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Virtual Reality as a mitigation for Remote Work issues: advantages, disadvantages and challenges

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Master's in Computer Science and Business Management

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Páginas Amarelas

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Department of Information Science and Technology

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“Our greatest weakness lies in giving up.”

Thomas A. Edis

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Resumo

No paradigma do trabalho contemporâneo, significativamente influenciado por desafios globais como a pandemia da COVID-19, a proeminência do Trabalho Remoto tem vindo a aumentar, oferecendo às empresas tanto vantagens competitivas como novos desafios. Este estudo aprofunda a interação entre o trabalho remoto e as questões a ele associadas, com o objetivo de identificar potenciais mitigações tecnológicas. Através da exploração de duas revisões sistemáticas da literatura e aplicação da metodologia Delphi, o estudo identifica a Realidade Virtual como uma ferramenta potencial para abordar vários desafios inerentes ao Trabalho Remoto.

O estudo revela que a capacidade da Realidade Virtual para incutir um sentido de presença, aumentar a interatividade e oferecer ambientes imersivos faz dela uma solução promissora. No entanto, a sua aplicação no trabalho remoto não está isenta de considerações. Embora a Realidade Virtual possa melhorar a coordenação organizacional, questões como a resistência à adoção, a ergonomia e a integração de sistemas, realçam a necessidade de uma abordagem abrangente.

Este estudo demonstra o potencial da Realidade Virtual para revolucionar o trabalho remoto. Enfatizando não apenas a integração tecnológica, mas a sua harmonização com as necessidades humanas, os objetivos organizacionais e o ecossistema digital mais amplo. Este estudo abre caminho para investigações futuras, incluindo considerações ergonómicas, módulos de formação para Realidade Virtual e avaliações quantitativas do impacto da Realidade Virtual na dinâmica do Trabalho Remoto.

Palavras-chave: Trabalho Remoto, Realidade Virtual, Revisão Sistemática da Literatura, Metodologia Delphi, Desafios do Trabalho Remoto; Realidade Virtual como mitigação para problemas de Trabalho Remoto.

Abstract

In the contemporary work paradigm, significantly influenced by global challenges like the COVID-19 pandemic, the prominence of Remote Work has surged, offering companies both competitive advantages and new challenges. This study delves into the interplay between RW and its associated issues, aiming to ascertain potential technological mitigations. Through the exploration of two Systematic Literature Reviews and the application of Delphi methodology, the study identifies Virtual Reality as a potential tool to address various challenges inherent to Remote Work.

The study reveals that Virtual Reality's capacity to instil a sense of presence, increase interactivity, and proffer immersive environments makes it a promising solution. However, its application in Remote Work isn't without considerations. While Virtual Reality can enhance organizational coordination, issues like adoption resistance, ergonomics, and system integration emphasize the need for a comprehensive approach.

This study sheds light on the potential of VR in revolutionizing RW. Emphasizing not just technological integration but its harmonization with human needs, organizational goals, and the broader digital ecosystem. This study opens the way for future inquiries, including ergonomic considerations, training modules for VR, and quantitative evaluations of VR's impact on RW dynamics.

Keywords: Remote Work, Virtual Reality, Systematic Literature Review, Delphi Methodology, Issues of Remote Work; RV as a mitigation for RW issues.

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List of abbreviations and acronyms

CRM	-	Customer Relationship Management
ERP	-	Enterprise Resource Planning
IS	-	Information Systems
RW	-	Remote Work
RQ	-	Research Questions
SLR	-	Systematic Literature Review
VPN	-	Virtual Private Network
VR	-	Virtual Reality
WFH	-	Work From Home

CHAPTER 1

Introduction

Currently, after the COVID-19 pandemic, many companies continue to adopt Remote Work (RW) [1], [2], a trend that has already been seen in the last few years [3]. The companies, always looking to overcome the competition, caught in the RW a competitive advantage that allowed them to reduce administrative, infrastructure and operational costs [4]. Hiring people from any geographic location [5] has helped companies hire more adequately and, at the same time, reduce costs [6]. Some companies started using the RW argument as a motivation factor to retain and hire employees [7].

With Industry 4.0, or the fourth industrial revolution, it has been verified that the transition barriers from physical to digital work were attenuated [8]. Through technological advances, primarily increased connectivity, RW becomes a viable alternative for organisations and employees [9].

Most of the previous literature presents more benefits than adverse effects of Work From Home (WFH) [10]. However, only some things are benefits, and there are issues for the employees and for the organisations [8] that must be analysed. Such as: for the employee, the work-life balance [11], social isolation [12], communication [13] and interruptions/distractions [14]; and for the organisations, management and coordination [15], security [16] and costs [17].

However, mentioning the problems is not enough, so this research proposes to identify a possible solution. Virtual Reality (VR) is a viable solution to some of these problems. This technology allows users to enter a virtual environment and interact with objects, applications and other people [18]. It can simulate real experiences [19], allowing users to explore and learn in an immersive and interactive way [20]. Also, virtual reality can increase productivity [21] and improve the remote work experience [22]. VR has been expanding to numerous industries as it presents great potential to improve work due to its unique characteristics and flexibility [23].

This study is divided into seven chapters; the first chapter presents the introduction; the second chapter provides a state-of-the-art overview through a Systematic Literature Review (SLR), identifying issues experienced by organizations and employees and possible mitigations related to the adoption of RW; the third chapter is dedicated to presenting the methodology implemented in this study; the fourth chapter aims to verify, also through an SLR, the advantages, disadvantages, and challenges of applying VR in RW; the fifth chapter validates and identifies new findings regarding the advantages, disadvantages, and challenges found in SLR 2, using the Delphi methodology; the sixth chapter analyses and discusses the results obtained, relating the RW issues that can be mitigated with VR; and finally, the seventh chapter details the main conclusions of the study, its limitations and also future work.

CHAPTER 2

State of the art

The rapid transition to remote work, driven by the COVID-19 pandemic, has made it imperative to understand the implications and transformations that this change has brought to the professional environment. Many companies have chosen to maintain this work arrangement, recognizing the significant benefits it can offer, but also facing unprecedented challenges. This workplace evolution has piqued interest from both academia and the corporate world to understand the dynamics and implications of remote work.

By adopting remote work, we not only change the physical location of our work activity but also transform the very nature of work and how we interact with our tasks and colleagues. This paradigm shift brings with it a series of challenges and opportunities that need to be meticulously examined [2].

To conduct an in-depth analysis of remote work issues and their respective mitigations, a SLR was employed, following the procedures outlined in the Figure 2.1. This methodology offers the advantage of impartially and comprehensively examining previously published articles on the subject, providing a comprehensive overview of the current state of knowledge in this domain. This SLR was conducted between September and October 2022, resulting in the development of a paper that was submitted to WorldCIST 2023 under the title "Issues and Mitigations of Remote Work."

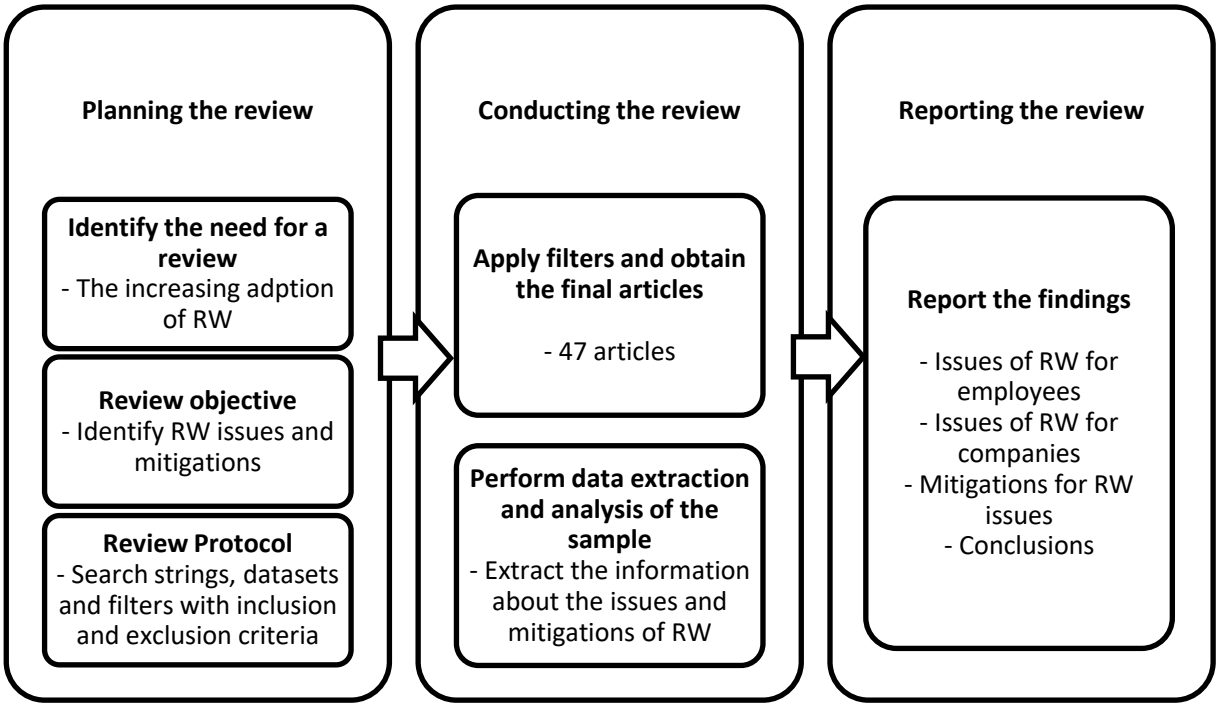

Figure 2.1 - Steps of the SLR 1 methodology performed

Table 2.1 shows the string with the keywords used for the search in the selected data-bases.

