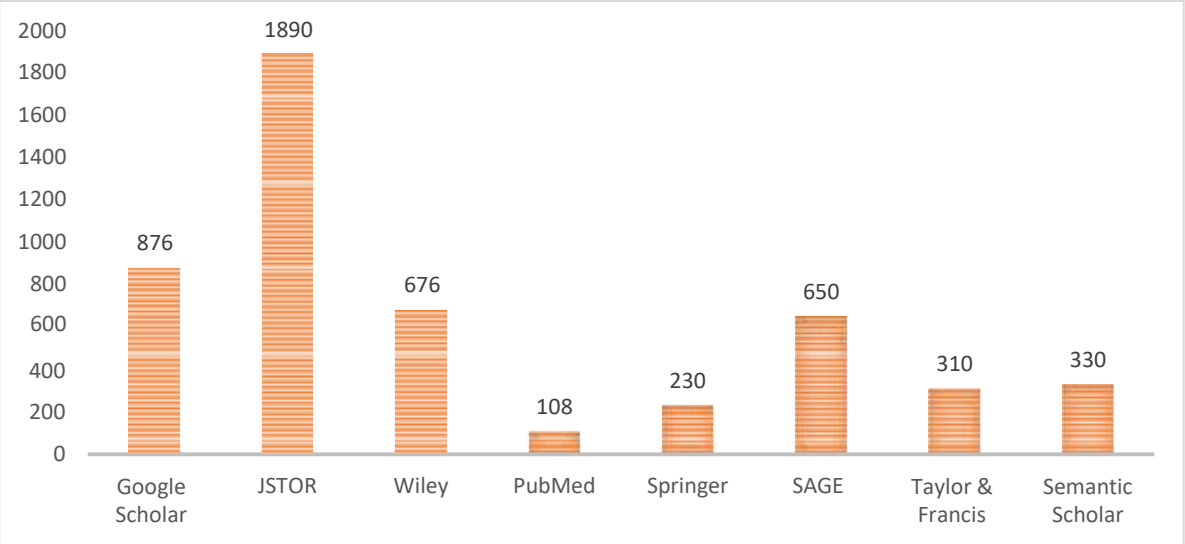


As shown in the above Figure 2, the years 2010 and 2021 witnessed a high interest in the topic of leading virtual teams and system thinking. This might be due to the high growth of sophisticated technology, specifically at the beginning of the year 2010 (Palandrani, 2020). This implies how rapidly change in technology prompts scholars to investigate about digitalization, remote leadership and system thinking.

3.2. Study characteristics

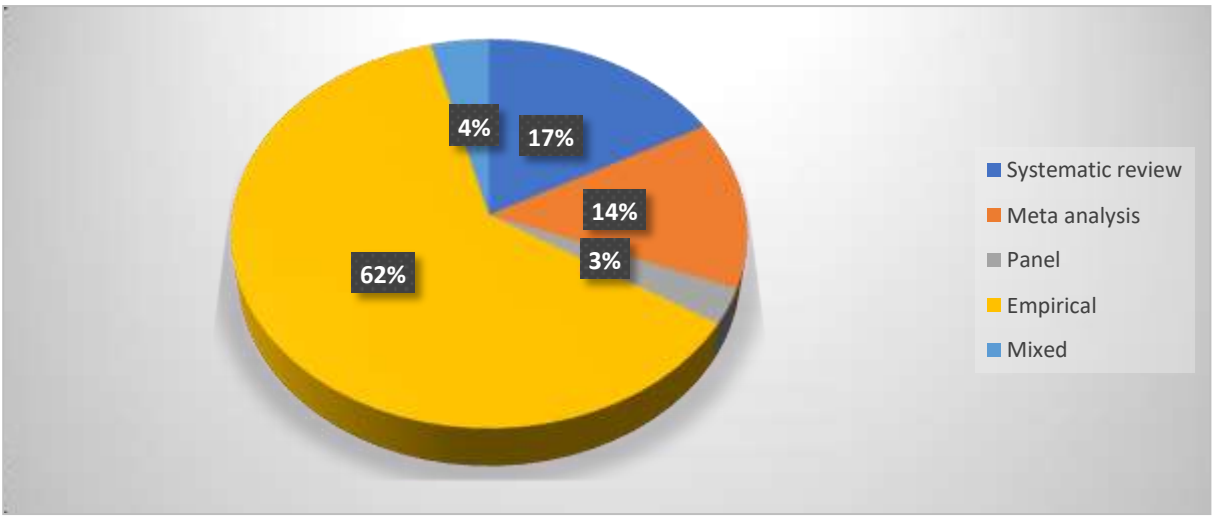
The results from selected databases for the review are shown in the below bar chart.

Figure 3: The databases for article search



As shown in the above bar chart, JSTOR was used to access the majority of the articles for this study, followed by Google scholar, Wiley, SAGE, Taylor & Francis, semantic scholar, Springer, and Pub Med respectively.

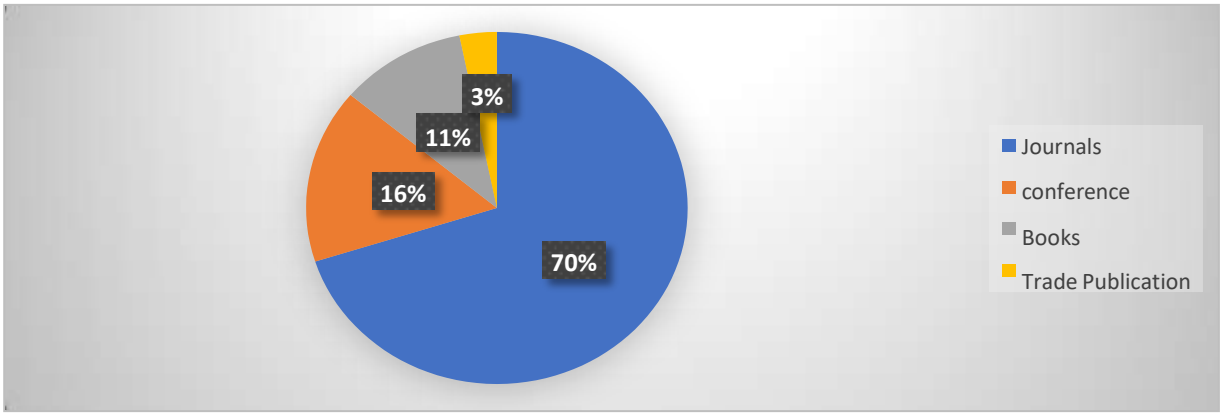
Figure 4: Type of studies reviewed



In the above pie chart (figure 4), the study characteristics are explained in terms of the types of studies reviewed. As shown in the pie chart, the majority of reviewed studies were empirical (62%) and followed by systematic reviews (17%), meta-analyses (14%), mixedapproaches (4%), and panels (3%) respectively. This implies that most (62%) studies on the topic of virtual teams and system thinking are based on observed and measured phenomena and it derives knowledge from experience rather than theory or belief.

3.3. Source of Database

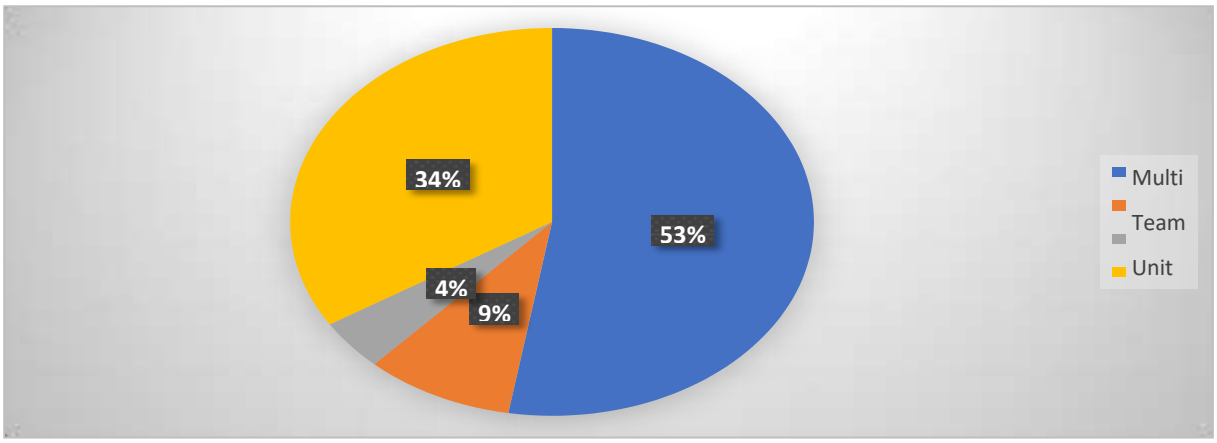
Figure 5: Publications by the source of database



The search results were categorized into five different types of data sources (Figure 5). The largest group (70%) was journals, followed by conference papers (16%). Books and trade publications account for 11% and 3%, respectively. Most publications are journals, which will enable the development of further emerging ideas in the theme of leading virtual teams and its system thinking perspectives.

3.4. Level of analysis

Figure 6: Level of analysis



The stud's characteristics are presented in terms of the level of analysis. As presented in above figure 6 (pie chart), 53% of reviewed studies adopted multi-level analysis, while 34% of them adopted firm-level analysis, 9% of articles are team level and 4% of articles are at the unit level. As most studies are multi-level analyses, it allows scholars to combine different theoretical approaches at different levels and establish relationships between concepts at different levels.

4. Results

4.1. Review Matrix

This review matrix aims to provide a well-organized standard structure for the selectedarticles.