Table 2.1 - String with the keywords used in the SLR 1

String	"remote work" OR "remote working" OR "virtual work" OR "virtual working" OR "work from home" OR "working from home" OR "work from anywhere" OR "working from anywhere" OR "telework" OR "teleworking" OR "telecommuting" OR "home working" OR "mobile work" OR "mobile working" OR "flexible workplace" OR "distributed teams" AND "challenge" OR "challenges" OR "challenging" OR "disadvantage" OR "disadvantages" OR "hurdle" OR "hurdles" OR "barrier" OR "barriers" OR "obstacle" OR "obstacles"

The databases selected for this SLR were Web of Knowledge, ACM Digital Library, Scopus and IEEExplore. Inclusion criteria were applied (articles with the string present in the abstract and title, articles and conferences and articles written in English) and exclusion criteria (duplicate articles and non-relevant articles). The order of the filters applied is presented in Table 2. A total of 47 articles were obtained, of which 16 are conferences and 31 are journal articles.

Table 2.2 - Filtration process

Database	**No filter**	**Abstract**	**Title**	**Articles and Conferences**	**English**	**Duplicates**	**Manual (read)**
		Filter 1	**Filter 2**	**Filter 3**	**Filter 4**	**Filter 5**	**Filter 6**
Web of Knowledge	1917	1539	91	78	70	56	26
ACM Digital Library	2934	124	5	5	5	1	1
Scopus	19145	2180	108	92	87	45	18
IEEExplore	363	274	6	5	5	3	2
Total	22442	4117	210	180	167	105	47

By reading the articles, it was possible to segment them by concepts considering the objective of this study, which are "Issues for employees", "Issues for companies" and "Mitigations". It can be noted that most of the selected articles refer to the concept of "Issues for employees" with a total of 45 articles. Of the 47 articles, 27 refer to the concept of "Issues for companies" and only 16 refer to mitigations. This demonstrates that articles are more focused on the problems of employees rather than organisations and, at the same time, indicates that only a few mitigations have been identified to overcome remote working issues.

Throughout the following sections, the key concepts that underpin this review will be presented, offering a more comprehensive understanding of the complexities and nuances involved in the phenomenon of remote work.

2.1. Background

2.1.1. Remote Work

Remote work refers to any form of work that does not take place at the company's physical location. It encompasses working from home, co-working spaces, cafes, or any other location apart from the central office. This arrangement may be interspersed with in-person work [24]. The term “Remote

Work” encompasses concepts like “Working from Home”, “Work from Anywhere”, “Telecommuting”, and “Telework”. We will use “Remote Work” throughout this study.

2.1.2. Working from Home

Working from home specifically denotes carrying out professional tasks from one's residential environment. It constitutes a common form of remote work, where employees perform their duties from their homes [25].

2.1.3. Work from Anywhere

The term 'work from anywhere' implies that employees have the flexibility to choose any location for their professional tasks. This may encompass the home, cafes, co-working spaces, hotels, or even recreational venues [26].

2.1.4. Telecommuting

Telecommuting, an older term, was often used to describe remote work facilitated through communication technology such as phones and fax machines. Today, it is often used interchangeably with "remote work" [27].

2.1.5. Telework

Similar to telecommuting, telework refers to work conducted outside the traditional workplace. This can include working from home, but also encompasses other forms of remote work, such as working in co-working spaces or alternative locations [28].

As we delve into the landscape of remote work concepts, it becomes essential to explore the influential technologies shaping our digital interactions. One such technology is Virtual Reality, which has profoundly changed how we perceive virtual environments.

2.1.6. Virtual Reality (VR)

Virtual Reality is a technology that creates an immersive digital environment simulating the sensation of being present in a different place from the actual physical environment. This is typically achieved using devices such as VR headsets and controllers that track the user's movements [29].

2.2. Report

The literature review is divided into three parts: first discussing issues faced by employees, secondly those faced by companies, and finally potential mitigations. The aspects identified in the first part are

interconnected with those in the second part since employees' work impacts organisations and the other way around. In this regard, the applications of mitigations will benefit both the company and the employees. There may be an employee problem that needs an action/definition on the company's side, such as the company taking a measure to combat the isolation the employees feel [4].

2.2.1. Issues for employees

Adopting remote work can change how we work, bringing benefits and problems concerning traditional work [2]. The analysis allowed us to identify the negative aspects felt by employees, and Table 2.3 presents these aspects in descending order of references found.

From the analysis of the selected articles, the most mentioned problem is isolation, caused by the lack of socialisation [13] and by the reduction of interactions with colleagues at the social level [4]. Different impacts were identified at the work level, that is, in some cases, communications were reduced [11], was noticed an inefficiency in communications [30], poor feedback [31] and a reduction of informal communication [32], on the other hand, it was also identified as a negative aspect the increase of meetings [14] and the increase of complexity in communications [6]. With these aspects, there are less information and transparency [6].

With working from home and without the physical delimitation of the workspace, the work-life balance was affected, with the employee spending, in some cases, more time working [7] or, in other cases, spending more time with family and cooking [11].

Furthermore, the family has been identified as one of the reasons for work interruptions at home [14], as well as domestic chores, neighbours [2] or messages from colleagues [13]. At the same time, the conditions of the workspace at home are often not ergonomic [33], causing physical health problems such as musculoskeletal problems, physical pain [34], and fatigue [35]. Since there is no specific place to work at home [36], no appropriate chairs, tables and light conditions, the employee is sometimes forced to invest in better conditions, causing a problem of increased costs [37].

To complicate the situation, employees complain about the lack of equipment [6], the difficulty of remote access to documents, access to VPN, access to other work tools [44]and the lack of technical support [16].

These problems mentioned above have an impact on productivity [55]. People who work from home experience reduced efficiency [42], delays in addressing tasks and activities [32] and difficulty managing their working time [3]. In this case, self-discipline is essential, as lack of routine [2], wearing habits [13] and impersonal environment [40] have been identified as problems.

The worker's privacy has been affected [11], the length of working hours has been exceeded [52], and the workload increased [48]. This creates increased stress [46]and irritation [38] in the employee, causing depression [8] and decreased mental health [34].

Table 2.3 - Issues of RW for employees

Issues for employees	Article	Total
Isolation	[2]–[4], [6]–[8], [10]–[14], [30]–[32], [34], [36]–[50]	30
Work-life balance	[1], [2], [6], [7], [9], [11], [13], [31]–[35], [37]–[40], [42], [44], [48], [49], [51]	21
Communication	[1], [3], [4], [6], [7], [9], [11]–[15], [30]–[32], [39], [40], [42], [45], [46], [52]	20
Interruptions/ Distractions	[2], [3], [6], [9], [11], [13], [14], [16], [30], [32], [33], [35], [37], [40], [42]–[45], [48]	19
Knowledge	[2], [4], [6], [9], [11], [31], [32], [37], [38], [40]–[42], [47], [50], [52]–[54]	17
Motivation and integration	[4], [6], [10]–[12], [14], [16], [32], [35], [37], [41], [44], [47], [48], [51], [52], [55]	17
Equipment and device	[1], [3], [6], [9], [11], [13], [30], [32], [33], [39], [42], [43], [45], [49], [53]	15
Teamwork	[5], [6], [9], [14], [16], [17], [32], [35], [40], [43]–[46], [50], [56]	15
Working overtime	[2], [7], [11], [13], [31], [34], [35], [38]–[40], [42], [48], [49], [52]	14
Mental health	[6], [8], [12]–[14], [31], [32], [34], [35], [37], [38], [42], [46], [48]	14
Space for WFH	[2], [9], [13], [14], [30], [35]–[37], [39], [42], [45], [48], [49], [51]	14
Productivity	[3], [4], [6], [11], [13], [30], [32], [35], [42], [44], [46], [55]	12
Work overload	[6], [8], [11], [14], [31]–[34], [37], [42], [48], [52]	12
Remote access	[1], [9], [11], [13], [14], [30], [33], [37], [42], [44], [53]	11
Career	[2], [6], [7], [9], [16], [32], [37], [38], [44], [45], [50]	11
Body Health	[4], [13], [31], [32], [34], [35], [38], [42]	8
Self-discipline	[2], [6], [11], [13], [33], [37], [40], [42]	8
Technical support	[1], [9], [11], [16], [30], [33], [50]	7
Privacy	[1], [44], [53]	3
Culture	[46], [49], [54]	3
Economics and Finance	[7], [13], [37]	3

This emotional whirlwind causes decreased motivation [51] and boredom [11], leading to a lack of employee effort [6], lack of commitment, lack of initiative [41], lack of confidence, and lack of responsibility [55].

Career is also a problem identified [16], with the disadvantages being the decrease of work opportunities [44], decreased visibility of the employee within the company [48] and greater difficulty in acquiring benefits [37] which leads to precariousness problems [45].

Another negative aspect is teamwork, with difficulty in collaboration between people, lack of trust [56], the inclination for harsh judgments [6] and different priorities [46] leading to conflicts [45] due to the interdependence of work between members [43] and different cultures, that is different

religions, time zones, festive dates, and holidays [54]. With these problems, knowledge sharing is reduced as there is greater difficulty in training people, mentoring, and documenting knowledge [4].

2.2.2. Issues for Companies

Just as there are many disadvantages for employees, there are also disadvantages for companies, which is expected as the two parties are intrinsically related.

According to the articles in Table 2.4, management and coordination represent one of the most identified problems for companies, which significantly affects how employees work. Some examples of this problem are the difficulty in convincing employees to use information and communication technologies [6] and the increased difficulty in organising the work plan, which has caused more significant pressure on managers [47]. Assessing employees and managing distributed teams become more difficult [15]. With RW, great complexity in leading teams [6] and integrating all stakeholders was identified, leading to a loss of control and less coordination [32].