Table 2: Review of Selected studies

S/n	Author/s	Year of publication	Title/*journal*	Purpose of study/ research setting or intervention	Type of study/ methodological design	Results/ conclusions or outcome variables	Implications for practice research, theory, or selected findings	Limitations/flaws	Citation
1	VìctorM. GarroAbarca, Pedro R. Palos-Sanchez, and Enrique Rus-Arias	2020	Working in Virtual Teams: A Systematic Literature Review and a Bibliometric Analysis. *IEEE Access.*	The aim was to identify the most relevant articles on virtual teams.	Systematic literature review and a bibliometric analysis	The set of existing research in the field of a virtual team is reviewed. This study concluded that rapid developments in information technologies have resulted in the rapid advance of virtual convergence. However, there is still a lot of research to be done.	Advancements in information technology permit teleworking and collaboration in virtual teams.	The study didn't look into the relationship between different aspects of virtual teams and how they work together.	11
2	KhurramMehtab, AmjadurRehman, SairaIshfaq, and Raja Ahmed Jamil	*2017*	Virtual Leadership: A Review Paper. *Mediterranean Journal of Social Sciences*	The goal of the study was to condense the existing literature on virtual team leadership.	Literature review	The ability of the business organization to produce products and services, as well as their distribution, has improved due to the virtual work environment. It also improves job satisfaction and efficiency, as well as gives opportunities to leaders to move the organization forward.	When businesses operate in virtual environments, they must adapt their working environment and leadership practices.	The study mainly focused on the advantages of virtual teams. It did not discussthe disadvantages of virtual organizations.	20
3	*Jeanne M. Wilson, Thomas D. Fletcher, Tuck Pescosolido, and Debra A. Major*	*2021*	Extraversion and Leadership Emergence: Differences in Virtual and Face-to-	The goal of this study was to compare andcontrast the leadership styles of virtual andface-to-	Analytical method	According to this study communication context may not affect the overall level of leadership exercised in the teams, it	The main implication of this study is that virtual interaction affects the salience of leadership behaviors and results in	The study used only text or chat toolsas a virtual team interaction. However, the text represents only	2

			Face Teams. *SAGE*	face teams.		does affect how extraversion influences who emerges as the leader(s) of the teams.	different outcomes for extroverts in teams.	one particular kind of virtual interaction.	
4	*Roni Reiter-Palmon, William Kramer, Joseph A. Allen, Vignesh R. Murugave, and Salvatore A. Leone*	*2021*	Creativity in Virtual Teams: A Review and Agenda for Future Research. *Science*	To conduct a review of the literature related to virtual teams, virtual meetings, and creativity.	Descriptive literature review	The study concluded that Organizations and teams need to be able to collaborate more effectively, and even generate creative solutions, outside what was normal operating procedures (i.e., face-to-face).	The rapid improvement of technology over the past few years and its proliferation over a global pandemic (COVID-19) has exposed possibilities of working virtually to several organizations.	The study's focus is on how virtuality and virtual tools affect team creativity across the entire dynamic range of the creative problem-solving process.	1
5	*D. A. G. Clark, A.L.Marnewick, C. Marnewick*	*2019*	Virtual Team Performance Factors. *IEEM*	To determine the most important factors that influence the performance of virtual teams.	A systematic literature review	The positive factors in virtual team performance were empathy, trust, and the appropriateness of communication technology used by the team. The effects of geographic and temporal dispersion, the effects of cultural diversity, and negative leadership qualities such as bias were identified as failure factors in virtual teams.	The performance of a virtual team can beimproved by cultivating a positive mental andemotional state, a positive bond between team members, a strong climate of wellbeing, trust, intrateam relationships, and active communication design.	The data sources for this study were limited between the years 1998 and 2019. The study only looked at English results.	10
6	*Sean A. Newman1, Robert C. Ford, and Greg W. Marshall*	*2019*	Virtual Team Leader Communication: Employee Perception and Organizational Reality: *SAGE*	To Provide insight to leaders of virtual teams about how a leader's effective use of communication tools and techniques in combination affects virtual team performance.	Analytical	Virtual team members' perceptions of their leaders' communication effectiveness are positively correlated with team members' perceptions of their team's performance.	Trust strengthens the relationship between perceived leader communication effectiveness and team performance results.	This study gathered data only from the United States and India.	38

7	U. YelizEseryel, Kevin Crowston, and Robert Heckman	2020	Functional and Visionary Leadership in Self-Managing Virtual Teams: *SAGE*	To examine a leadership theory in self-managing virtual teams.	Deductive and descriptive	The study finding shows that successful self-managing virtual teams require both functional and visionary leadership. Functional leadership is complemented by strong, concentrated, and centralized visionary leadership, visionary leadership is enabled by functional leadership in the form of substantive team member contributions.	The importance of shared mental models enables team members to work together effectively in the absence of direction from a singular leader.	The article is more descriptive and failed to use a correlation model to look at the relationship between variables.	10
8	*Luis L. Martins and Marieke C. Schilpzand*	*2011*	Global virtual teams: key developments, research gaps, and future directions. *Emerald*	To identify the research gaps and areas in which additional research is needed.	Literature review	The global virtual team plays a critical role in the success of many of today's global organizations and will increasingly do so in the future.	As business becomes more global, organizations increasingly use Global virtual teams for various tasks.	The scope of this study is limited to a descriptive literature review. The authors focused only on determining the research gap and providing future detection	53
9	*Julia E. Hoch and Steve W. J. Kozlowski*	*2012*	Leading Virtual Teams: Hierarchical Leadership, Structural Supports, and Shared Team Leadership. *Journal of Applied Psychology*	To evaluate the impact of hierarchical leadership, structural supports, and shared team leadership on team performance.	Analytical	The extent to which teams were more virtual reduced relations between hierarchical leadership and team performance but strengthened relations between structural supports and team performance. However, shared team leadership was significantly related to team performance	Results of the study improve understanding of leadership processes in virtual teams and practical implications for leading virtual teams.	The study does not address the underlying process mechanisms by which hierarchical leadership is inhibited and structural supports provide supplements.	721