Another major problem identified was security due to the risk of data loss [53] and the use of unofficial channels for communications. For the adoption of telework, it was verified that companies need to invest more in infrastructure and equipment [6], leading to increased costs [47].

At the level of the knowledge of the company, there is a reduction and difficulty in the transfer of knowledge [4], lower registration and capture of data and challenges in training [55]. It was observed in the research that the different cultures of employees [57], the change in the structure of the company itself [33] and the adoption of policies [55] to adopt telework caused problems for the companies.

Two other problems identified, which are highly related to the employees, are the decrease in productivity [9] and the difficulty in recruitment and retention [39].

Table 2.4- Issues of RW for companies

Issues for companies	**Article**	**Total**
Management and coordination	[6], [7], [9], [12], [13], [15]–[17], [31]–[33], [39], [40], [47], [49], [50], [54]–[56]	19
Security	[6], [9], [16], [33], [47], [53], [55], [58]	8
Cost	[12], [16], [17], [40], [47]	5
Company knowledge	[4], [16], [40], [41], [55]	5
Organisational structure	[12], [33], [40], [53]	4
Productivity	[1], [9], [35]	3
Infrastructure and technology	[16], [40], [55]	3
Recruitment and retention	[39], [59]	2
Organisation policies	[42], [55]	2
Organisational cultural	[57]	1
Communication	[55]	1

2.2.3. Mitigations

This study used a conceptual map of the relationships between the issues and their possible mitigations, when they exist, as illustrated in Figure 2.2. In this study, the most observed issue for employees was isolation. However, it was possible to identify possible mitigation. Having periodic meetings through VR helps to combat isolation [4]. Regular communication between employees should be maintained [9] and for that, the companies should define a clear communication policy compatible with teleworking [50] to combat communication problems.

The mitigation most mentioned in the analysed articles, “Organise tasks, delegate, and clarify responsibilities”, combats the most cited problem for companies, management and coordination, as seen in Table 2.5. To overcome this problem, the activities and respective hours assigned to each employee should be defined, the responsibilities of each one should be clarified, and the goals should be established [5], [15]. All problems and solutions detected should also be documented and sent an e-mail to clarify any doubts [54]. For good team coordination, regular video conferences should be arranged [49]. In the case of teams distributed over different countries, all employees’ bank holidays and holidays should be registered and communicated, and the different cultures should be recognised by the company management [54].

In remote work, focusing on the result is essential to mitigate the problems of productivity, management and coordination. Goals should be defined and prepared to-do lists [33], [43].

Another problem identified in remote work for companies was the recruitment difficulty. With the evolution of technology, it is possible to use artificial intelligence to help the Human Resources area to find the best profiles [59].

For teleworking, companies should be concerned about providing the necessary equipment to employees [1], as well as providing access to the information required for operational activities, while ensuring information security [33] by implementing a policy against cyber-attacks [58]. For information to be centralised and the knowledge to be accessible to all, a central database or "group rooms" by a specific knowledge domain should be created [50], [54].

When WFH, many issues are experienced, and it is essential to have support from the support team to solve technological problems. Companies should train their workers to be independent in solving typical software and network problems [50]. It is essential to check in advance if the internet connection at the employee's home needs any upgrading so that the employee can avoid remote access problems [33].

A healthy mind is essential for the well-being of the employee because problems such as stress can cause a reduction in concentration and performance. In this regard, it was identified as mitigation the use of mindfulness techniques, i.e., meditation practices, breathing exercises and grounding exercises, among others [35]. Companies should adopt flexible working conditions, such as flexible

working hours or a four-day working week, to motivate and help balance the work-life of their employees [43]. However, for the work-life balance, the State can have an essential role in legislation and consequent verification of worker protection measures [11].

Table 2.5 - Mitigations of RW issues

Mitigation	Issues it solves	Article	Total
Organise tasks, delegate, and clarify responsibilities	Management and coordination	[5], [15], [45], [49], [54]	5
Focus on results	Management and coordination Productivity	[9], [33], [35], [43], [45]	5
Define a communication policy	Communication	[1], [9], [35], [46]	4
Adopt flexible working conditions	Work-live balance Motivation Distractions	[11], [43]	2
Create a dedicated workspace	Work-live balance Distractions Space for WFH	[33], [43]	2
Create good practices for knowledge sharing	Knowledge	[50], [54]	2
Meeting with virtual reality	Isolation	[4]	1
Legislation	Work-live balance Working overtime	[11]	1
Create a daily schedule and maintain the same routine	Self-discipline	[33]	1
Check if the Internet connection needs an upgrade	Remote access	[33]	1
Control and assign staff access to information	Remote access Security	[33]	1
Define steps to combat cyber-attacks	Security	[58]	1
Use of artificial intelligence to hire	Recruitment and retention	[59]	1
Training the employees	Technical Support	[50]	1
Hybrid work	Isolation	[45]	1
Provide more computer-related equipment	Equipment and devices	[1]	1
Mindfulness techniques	Mental health Productivity	[35]	1
Avoid sending emails outside of regular work hours	Interruptions/ Distractions	[35]	1
Define telework policy	Organisation policies	[55]	1

WFH can become complicated, especially when you do not have a proper workspace and self-discipline. Whenever possible, the employee should create their workspace at home, away from possible distractions, to allow concentration and to distinguish work from personal life [43]. Establishing routines and sticking to specific working hours will help the worker maintain discipline [33].

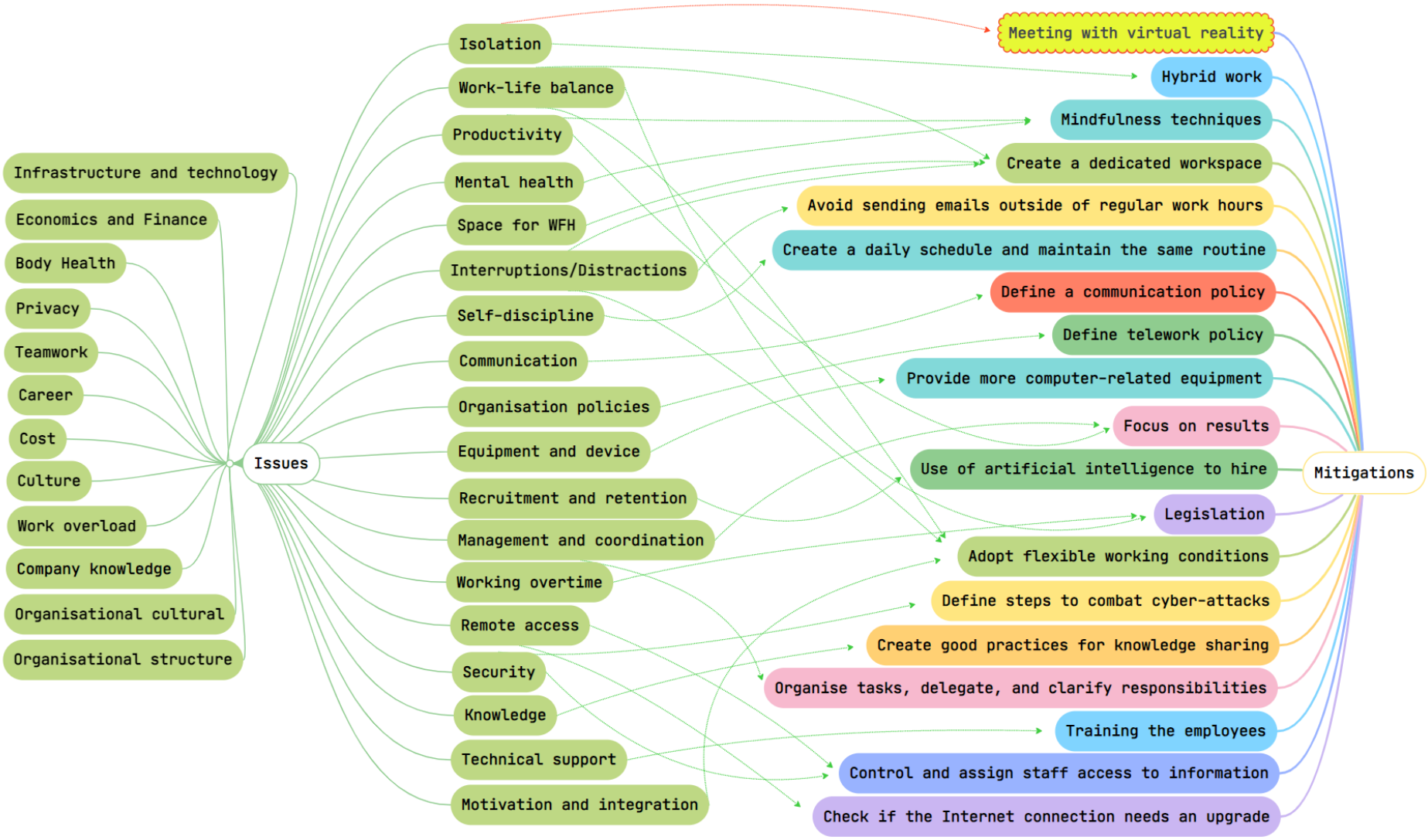

Figure 2.2 - Concept map of the relations between issues and possible mitigations

2.3. Synthesis of Literature Review

Chapter 2 has allowed the identification of the problems that workers and companies face when adopting remote work and also to identify ways to mitigate these problems.

Since the onset of Covid-19, the adoption of remote work has surged. However, it brings forth several challenges, primarily related to employees. Workers find themselves isolated at home, without social interaction, facing a new reality that affects their personal and professional lives. In teleworking, it has been observed that the workload may increase, leading to elevated stress levels and subsequently affecting the worker's motivation and productivity.

Companies, on the other hand, also experience the repercussions of this working arrangement. These may stem from either employee-related factors or aspects of the organizational structure, policies, culture, and management practices. Managing and coordinating employees remotely proves to be more challenging compared to in-office work. Leading teams in a teleworking environment is complex, and effectively engaging all stakeholders can be difficult.

For the problems detected, it was possible to identify some mitigations. However, with this study, it is possible to verify that there are still some problems to be overcome on the part of the employee. The adoption of remote work has been increasing, but it is still a new challenge for companies and employees since this adoption started to grow since the pandemic, so it is expected that adjustments to this mode of work are ongoing.

One of the mitigations identified for worker isolation in RW was the use of VR. With the evolution of technology, adopting remote work may become easier. The implementation of VR may help workers to interact more and return to feeling that they belong to the company.

Considering the issues identified in SLR 1, this study addresses two key research questions:

RQ1 - Can VR be a mitigation for issues in RW? If so, which ones?

RQ2 - What are the challenges and disadvantages of using VR in RW?

CHAPTER 3

Methodology

This study adopts a comprehensive methodological approach to investigate the effectiveness of Virtual Reality (VR) as a solution to the issues associated with remote work. The methodology is divided into four distinct stages, each designed to provide a detailed and well-founded insight into the subject matter, as shown in Figure 3.1.

In the first stage, Chapter 2, a SLR was conducted to identify and analyse the issues faced by workers and companies when adopting remote work. This SLR encompassed a wide range of research sources, including academic articles, technical reports, and relevant case studies, and is grounded on 47 articles, with 66% published between 2019 and 2022, coinciding with the appearance of the COVID-19 pandemic and the subsequent widespread adherence to remote work. The results of the SLR serve as a solid foundation for understanding the issues associated with remote work and their mitigations, for example the use of VR to mitigate the employee's isolation.

The second stage of the research focuses on answering to both Research Questions (RQ1 and RQ2). Another SLR, in Chapter 4, was conducted, this time focusing on existing literature exploring the application of VR in the context of RW. This involved analysing the advantages, disadvantages, and challenges associated with implementing VR in this environment. The findings on the advantages of using VR in RW will make it possible to identify which problems VR can mitigate. Based on 18 articles, notably, there was only one article each year related to the theme in 2019, 2020, and 2021. However, 2022 saw a significant increase with four articles. This increase may be due to the perception of the problems of RW, which might have spurred interest in solutions like VR.

Due to the few articles found and following the conclusion of the second SLR, the Delphi methodology will be implemented to validate and consolidate the obtained results, Chapter 5. Experts in the field of VR and RW will be invited to provide their opinions and insights regarding the effectiveness of VR as a solution to the challenges of RW. This approach will allow for additional validation and the acquisition of expert perspectives. Delphi is particularly valuable due to its ability to harness expert knowledge in emerging and innovative fields. It's useful for gathering insights in areas where empirical data may be scarce, synthesizing diverse perspectives in a rapidly evolving field to achieve a common understanding. The methodology is effective in validating trends and hypotheses in the realm of VR and RW, where expert opinions can provide a reality check against theoretical assumptions. Furthermore, Delphi is often employed to develop practical guidelines for implementing new technologies or work practices. In the context of VR in RW, this could mean obtaining practical advice on how best to implement and utilize VR in remote work environments. Therefore, the Delphi Methodology is an appropriate and aligned choice for studies exploring the implementation of

innovative technologies in the workplace, providing a platform for expert knowledge utilization, consensus building in emerging fields, validation of trends, and development of practical guidelines.

At the conclusion of this study, the conclusions derived from the two SLRs and the Delphi process are integrated to provide a comprehensive and well-founded assessment of the effectiveness of Virtual Reality as a solution to the issues of remote work, providing answers to the research questions.

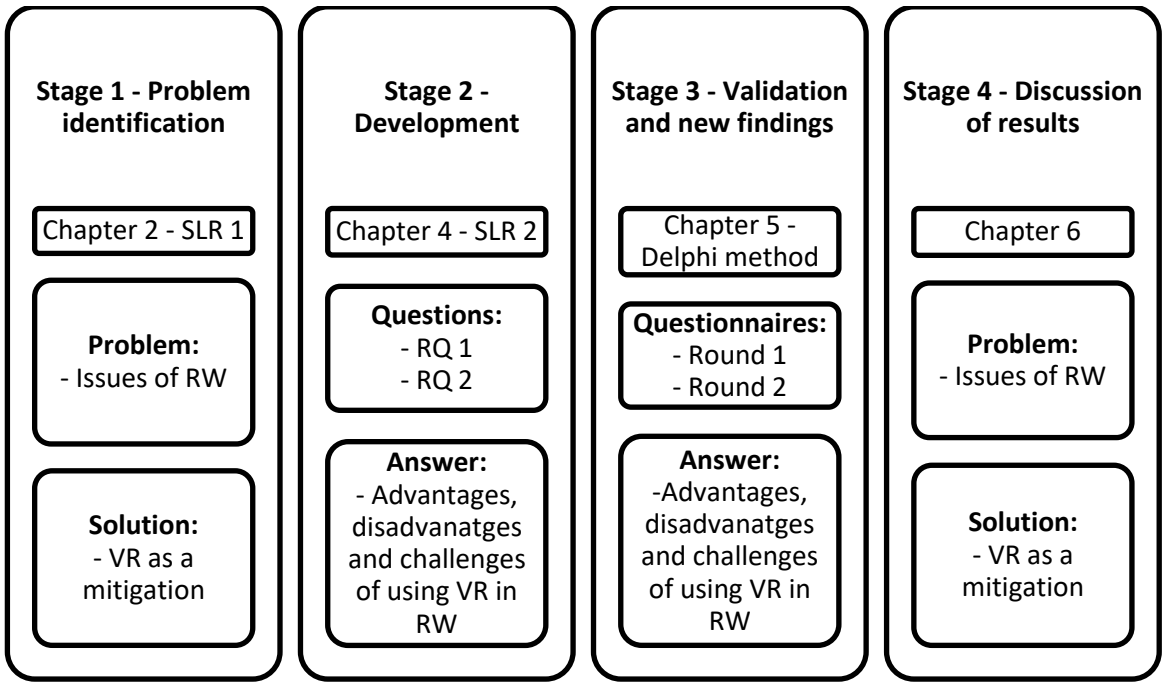

Figure 3.1 - Methodology followed

3.1. Theory on SLR

A SLR is a rigorous methodological approach that seeks to systematically identify, analyse, and synthesize all available evidence on a specific research topic. It is a widely used method to gain a comprehensive and unbiased understanding of the current state of knowledge in a specific field [60]–[62].

An SLR follows a predefined set of steps, including:

- Formulating the Research Question: Clearly defines the scope of the review and the research question to be answered.
- Source Identification: Conducts a systematic search in academic databases, digital libraries, and other relevant sources to find articles and works pertinent to the topic.
- Study Selection: After the search, applies inclusion and exclusion criteria to identify the studies that will be included in the review.
- Assessment of Study Quality: Analyses the methodological quality of the selected studies to ensure the validity of the conclusions.

- Data Extraction: Extracts relevant information from the selected studies, such as methods used, results, and conclusions.
- Data Synthesis and Analysis: Combines and analyses the extracted data to draw conclusions about the research topic.
- Reporting Results: Presents the results clearly and objectively, often through tables, graphs, and narratives.
- Evidence Assessment: Evaluates the strength of the evidence found and its implications for the study area.
- Identifying Knowledge Gaps: Identifies areas where existing research is limited and suggests directions for future investigations.

3.2. Theory on Delphi Methodology

The Delphi Methodology is a structured process that leverages the opinions of a group of experts to reach consensus on a particular subject. It was initially developed at the Rand Corporation in the 1950s and has since been widely applied in various research areas and decision-making processes.

The Delphi process is conducted in multiple rounds, each consisting of questionnaires distributed to the experts. After each round, the results are compiled and anonymously presented to the participants, allowing them to reevaluate their responses in light of others' opinions. This iteration is repeated until a consensus is reached or until a point of convergence is deemed achieved [63].

The Delphi Methodology offers several advantages, such as eliminating influences from dominant leaders or participants, the ability to engage experts dispersed geographically, and gaining valuable insights from a diverse group of participants [64], [65].

CHAPTER 4

SLR 2 - Virtual Reality for Remote Work

This chapter dives deep into an SLR to unravel the advantages, disadvantages and challenges of integrating VR into remote working setups. By systematically examining pertinent literature, we aim to provide an unbiased and comprehensive perspective on this subject.

4.1. Research Methodology

To synthesise the existing information concerning the subject under study, a SLR was used. This methodology makes it possible to review already published articles in an impartial and complete way based on the steps defined in Figure 4.1.