						regardless of the degree of virtuality.			
10	*Christine Z. Miller, SaadAqeel-Alzroonib, and R Wade Cam*	*2010*	Learning to Collaborate in COINs: Insights from a multidisciplinary global virtual collaboration. *Elsevier*	To understand an interdisciplinary vir tual collaboration betw een four university tea ms.	Descriptive	Team members must quickly communicate and demonstrate the value of key principles, processes, and work practices while navigating multiple levels of complexity, knowledge cultures, skills, and capabilities when collaborating across disciplines.	Cross-disciplinary global virtual team projects improve learning outcomes and are critical to the long-term success of projects and initiatives.	The scope of the study is limited to four universities.	357
11	*Amanda Bishopa, Ken Riopelleb, Julia Gluesingb, James Danowskic, and Tara Eatonb*	*2010*	Managing Global Compliance through Collaborative Innovation Networks. *Elsevier*	To investigate global compliance through a collaborative innovation network.	Descriptive	Managers can use the Digital Diffusion Dashboard to analyze, interpret, and communicate with their international teams.	The Digital Diffusion Dashboard is a one-of-a-kind set of tools that allows global managers to accurately measure and interpret their teams' communication networks.	The study was deficient insufficient references and was not adequately supported by previous evidence.	20
12	*Mario Tani, OrnellaPapaluca, and Pasquale Sasso*	*2018*	The System Thinking Perspective in the Open-Innovation Research. *Journal of open innovation: technology and marketing and complexity*	To investigate how the major themes in the System Thinking Perspective, particularly those related to Complex Systems, are related to the Open Innovation research.	Systematic Literature Review	Even though Open Innovation and Complex Systems are theoretically related, they are only rarely used together in academic literature.	Managers who understand the interactions between Complex Systems and Open Innovation can recognize the whole system.	The review failed to Explain the article screening flow diagram.	44
13	*John H Powell*	*2014*	System/scenario duality is a supporting equivalence	To is to explore the nature of duality between coherence in a scenario ensemble and the underlying system representation	Case study	To create a suitable scenario ensemble (for strategic hypothesizing, assessment of candidate policies, risk appraisal, etc) there needs to exist a	There is alinkage between scenario-based understanding and system thinking.	The study scope Merely depends on the case study business school industry.	10

				and to illustrate a procedure for utilizing this duality to improve scenario and system model building.		stable system assumption common to all of the scenarios.			
14	*Carolyn Mann, John R. Parkins, Marney E. Isaac, and Kate Sherren*	*2019*	What do practitioners of holistic management exhibit systems think?*Resilience Alliance Inc*	To identify different levels of systems thinking among people engaged in holistic management.	Exploratory mixed-method approach	Systems thinking can help to cope with complexity and improve decision-making.	System thinking helps to manage complex decisions.	The study is limited to only a holistic farmers' context.	11
15	*NiamatUllahIbne, Hossain, Vidanelage L., Dayarathna, Morteza and Nagahi and RaedJaradat*	*2020*	Systems Thinking. *MDPI*	To provide a comprehensive review of research trends and themes in the field of systems thinking.	A systematic review and Bibliometric Analysis	From 1991 to 2018, the top 15 authors in the top 20 journals published more than 30% of all publications in the field of systems thinking and related topics.	Systems thinking is a hot issue for practitioners, government officials, military personnel, and researchers in a variety of fields, including systems engineering, management, education, and healthcare.	The period of the data is limited to the years 1991 to 2018.	24
16	*Kurt Luther and Amy Brukman*	*2010*	Collaborative innovation network inonline communities of Animator. *ELSEVIER*	To investigate amateur collaborative innovation networks within the domain of online, collaborative animation projects.	In-depth qualitative interview method	Leaders are crucial in every step of collaborative innovation	A collaborative innovation network has great potential and this potential has not yet been reached.	The study is limited to the descriptive method, due to that, it can't properly address the relationship between collaborative innovation networks and online communication.	18
17	*Robert C. Ford, Ronald F. Piccolo, and Loren R. Ford*	*2017*	Strategiesfor building effective virtual teams: Trust is key. *ELSEVIER*	To identify strategies that organizations used to successfully lead virtual teams.	Descriptive	Strategy contributes to building and sustaining a climate of trust in virtual teams	Developing a strategy can save money, and time as well as build trust among virtual team members and leaders.	There is no conclusion or further research direction in this article. That may hinder readers from understanding what was concluded at the	219