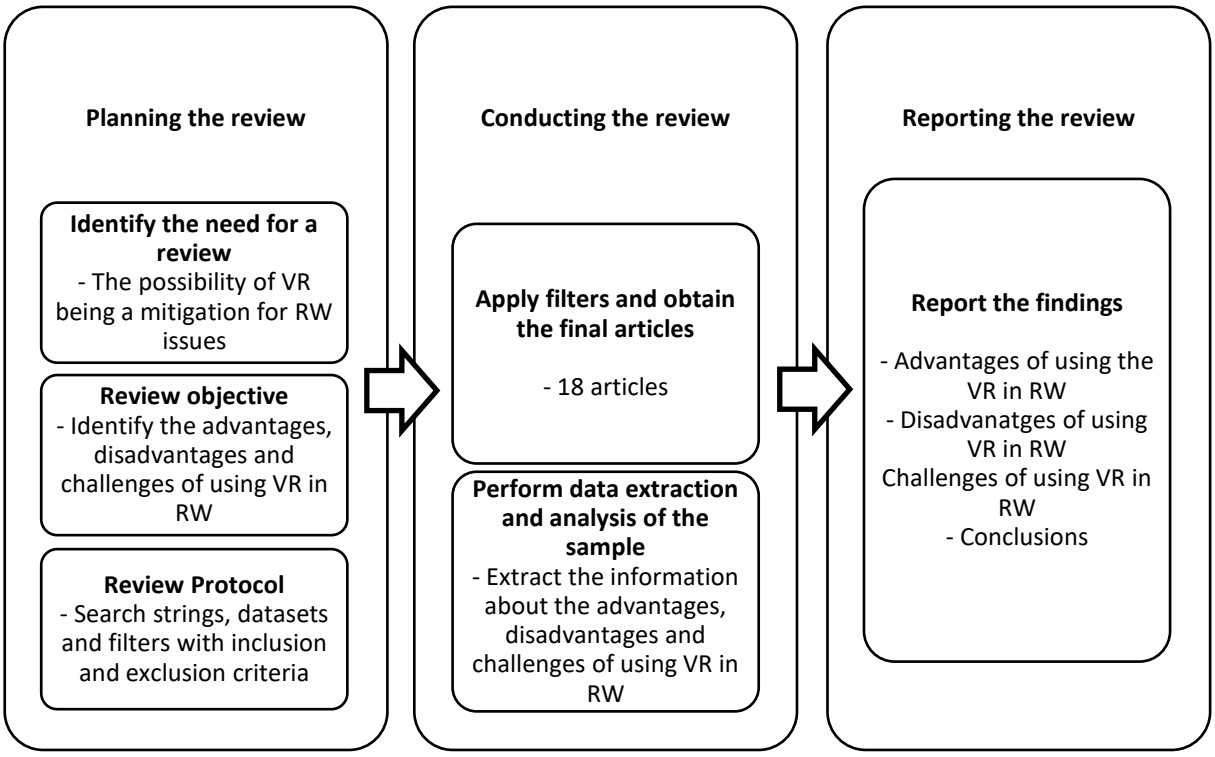

Figure 4.1 - Steps of the SLR 2 methodology performed

Table 4.1 shows the string with the keywords used for the search in the selected databases.

For this SLR, the chosen databases included the ACM Digital Library, IEEE Xplore, Web of Knowledge, and Scopus. Inclusion criteria were applied (articles with the string present in the abstract and articles written in English) and exclusion criteria (duplicate articles and non-relevant articles). A total of 18 articles were obtained, and the order of the filters applied is presented in Table 4.2. The database search was carried out in January 2023.

Table 4.1 - String with the keywords used in the SLR 2

String	("remote work" OR "remote working" OR "virtual work" OR "virtual working" OR "work from home" OR "working from home" OR "work from anywhere" OR "working from anywhere" OR "telework" OR "teleworking" OR "telecommuting" OR "home working" OR "mobile work" OR "mobile working" OR "flexible workplace" OR "distributed teams") AND ("virtual reality")

Table 4.2 - Filtration process

Database	**No filter**	**Filter 1 Abstract**	**Filter 2 English**	**Filter 3 Duplicate**	**Filter 5 Manual**
ACM Digital Library	776	23	23	23	4
IEEE Xplore	117	35	35	30	5
Web of Science	223	77	73	43	6
Scopus	2197	108	106	38	3
Total	3313	243	237	134	18

Upon reviewing the articles, they were categorized based on concepts aligned with this study's objectives, which are "Advantages", "Disadvantages", and "Challenges" of using VR in RW. It can be noted that most of the selected articles refer to the concept of "Advantages", with a total of 16 articles. Of the 18 articles, 5 refer to the concept of "Disadvantages", and 6 refer to "Challenges".

4.2. Report

This literature review is divided into three parts: the first with the advantages, the second with the disadvantages and the third with the challenges.

4.2.1. Advantages

The use of Virtual Reality in remote work contexts has several advantages, the most mentioned ones being "flexibility in modulating the workspace" and the "greater sense of presence/immersion", as shown in Table 4.3.

For those who aren't digital nomads, the remote workspace typically confines to their residence, sometimes to an office, a room or a bedroom. However, with virtual reality, the virtual workspace can drift to infinity, choosing the environment that best suits the worker's state and the work to be performed [66], it can be a beach, countryside, mountain, office, etc. Besides the visual aspect of the space, the limitation of the size of the physical equipment, such as the computer screen [67], is no longer a problem, and the user can have several screens in the proportions he wants.

The virtual space also allows several workers to be in the same room [68], for example, in a prototype cabin of a machine or a car, which would be impossible to do in the physical world because it has a limit. Furthermore, the cost of producing a physical prototype is higher than a virtual one [20]. In the latter, in VR, it can be observed in detail, through several layers and with several information, facilitating the collaboration among all the intervening parties [23] and allowing faster changes [21]

which may not occur through remote work. Another great advantage is to facilitate the workflow [20] because it is possible to quickly check the last changes made by previous users and their status, which also facilitates coordination between teams [69].

Table 4.3 - Advantages of using Virtual Reality in Remote Work

Advantages	**Article**	**Total**
Flexibility in modulating the workspace	[19], [22], [23], [66], [67], [70], [71]	7
More sense of presence	[20], [23], [66], [67], [70], [72], [73]	6
Increased immersion	[20], [23], [66], [67], [70], [72], [73]	6
Less isolation	[20], [21], [69], [72], [74]	5
Increased productivity	[20], [21], [23], [67]	4
Enabling people with special needs	[66], [67], [71], [75]	4
Efficient training	[19], [20], [23], [70]	4
Better collaboration	[20], [21], [23]	3
Elimination of distractions and interruptions	[23], [67]	2
Increased concentration	[23], [67]	2
Stress reduction	[67], [74]	2
Improves communication	[20], [76]	2
Improves integration	[23], [74]	2
Removes the size limitation of physical screens	[67]	1
Reducing fatigue	[67]	1
Unlimited space	[68]	1
Facilitates team coordination	[69]	1
Enriched data and information	[20]	1
Reduced prototyping costs	[20]	1
Increased trust	[20]	1

With the flexibility to tailor the workspace, other benefits naturally arise, such as the elimination of real-world distractions [67] and consequent increase in concentration [23] and productivity [21]. VR also allows mapping body movement patterns that reduce fatigue [67] and facilitate the integration of people with special needs [75].

A defining characteristic of VR is its immersive nature, giving users an enhanced sense of presence [70] facilitating communication [76], increasing trust between users [20] and reducing the isolation [72] that comes with remote work. Despite the great immersion of VR, the signal transmissions of our body are not picked up by the other users, which facilitates the integration of teams [23] and reduces stress [74].

Training through VR allows the user to have a real perspective of the challenges of the work to be performed [19], also making possible to create moments of tension and risk [70] that help prepare the worker.

4.2.2. Disadvantages

While virtual reality offers the benefit of enhanced concentration and immersion in work, it also poses the risk of disrupting the work-life balance [74].

With the user's visual focus placed inside the VR space, the user loses the sense of the physical space, leading to safety concerns [23] by not knowing where the real space ends or begins. At the same time, the user's concentration within VR, according to [67], can cause greater mental fatigue. Furthermore, it has been found that the use of VR can cause nausea, anxiety, headaches or dizziness [19], [67], called cybersickness [68] which reduces the comfort of users. Table 4.4 demonstrates the disadvantages identified in this study.

Table 4.4 - Disadvantages of using Virtual Reality in Remote Work

Disadvantages	**Article**	**Total**
Cybersickness (headache, anxiety and nausea)	[67] [68] [19]	3
Increased mental fatigue	[67]	1
Work-life imbalance	[74]	1
Less safety for the user	[23]	1

4.2.3. Challenges

The main challenge found is related to the interaction with others since the perception that one has of the interaction with another user is formed by the avatar's aspect [23], the tone of the voice and the movement of the head and hands [77], not allowing a complete reading of the reactions. In this case, the closer to the real this technology is, whether at the level of the avatar, the space or the sensations provoked [76], more benefits the user will get, and there will be a greater adoption of VR.

The comfort of usage is also an important challenge to overcome [23] since at this moment VR causes cybersickness and discomfort in the face, which consequently causes resistance to adoption, especially in older people [18].

Table 4.5 - Challenges in using Virtual Reality in Remote Work

Challenges	**Article**	**Total**
Interaction with others	[75] [20], [76], [77]	4
Realism	[76] [23]	2
Presentation and quantity of content/information	[76] [23]	2
Reliability of positioning	[75]	1
Good internet connectivity	[75]	1
Battery lifetime	[75]	1
User safety	[75]	1
Sensory factors	[76]	1
Resistance to adoption	[18]	1
User comfort	[23]	1
Integration with information systems	[20]	1

While VR's information presentation can enhance productivity, the sheer volume of information might be overwhelming for users to process [76]. For this reason, it is essential that the content presented is adjusted to the human being's capacity to process information.

All the information presented by the VR must be integrated bilaterally with the organisations' information systems [20] since organisations usually already have Information Systems (IS) with all the data, as is the case of an ERP (Enterprise Resource Planning) or a CRM (Customer Relationship Management).

While using VR, it is necessary to ensure that the user is safe so that there are no collisions with other objects in the physical space [75], which is not always guaranteed.

In terms of technical challenges, short battery life, unreliable positioning of the device in the physical space, poor internet connectivity with limited bandwidth and high wireless network latencies [75] were identified in Table 4.5.

CHAPTER 5

Delphi Methodology

The Delphi methodology stands as a fundamental instrument in this study, orchestrating a structured process that harnesses the expertise of professionals. Building on the foundation laid by the SLR 2, which unearthed critical insights into the challenges of RW and the potential of VR, the Delphi method takes us deeper into the realm of expert consensus.

This chapter delineates the comprehensive protocol employed in the Delphi process, Figure 5.1, meticulously designed to elicit refined perspectives from a carefully selected panel of experts. These individuals are proficient in the realm of VR, and crucially, possess hands-on experience in the domain of RW. Their insights form the bedrock of our exploration into the potential of VR as a transformative solution.

Two rounds of consultations with experts were conducted. The first round started on April 10, 2023, with experts given the opportunity to respond by the end of that month. This was followed by an analysis of their responses and corresponding mapping with the findings from SLR 2. With the results from the first round, the second round was initiated on May 19, and experts were given until the end of June to respond. The timeline for this second round was extended to ensure a higher response rate. However, during the month of June, reminders were sent out twice to encourage expert participation and responses.

5.1. Expert Selection

For this study, it was crucial to involve qualified experts with substantial experience in VR, as well as current or prior experience in RW. A total of 50 experts were selected, based on a LinkedIn search in which experience or work in VR was checked and by contacting them, it was ascertained whether the individual had ever done RW.

5.2. Communication protocol

Maintaining anonymity is important in the Delphi study's communication process with these experts. As such, invitations were sent through email, providing an overview of the Delphi study along with the commencement date of the first round.

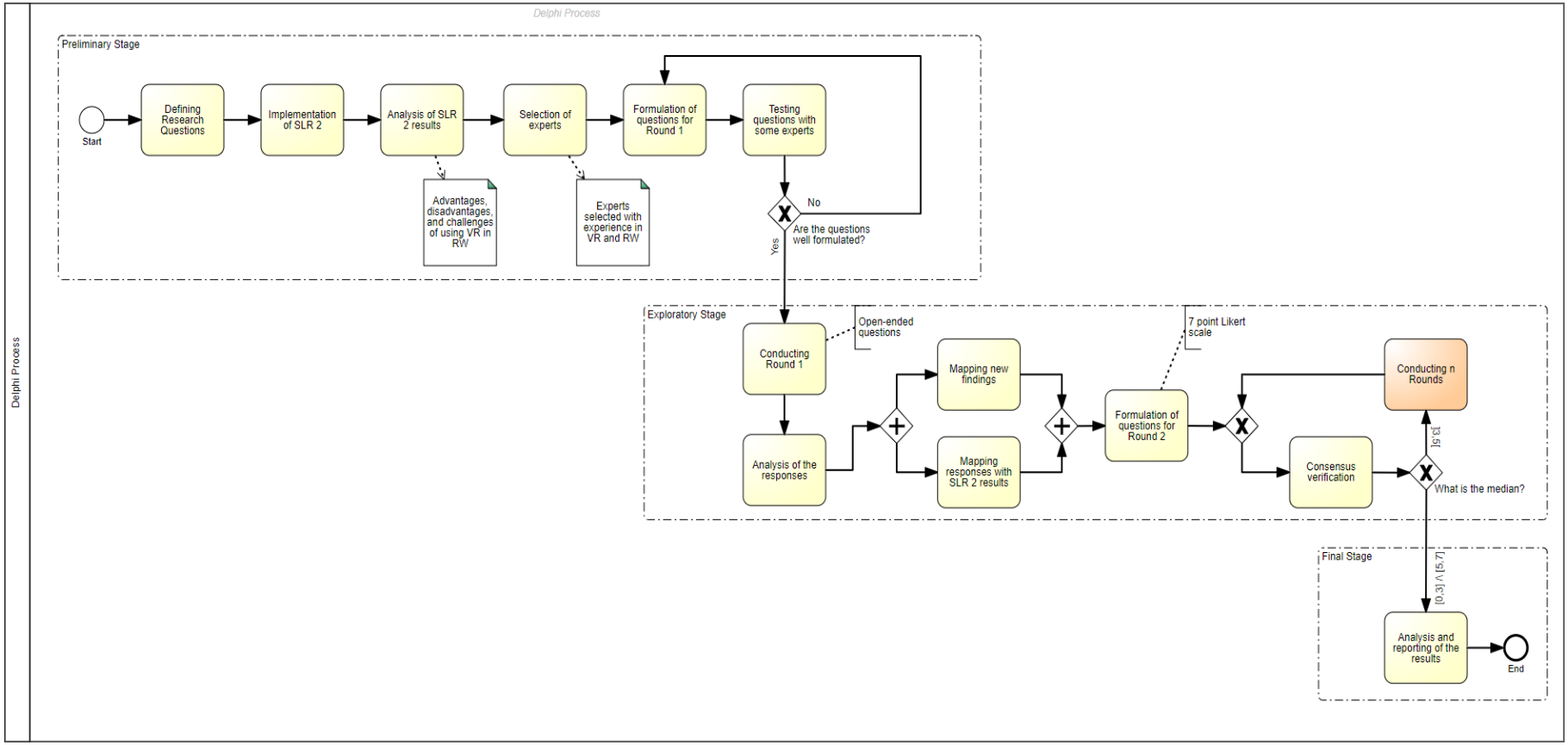

Figure 5.1 - Delphi Protocol

5.3. Conducting the Delphi Rounds

5.3.1. First Round

The Google Forms platform was used to administer surveys with open-ended questions. The goal was to gather detailed information about the advantages, disadvantages, and challenges associated with implementing VR in the context of RW.

The responses obtained in the first round were meticulously categorized and related to the results of the SLR, using Microsoft Excel. This step was essential to establish a solid foundation of understanding.

5.3.2. Second Round

Experts were invited to rate, on a Likert scale from 1 to 7, the advantages, disadvantages, and challenges previously identified. This step aimed to determine the level of agreement among experts regarding each analysed aspect.

5.3.3. Consensus Criterion

The determination of when consensus will be reached was established at the beginning of the study. In this case, with the Likert scale ranging from 1 to 7 points, it is considered that a statement is appropriate if the median score is equal to or greater than 5, and inappropriate if the median score is equal to or less than 3. Disagreement occurs when at least one-third of the participants evaluate the statement at the opposite extreme of the scale compared to their peers. If this happens, it is concluded that consensus has not been reached. In the case of the score falling between 3 and 5, it is concluded that consensus has not been reached and an additional round would be necessary[78].

This protocol provided a robust framework for data collection and analysis, ensuring a comprehensive assessment of the effectiveness of Virtual Reality as a solution to the challenges of RW.

5.4. Report

Out of the 50 questionnaires sent to the experts, 46 responses were received, yielding a remarkable response rate of 92%. The respondents' ages ranged from 24 to 63 years old. Among them, 28 reported having up to 3 years of experience in remote work, while the remaining participants possessed over 3 years of experience in this domain. It is noteworthy that all participants had significant experience with Virtual Reality.

In the subsequent phase of the Delphi process, a substantial majority of the 46 experts, precisely 38, provided their valuable insights, resulting in an impressive response rate of 82.6% (Figure 5.2).

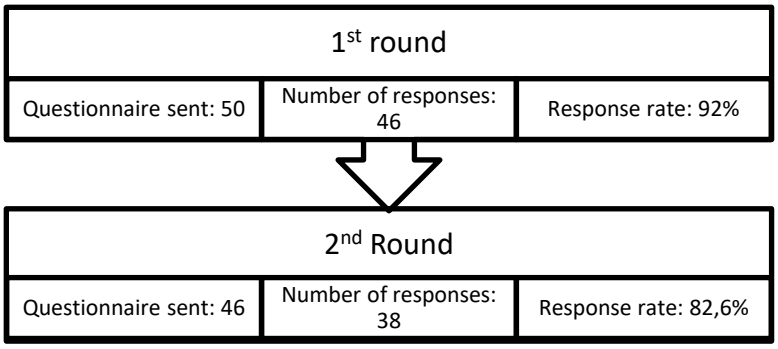

Figure 5.2 - Response rates per Delphi round

5.4.1. Round one

In the initial round of the Delphi process, open-ended responses were analysed and categorized into distinct items. Subsequently, these items were compared with those identified in the SLR 2. The questions of the first round of the Delphi questionnaire were as follows in Figure 5.3

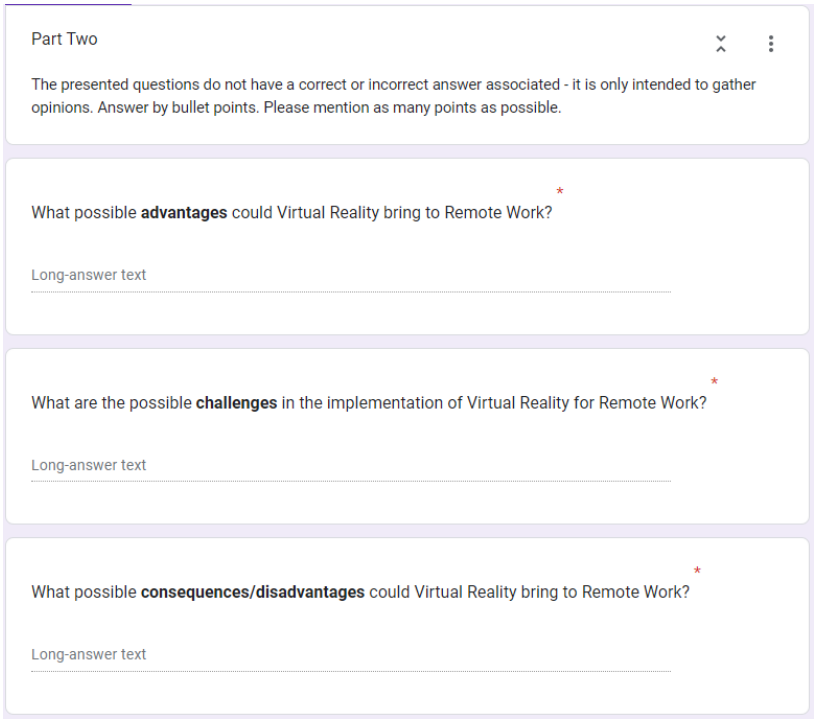

Figure 5.3 - Display of survey items for Delphi round 1

5.4.1.1. Advantages

A total of 19 advantages were identified, with 10 of them being novel insights (Tabel 5.1). The remaining 9 advantages were consistent with the findings of SLR 2. Notably, 11 advantages highlighted in SLR 2 were not reiterated by the experts.