								end of the study.	
18	*Ross D. Arnold and Jon P. Wade*	*2015*	A Definition of Systems Thinking: A Systems Approach. *ELSEVIER*	To suggest the meaning of systems thinking that can be applied across disciplines.	Literature review	The definition of system thinking was derived from a review of the literature in the article.	The use of systems thinking touches many disciplines, assisting and connecting them in unexpected but powerful ways.	The article is limited to secondary data.	852
19	*Leif JarleGressgard*	*2011*	Virtual team collaboration and innovation in organizations. *Emerald*	The research aimed to look at how t he use of ICT in team collaboration affects th e creation of shared un derstanding and knowl edge development wit hin teams, and how the se factors affect an org anization's ability to in novate.	Literature review	Several key aspects of th e use of ICT in teams wo rking on innovation proje cts are discussed. Based on a literature review, a c onceptual model and futu re research directions are proposed.	To realize an organization's innovation potential, well-functioning computer-mediated team interaction is critical.	The scope of this paper was limited to the ICT aspect, but, virtual team collaboration can be influenced by other factors such as leadership.	172
20	*SnellmanCarita Liliana*	*2013*	Virtual teams: opportunities and challenges for e-leaders. ELSEVIER	To determine how information and communication technology has affected organizations, working environment, and leadership, the main challenges and opportunities e-leaders faces when managing virtual teams.	Descriptive literature review.	The study presents the opportunity and challenges of virtual teams. The success of a virtual team greatly depends on leadership.	As they strive to achieve their objectives in a globalized world marked by critical technological changes, leaders face both unexpected opportunities and challenges.	Only secondary data is used in this study.	205
21	*HaimShaked, Chen Schechter*	*2020*	Systems thinking leadership: new explorations for school improvement. *SAGE*	To identify potential research avenues in the area of systems thinking in school leadership.	Descriptive	Systems thinking enables managers to deal with increasing complexity and change. Systems thinking can be extremely beneficial to school leadership because of the inherent	The ability to see the whole beyond its parts and the parts in the context of the whole is referred to as systems thinking.	The study is limited in the context of school dynamics.	20

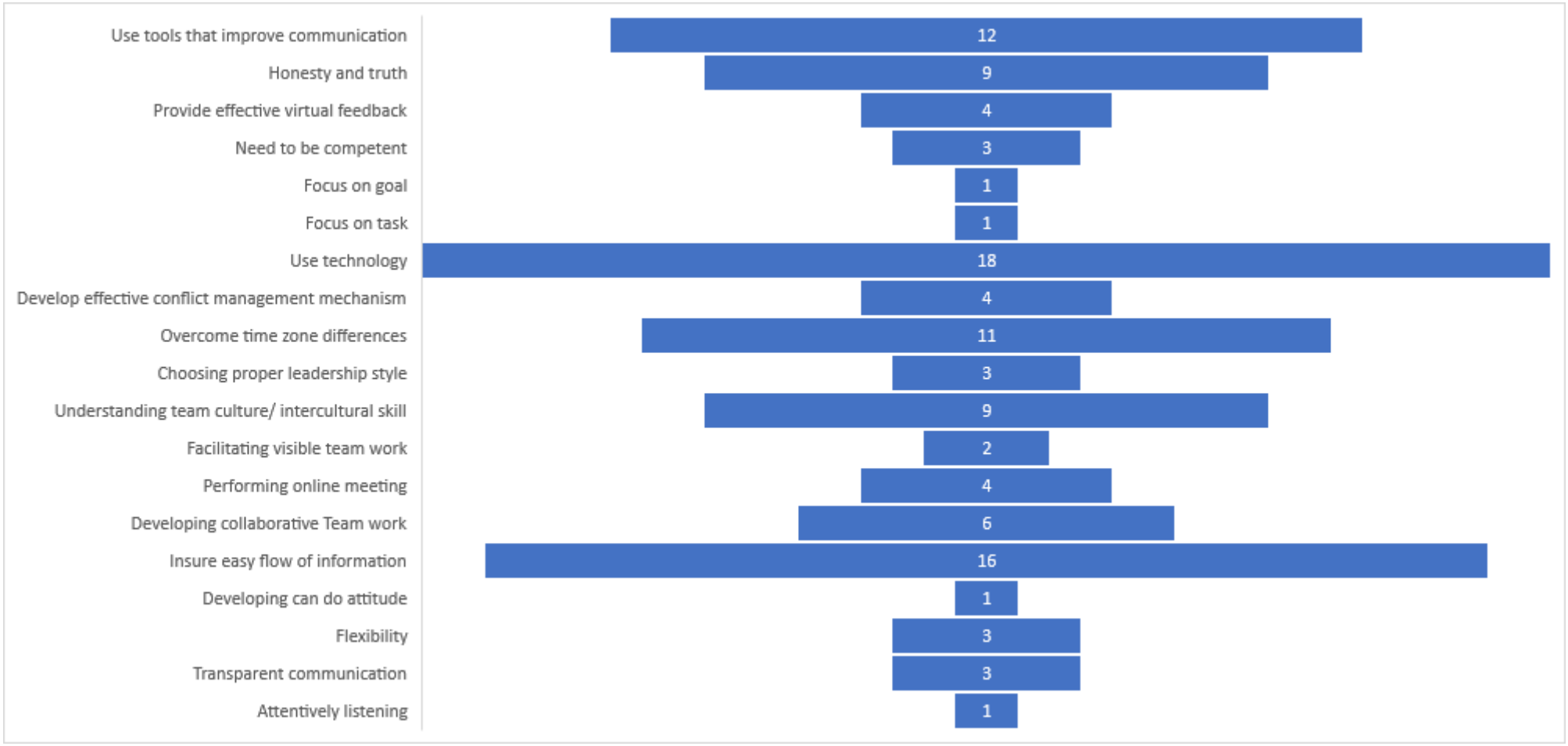
						complexity of school organizations in dynamic educational environments.			
22	*Robert Louis Flood*	*2010*	The relationship of 'systems thinking' To action research. *SAGE*	To determine the relationship between system thinking and action research.	Descriptive	System thinking is the ground for action research.	Systemic thinking is a mode of thinking that keeps people in touch with the wholeness of our existence. It helps to keep in mind that human thought is not capable of knowing the whole, but it is capable of 'knowing that we don't know.	It's better to use a correlation model to test the relationship rather than discretion.	7
23	*Caroline Green, Owen Molloy, and Jim Duggan*	*2021*	An Empirical Study of the Impact of Systems Thinking and Simulation on Sustainability Education. *MDPI*	To determine how systems thinking increases the effectiveness of educational sustainability.	Analytical	System dynamics simulation has a strong effect on understanding a sustainability problem, and a weakly effect on the transfer of understanding to another problem with a similar systemic structure	Simulation is a powerful and highly efficient way of teaching sustainability.	The conclusions are limited to the effect of the factors in a learning environment designed for a single individual learning session. Moreover, the findings of the study are limited to cognitive aspects of sustainability understanding, not its affective or behavioral aspects	-
24	*AelitaSkarz˘auski ene*	*2010*	Managing complexity: systems thinking as a catalyst of the organization's performance. *Emerald*	To analyze new management practices for dealing with today's business landscape's complexity, uncertainty, and changes.	Analytical	Organizational performance was directly associated with systems thinking.	A systems thinking approach enables the realization of various interrelationships and working schemes within the organization.	The sample of the research is limited to the national level.	123
25	*Jamie Monat,*	*2020*	Practical	To summarize the	Descriptive	All components of an	The Systems Thinking	The study is limited to	9