Table 5.1 - Advantages found in Delphi round 1 versus SLR 2

Advantages	Round 1	SLR 2
Increased creativity	X	
More engagement	X	
More fun and captivating	X	
More interactive (meetings, work, training)	X	
More realistic	X	
Better work-life balance	X	
Meeting more personal	X	
Quicker answers	X	
Easy troubleshooting of the machine	X	
More social interaction	X	
Flexibility in modulating the workspace	X	X
More sense of presence	X	X
Increased immersion	X	X
Increased productivity	X	X
Efficient training	X	X
Better collaboration	X	X
Improves communication	X	X
Improves integration	X	X
Removes the size limitation of physical screens	X	X
Enriched data and information	X	X
Less isolation		X
Enabling people with special needs		X
Elimination of distractions and interruptions		X
Increased concentration		X
Stress reduction		X
Reducing fatigue		X
Unlimited space		X
Facilitates team coordination		X
Reduced prototyping costs		X
Increased trust		X

5.4.1.2. Disadvantages

Among the responses, 12 disadvantages were identified (Tabel 5.2). Out of these, 10 were identified as new considerations, while 2 were in alignment with the observations from SLR 2. It is worth noting that the remaining 2 disadvantages from SLR 2 were not reiterated by the experts.

Table 5.2 - Disadvantages found in Delphi round 1 versus SLR 2

Disadvantages	Round 1	SLR 2
Isolation	X	
Dependency on the device	X	
Equipment compatibility issues	X	
Potential divide between adopters and who cannot use it	X	
Misuse of tracking data (body, eyes and face tracking data)	X	

Table 5.2 (continued) - Disadvantages found in Delphi round 1 versus SLR 2

Disadvantages	Round 1	SLR 2
Addiction	X	
False perception of work environment and relationships	X	
High costs	X	
Increased risk of cybersecurity	X	
Discomfort in wearing VR devices for long periods of time	X	
Work-life imbalance	X	X
Cybersickness (headache, anxiety and nausea)	X	X
Increased mental fatigue		X
Less safety for the user		X

5.4.1.3. Challenges

A total of 15 challenges (Tabel 5.3) were surfaced during this round, with 11 of them being novel observations. The remaining 4 challenges were in accordance with the findings of SLR 2. Additionally, 7 challenges identified in SLR 2 were not reiterated by the experts.

Table 5.3 - Challenges found in Delphi round 1 versus SLR 2

Challenges	Round 1	SLR 2
Usability	X	
High costs for implementation	X	
Deciding the collaboration rules (movements and interactions of the user avatar)	X	
Training	X	
Equipment capacity limitations	X	
Health concerns	X	
Work life balance	X	
Alignment with the company strategy and not isolated initiatives	X	
Discipline to use it	X	
Adoption	X	
Change management in large corporations	X	
Interaction with others	X	X
Realism	X	X
Resistance to adoption	X	X
Integration with information systems	X	X
Presentation and quantity of content/information		X
Reliability of positioning		X
Good internet connectivity		X
Battery lifetime		X
User safety		X
Sensory factors		X
User comfort		X

This initial round of the Delphi process provided valuable insights, both affirming and extending the existing understanding of the advantages, disadvantages, and challenges associated with the

integration of Virtual Reality in the context of Remote Work. The novel considerations unearthed in this round serve as crucial additions to the body of knowledge in this domain.

5.4.2. Round two

In the second round, experts were asked to rate all the advantages, disadvantages, and challenges identified in the first round, as well as those from SLR 2, using a scale ranging from 1 (strongly disagree) to 7 (strongly agree). It was observed, based on the consensus criterion, that out of the 66 items evaluated, only 3 did not achieve consensus, indicating that all other items reached an agreement, making a third round unnecessary.

According to expert understanding, two advantages identified in SLR 2, namely "less isolation" and "reducing fatigue," were not confirmed as advantages, as they obtained a median score of 2. All new advantages identified through the Delphi methodology achieved consensus as being advantages (Table 5.4).

Table 5.4 - Verification of the experts' consensus about the advantages

Advantages	Median	Agree	No consensus	Disagree
More fun and captivating	7	X		
Better collaboration	6	X		
Improves integration	6	X		
Efficient training	6	X		
Enriched data and information	6	X		
Unlimited space	6	X		
Increased creativity	6	X		
Facilitates team coordination	6	X		
Increased productivity	6	X		
Better work-life balance	6	X		
Quicker answers	6	X		
Reduced prototyping costs	6	X		
Enabling people with special needs	6	X		
Elimination of distractions and interruptions	6	X		
Increased immersion	5	X		
Improves communication	5	X		
Flexibility in modulating the workspace	5	X		
More engagement	5	X		
More interactive (meetings, work, training)	5	X		
Meetings more personal	5	X		
More realistic	5	X		
More sense of presence	5	X		
More social interaction	5	X		
Easy troubleshooting of the machine	5	X		

Table 5.4 (continued) - Verification of the experts' consensus about the advantages

Advantages	Median	Agree	No consensus	Disagree
Increased concentration	5	X		
Stress reduction	5	X		
Removes the size limitation of physical screens	5	X		
Increased trust	5	X		
Less isolation	2			X
Reducing fatigue	2			X

Regarding disadvantages, experts did not consider "work-life imbalance" as a genuine disadvantage, as it obtained a median score of 2. This is to be expected, as the experts agreed that "better work-life balance" would be an advantage, with a median score of 6 (Table 5.5).

Table 5.5 - Verification of the experts' consensus about the disadvantages

Disadvantages	Median	Agree	No consensus	Disagree
Increased risk of cybersecurity	6	X		
Discomfort in wearing VR devices for long periods of time	6	X		
Cybersickness (headache, anxiety and nausea)	6	X		
Misuse of tracking data (Body, eye, and face tracking data)	6	X		
Less safety for the user	5,5	X		
Potential divide between adopters and who cannot use it	5,5	X		
Isolation	5	X		
Dependency on the device	5	X		
Equipment compatibility issues	5	X		
Addiction	5	X		
False perception of work environment and relationships	5	X		
High costs	5	X		
Increased mental fatigue	5	X		
Work-life imbalance	2			X

As for the challenges, both those identified in SLR 2 and those obtained through the Delphi methodology, they were unanimously recognized as genuine challenges, obtaining median scores equal to or greater than 5 (Table 5.6).

Table 5.6 - Verification of the experts' consensus about the challenges

Challenges	Median	Agree	No consensus	Disagree
Adoption	6,5	X		
Discipline to use it	6	X		
Usability	6	X		

Table 5.6 (continued) - Verification of the experts' consensus about the challenges

Challenges	Median	Agree	No consensus	Disagree
Resistance to adoption	6	X		
High costs for implementation	6	X		
Deciding the collaboration rules (movements and interactions of the user avatar)	6	X		
Alignment with the company strategy and not isolated initiatives	6	X		
Integration with information systems	6	X		
Realism	6	X		
User safety	6	X		
User comfort	6	X		
Reliability of positioning	5,5	X		
Sensory factors	5,5	X		
Interaction with others	5	X		
Training	5	X		
Equipment capacity limitations	5	X		
Health concerns	5	X		
Work-life balance	5	X		
Change management in large corporations	5	X		
Presentation and quantity of content/information	5	X		
Good internet connectivity	5	X		
Battery lifetime	5	X		

CHAPTER 6

Discussion of the results

In an era where remote work (RW) is fast becoming the norm, understanding how emerging technologies can be harnessed to optimize this new mode of work is of paramount importance. VR stands at the forefront of these technological advancements, offering potential solutions to challenges inherent to RW. The integration of VR into the RW landscape promises not only to address these challenges but also to redefine the very fabric of how we perceive and engage in work from a distance.

The analysis of the results reveals that the application of Virtual Reality (VR) shows remarkable potential in mitigating various issues associated with Remote Work (RW) for both employees and organizations. Next, we will analyse the key points according to the obtained results.

6.1. Synthesis

The Delphi methodology, rooted in its structured and iterative approach, has been an invaluable instrument in our study, providing both depth and precision to our understanding of VR's role in remote work. Through this method, we garnered insights from 46 professionals who are well-versed in the realm of VR and experienced in RW, allowing for a comprehensive exploration into the potential of VR as a solution for RW challenges.

Several notable findings emerged from this process:

- Round 1 of the research identified 19 advantages, 12 disadvantages, and 15 challenges associated with implementing VR in the context of RW.
- Novel insights, previously unidentified in SLR 2, were brought forth by the experts, emphasizing the dynamic nature of the VR-RW intersection and its evolving landscape.
- The high consensus rates among experts, in the second round, reinforces the robustness of our findings and the validity of the insights obtained.
- Of the 30 advantages, the experts agree that 28 are indeed an advantage.
- Of the 14 advantages, only 1 was not considered a disadvantage by the experts.
- All the 22 challenges were confirmed by the experts as such.

These outcomes not only validate previously identified literature findings but also introduce new perspectives, enriching the body of knowledge on the subject. As we navigate the challenges and opportunities of remote work in a progressively digital age, the consensus and insights derived from this Delphi study play a pivotal role in shaping our understanding and informing future strategies and interventions.