	Matthew Amissah and Thomas Gannon		Applications of Systems Thinking to Business. *MDPI*	research on Systems Thinking for business management.	literature review	organization are part of system thinking. The paper explores several examples of business failures due to a lack of application of Systems Thinking.	approach is useful to all levels of management.	high-level system thinking only.	
26	*Brian J. Galli*	*2020*	Measurement System Analysis and System Thinking in Six Sigma: How They Relate and How to Use Them.*International Journal of System Dynamics Applications*	To investigate measurement system analysis and system thinking in Six Sigma, as well as the factors that influence these actions	Descriptive	The success of a company depends on the ability to think in systems.	Fixing a system as a whole helps to identify the real causes of issues and to know where to address them.	This study only assessed the key factors and their relationship within a project environment. The findings could not be applied to other areas (supply chain management, operations management, strategic management, etc.)	8
27	*Daniell Wilden, · John Hopkins, and Ian Sadler*	*2021*	The Prevalence of Systems Thinking in Supply Chain Management. *Springer*	To find out how common Systems thinking is in supply chain strategic management.	A Systematic Literature Review	Systems Thinking and Supply Chain Performance have a positive relationship.	There is a strong relationship between Systems thinking, maturity, and Supply Chain Performance.	The procedure of article selection is not clearly stated.	-
28	*Joy J. Godin,*	*2019*	Using design thinking strategies and virtual reality in global virtual teams. *International Association for Computer Information Systems*	To determine a framework for incorporating design thinking strategies and virtual reality tools into global virtual teams.	Descriptive	Design thinking is a strategy for solving managerial problems that involve higher-order thinking. Virtual reality offers a realistic and low-cost collaborative environment that has the potential to boost the success and effectiveness of global virtual teams.	Design Thinking is a user-centered approach to innovation, design, and development that prioritizes the discovery and observation of human needs.	The research design, data collection, and data analysis procedures were included in the methodology section of the article.	-

29	*Samir Patel &Khanjan Mehta*	*2016*	Systems, Design, and Entrepreneurial Thinking: Comparative Frameworks. *Springer*	To determine the comparative framework of design thinking, entrepreneurial thinking, and systems thinking.	Case study	Design thinking can be pivotal to identifying innovative products, Entrepreneurial thinking can ensure that the product creates sustainable value, and Systems thinking can strategize how the product harmonizes with the extant system in the short- and long term.	The philosophies of design thinking, entrepreneurial thinking, and systems thinking have a widespread application in diverse fields	The authors failed to incorporate limitations and further research direction in the article.	36
30	*FarnazTaghizadehKourayem and MohammadrezaKabaranzadGhadim*	*2021*	A review of system thinking and wise organization.*Journal of New Applied Studies in Management, Economics & Accounting*	To examine why system thinking or holistic thinking is needed to strengthen wisdom in the whole organization?	Descriptive literature review	System thinking strengthens wisdom and increasesthe competitive advantage of an organization because it helps managers to look at an organization as a whole and manage its components about each other.	System thinking is a holistic approach that has been considered by thinkers in the field of organization and management.	The authors failed to develop a concrete conclusion of the study. The conclusion of this article is crowded with questions and it may not lead readers to concise inference about the topic of the study.	-

Source: Own review result, 2022

Figure 7: Important mindset (attribute) for leading virtual Team



Source: Count results from selected articles, 2022

5. Discussion

5.1. Summary of key terms related to Leading virtual team

Most of the selected studies (e.g., Martins & Schilpzand, 2011; Roni et al., 2021; Gressga, 2011; Victor et al., 2020; Khurram et al., 2017; Bishop et al., 2010; Clarket al., 2019; Jeanne et al., 2020; Victor et al., 2020), shows that, information and communication technology and digitalization play vital role in the effectiveness of the virtual organization. Likewise, the studies by (Newman et al., 2019; Hoch and Kozlowski, 2012; Yeliz et al., 2020; Khurram et al., 2017; Miller et al., 2010) also argued that trust, participatory leadership, learning, and cooperation improve the performance of virtual organizations. In addition, as suggested by (Martins & Schilpzand, 2011; Clark and Marnewick, 2019), interpersonal factors (e.g., communication), psychological factors (e.g., perception, attitude, personality, and learning), and social factors(group) are mentioned as factors that affect the virtual organization performance.

The following section provides a one-by-one summarized explanation regarding key terms related to Leading virtual team:

a) Information and Communication technology

Due to the advancement of information and communication technologies, organizational working environments change from time to time (Roni et al., 2021; Victor et al., 2020; Khurram et al., 2017). The business has become more globalized and competitive in recent years than past. Because of the rapid advancement of information and communication technologies, jobs have become more dynamic and multidimensional (Roni et al., 2021).

Virtual teams are made up of members who are spread out across the globe and communicate primarily through information and communication technologies (Gressga, 2011). Scholars (Bishop et al., 2010; Clark et al.,2019) addressed how technology can help the collaboration of global virtual teams.

b) Trust

There is significant alignment between virtual team members' perceptions about their leader and team performance (Newman et al., 2019). Trust is a very important issue to improve team performance their relationship. The team's performance will be improved as the relationship between the team members and the team leader is trustful.

c) Shared leadership

Through empirical research, Hoch and Kozlowski (2012) investigated the relationships between virtual team performance, shared team leadership, structural support, and traditional hierarchical leadership. The study found that, shared(participatory) leadership is significantly associated with team performance.

d) Virtual interaction

Jeanne et al. (2021) found that regular virtual interaction improves team performance.

e) Digital Culture and Globalization

Globalization, ICT, and the spread of internet have all supports virtual teams' development (Victor et al.,2020).

According to Martins &Schilpzand (2011), members of global virtual teams come from two or more countries and work together primarily through information and communication technologies. The technological, social, and psychological factors affecting global virtual team functioning and their outcomes.

f) Interpersonal characteristics

Virtual teams continue to fail at a higher rate than non-virtual teams (Clark and Marnewick, 2019). The most common positive factors for improving virtual team performance are good interpersonal characteristics such as empathy and trust. Geographic dispersion, cultural diversity, and bias are the most common factors that reduce virtual team performance.

g) Learning and Cooperation

Miller et al., (2010) and Luther and Bruckman (2010) studied how virtual teams are use collaborative networks. Learning and Cooperation are very important elements to forming collaboration among the team and, as well as, for survival and growth of virtual organization.

According to Khurram et al. (2017), to get their members commit to the organization's goals, leaders are responsible for their members' emotional feelings, cohesion, norms, knowledge sharing, and motivations (Yeliz et al.,2020).

. **Table 3: Positive factors for leading virtual team**

Common Dimensions	**Count result**
Communication Technology	14
Trust	13
Intra-team Relationships	11
Leadership quality	11
Leadership Structure	9
Interpersonal Characteristics	9
Communication Structure / Guidelines	8
Empowerment/Autonomy	8
Leader Qualities	8
Knowledge Transfer	7
Commitment	6
Collaboration	6
Task Structure / Guidelines	5
Communication Characteristics	5
Team Characteristics	4
Intercultural	3
Leadership Training	3

Source: Count results from selected studies, 2022

As shown in the above Table 3; communication technology, trust, intra-team relationships, and leadership quality are the most dominant positive factors that contribute to the effectiveness of leading virtual team.

Table 4: Challenges for leading a virtual team

Common Dimensions	Count result
Dispersion	21
Cultural Diversity	17
Poor Leadership Qualities	13
Poor Technology	7
Poor communication	6
Cultural Characteristics	4
Bias on the behalf of the leader	4
The difference in the ruling/regulation system	4

Source: Own Count Results from selected studies, 2022

Dispersion, cultural diversity, and poor leadership quality arethe relatively most mentioned challenges of virtual team.