In retrospect, the Delphi method has unequivocally reinforced the foundational knowledge laid by SLR 2, and the synergy between both methods has yielded a comprehensive and actionable roadmap for integrating Virtual Reality in the realm of Remote Work.

6.2. For Employees

1. Isolation: In the SLR 1 was verified that VR can offer a solution to mitigate isolation by creating virtual environments that provide a sense of presence and more significant social interaction. However, it is important to note that experts did not entirely agree that "reduced sense of isolation" is an advantage of VR.
2. Work-Life Balance: VR can contribute to the balance between professional and personal life by allowing workers to modify their virtual workspaces according to their needs and preferences. However, it is crucial to consider that VR can also lead to greater imbalance if not used with discipline.
3. Motivation and Integration: VR can offer more engaging and interactive experiences, which can increase motivation and the sense of belonging to the company.
4. Mental Health and Well-being: VR can contribute to workers' mental health by offering mindfulness techniques and creating more comfortable work environments that are less prone to distractions.
5. Productivity and Work overload: VR can help improve productivity by providing a more focused environment and eliminating physical distractions. However, it is essential to balance this to avoid work overload.
6. Self-discipline and Technical Support: VR may require a certain level of self-discipline from workers to be effective. Additionally, providing technical support may be necessary to ensure a seamless VR experience.

While employees stand to benefit in numerous ways from VR integration, companies too find themselves at a pivotal juncture. The promise of enhanced communication, management, and knowledge transfer beckons, but so do challenges that need adept handling.

6.3. For Companies

1. Management and Coordination: VR can facilitate the management and coordination of remote teams by providing more effective communication and the ability to conduct more interactive meetings.

2. Security and Costs: VR may introduce security challenges, especially concerning data protection. Additionally, the implementation of VR may involve significant costs in terms of infrastructure and technology.
3. Organizational Knowledge and Structure: VR can contribute to the preservation and transfer of knowledge within the organization, as well as facilitate collaboration on complex projects.
4. Policies and Organizational Culture: The introduction of VR may require adapting policies and organizational culture to effectively integrate this technology into the remote work environment.

With organizations poised to experience transformative shifts with VR, there are broader considerations that apply to both employees and companies alike. These additional factors further underscore the multifaceted nature of integrating VR into RW.

6.4. Additional Considerations

1. Adoption Resistance and Training: VR may face initial resistance to adoption due to its innovative nature. It will be crucial to provide adequate training to ensure effective use of this technology.
2. Ergonomic Issues and Comfort: VR should be designed with ergonomics in mind to ensure user comfort during extended periods of use.
3. Integration with Information Systems: The integration of VR with existing information systems in companies will be a significant challenge to ensure operational cohesion.

Overall, VR can be a valuable tool in mitigating many of the issues associated with Remote Work, as represented in Figure 6.1 which illustrates this study's proposal for the relationship between the issues identified in SLR 1 and the expert’s opinions in the Delphi methodology. However, it is essential to address these challenges proactively and consider the needs and limitations of all involved parties.

In summarizing the exploration into the intersection of VR and RW, it becomes clear that VR holds transformative potential. From addressing work-life balance to redefining collaborative processes for companies, VR emerges as a tool of significant value. However, with this potential come challenges that need proactive addressing — from ensuring ergonomic comfort to safeguarding data security. As we move forward in this digital age, it's crucial to keep these insights at the forefront, ensuring that the integration of VR into RW is not just seamless but also maximally beneficial for all stakeholders involved.

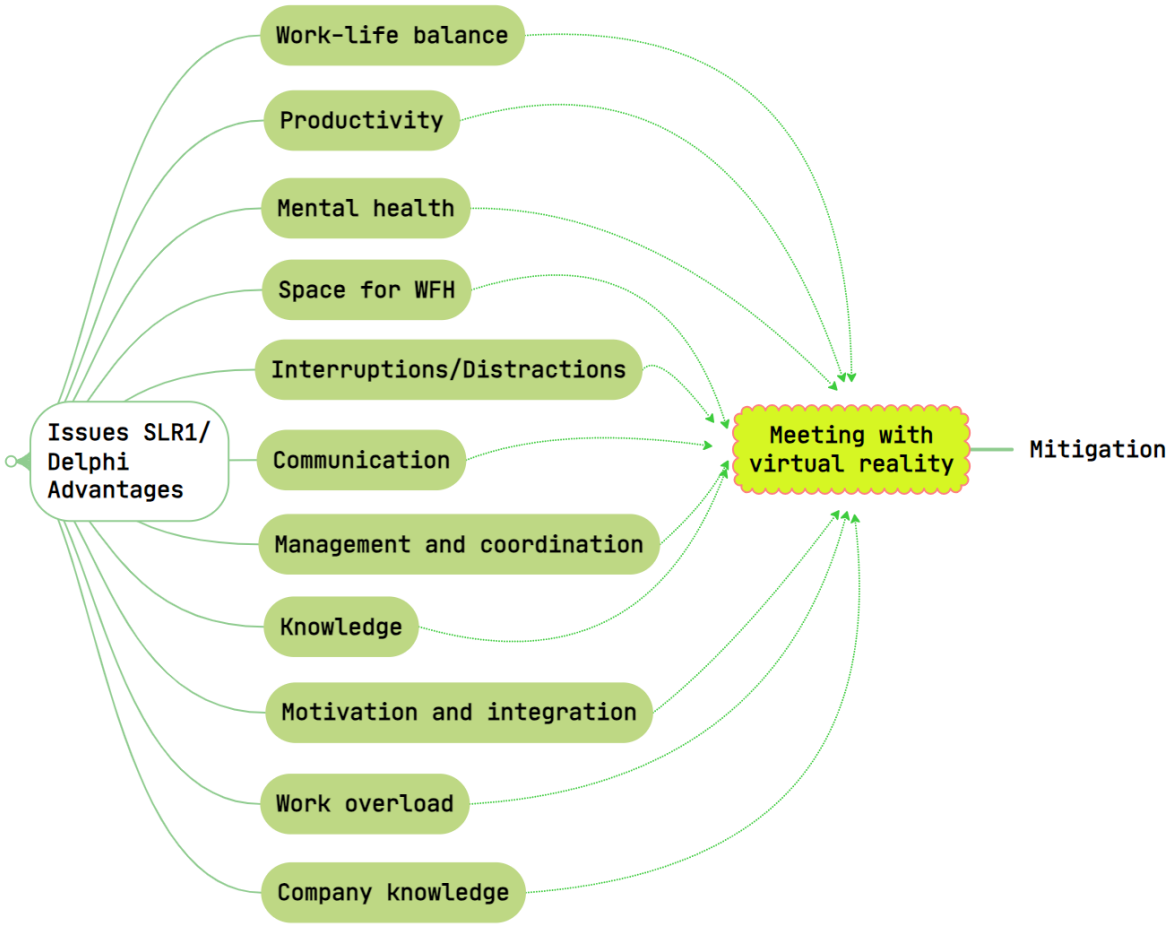

Figure 6.1 - Issues mitigated by Virtual Reality

CHAPTER 7

Conclusion

In the ever-evolving landscape of work, catalysed significantly by unforeseen global challenges such as the COVID-19 pandemic, RW has emerged as a predominant fixture in organizational strategies. As our research delineated, while RW offers a plethora of benefits ranging from cost savings to flexible hiring practices, it is not devoid of challenges. Both employees and organizations grapple with diverse issues, from work-life balance to management issues.

Our study embarked on an exploratory journey, initially through two Systematic Literature Reviews (SLRs), to unravel these intricacies. We ascertained that while there are numerous facets to remote work, a comprehensive solution might lie in a burgeoning technology - Virtual Reality (VR). VR's potential to foster a sense of presence, enhance interactivity, and create immersive environments positions it as a viable tool to mitigate several of the challenges identified.

Our Delphi study further illuminated that the application of VR in the realm of RW isn't a straightforward panacea. The technology, while promising, comes with its set of considerations. Issues such as adoption resistance, ergonomics, and integration with existing systems demand careful attention.

For the employees, VR presents a way to reduce interruptions and distractions, increase motivation, and even contribute positively to their mental well-being. Companies, on the other hand, can harness VR to refine management techniques, foster knowledge preservation, and facilitate intricate project collaborations.

In the broader perspective, our research underscores the immense potential of VR to transform RW but also emphasizes a proactive and holistic approach in its implementation. It's not just about integrating a technology; it's about harmonizing it with human needs, organizational objectives, and the overarching digital ecosystem.

As we stand at the precipice of a digital revolution in work, the nexus between RW and VR offers a tantalizing glimpse into the future. As with any transformative journey, the path forward requires judicious navigation, informed choices, and a spirit of continuous learning and adaptation. However, our study identifies more advantages than disadvantages in adopting VR in RW. This finding is a promising indication of the potential of this technology to significantly improve the way remote work is conducted, signalling opportunities for future development and practical adoption of VR in remote work environments.

7.1. Study Limitations

This research, like all studies, has its limitations. The reliance on SLR might have led to a skewed view based only on published studies, not considering unpublished works or industry practices that might not have been documented. Additionally, the Delphi study hinges on the expertise and opinions of the participants; different selections of experts might bring different insights or emphases. The qualitative nature of some of our research phases also means findings can be interpretative and might not be generalizable across all situations or organizational cultures.

7.2. Future Work

Looking forward, several lines of investigation emerge from this work. A deeper exploration into the ergonomic design of VR systems, especially in the context of long work hours, would be invaluable. Another study could examine the adaptation and training of employees for VR use, identifying best practices to hasten its acceptance. Lastly, a quantitative assessment of the actual impact of VR on productivity, well-being, and other key indicators within the RW environment would be a valuable extension of this research.

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