Moreover, balancing his or her personal life with the demands of his or her virtual team is one of the main challenges of virtual teams. Because, virtual work is mostly performed from home, therefore, it can be difficult to balance between work and family obligations (Ford et al., 2017; Lilian, 2013). Time zones, nationalities, cultures, working styles, and languages are all make communication within virtual teams more difficult. Fixing problem by dealing with these challenges is mainly the responsibility of virtual team leaders.

5.2. System thinking perspectives in leading virtual team

Researchers (e.g., Godin &Pridmore, 2019; Flood, 2010; Powell, 2014; Carolyn et al., 2019; Mario et al., 2018; Arnold and Wade, 2015; Shaked& Schechter, 2020; Kourayem & Ghadim, 2021) argued that system thinking forms relationships among environmental factorsthrough synergy to see the whole beyond its parts and to see the parts in the context of the whole. According to (Caroline et al., 2021; Auskiene, 2010; Jamie et al., 2020;Galli, 2020; Daniell et al., 2021), system thinking can be applicable at all managerial levels to improve organizational performance, solve organizational problems, and serve as a core competency in any organization.

The following section highlights perspectives of system thinking that might be applied in the scenario of virtual team leadership:

a. Higher-order thinking

Employees with strong higher-order thinking skills wanted in any work environment (Godin & Pridmore, 2019; Flood,2010). This can be also true in virtual organization.

b. Network of relationships

According to Mario *et al.* (2018), businesses are part of a network of relationships; they collaborate with their external partners and should not limit their activities to a specific area. To learn from the environment in a virtual team setting, virtual organization's system should be open and interactive with the outside world (Powell, 2014; Carolyn et al., 2019).

c. A set of synergistic analytic skill

Systems thinking is a set of synergistic skills used to improve the capability by understand the systems (Arnold and Wade, 2015).

d. Looking the whole beyond its parts and looking the parts in the context of the whole

Systems thinking is defined as the ability to see the whole beyond its parts and looking the parts in the context of the whole (Shaked & Schechter, 2020). Leaders can wide up their view by using systems thinking and holistic management approach. Leaders who focus on the parts ratherthan the whole fail to consider the complex interactions between different parts of the system (Caroline et al., 2021).

e. System thinking improves organizational performance

Auskiene (2010) looked into the link between systems thinking and business performance. The overall conclusion of the article's is there is positive and significant association between systems thinking and organizational performance.

f. System thinking is applicable at all levels of managerial hierarchy

According to Jamie et al (2020) lack of systems thinking ability causes failure of business. The systems thinking is enormously valuable to managers at all levels. Systems thinking is viewed as a way of thinking, a set of tools, and a language for understanding and optimizing system behavior at all levels of the managerial hierarchy.

g. System thinking helps organizations to solve the problem

Galli (2020) proposes that rather than attempting quick fixes to organizational problems, it is preferable to address issues at their source. Problems can be solved on a much larger scale by thinking system as a whole and examining interactions between different parts. System thinking is the ideal method for addressing challenges and solvingproblems.

According to Daniell et al (2021) Systems thinking can be used to understand wicked problems. Moreover, design thinking, entrepreneurial thinking, and systems thinking have all serve as vehicles for resolving complex organizational problems (Kourayem & Ghadim,2021; Patel & Mehta,2016).

6. Conclusion

The fast growth of virtual integration is due to the rapid growth of information communication technologies. Virtual team leaders must have virtual communication skills to facilitate intra-team relationships. Leading virtual team is more flexible and requires system thinking compared to conventional leadership.

Our findings show that, in the past decade there was an increasing trend in the publications of leading virtual teams as well as the system thinking. The majority of the publications were empirical and from the field ofbusiness. The most commonly published format was the journal article. Based on our review results, challenges for virtual organization performance include; dispersion, cultural diversity, and poor leadership quality. To overcome these challenges, the scholars recommended formal training and informal exposures regarding communication,

cultural, and language aspects. The most positive factors that can contribute to the effectiveness of leading a virtual team are communication technology, trust, intra-team relationships, and leadership quality. Virtual team leaders can wide up their view by using systems thinking perspectives.

In previous publications, there has been limited empirical evidence on the relationship between systems thinking and leading virtual team. Therefore,further research is needed to determine their association.

This systematic review has the following main limitations: First, the review is limited to the period from 2010 to 2021 and excludes early (pre-2010) contributors to the field. Also, it was limited to publications that are selected from only eight databases. Additionally, the process of article identification was through a *keyword-based search,* and that limited authors to gather data based on selected keywords only.

Despite these limitations, we believe that thisreview plays an important role in the topic of leading virtual teams and systems thinking and encourages further scholars to expand their viewpoint on the topic.

7. Further research direction

The available evidence about *Systems thinking and leading virtual team, Leading virtual team and leadership theories, Leading virtual team and leadership style are* very limited. Besides, how does system thinking improve the performanceof leading virtual teams? remains to be addressed by further researchers. Future researchers may also find manageable ways to broaden their search boundaries, language, and time-period to conduct more generalizable studies. Moreover, future scholars can consider more databases to reach in more reliable result.

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