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Investigating Virtual Reality for workforce reintegration after absenteeism:

A Value Sensitive Design approach through a KLM Case study

TU Delft

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Investigating Virtual Reality for workforce reintegration after absenteeism

A Value Sensitive Design approach through a KLM Case study

By

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Abstract

This thesis explores the potential of Virtual Reality (VR) as a tool for workforce reintegration after absenteeism, using a Value Sensitive Design (VSD) approach in the context of KLM, a major airline company. The study addresses the values and concerns of cabin crew employees undergoing traditional reintegration processes and examines how VR can be customized to better meet the diverse needs of employees returning to work after prolonged absence.

Background & Problem Area: Certain conditions may lead employees to stay away from their regular working environment for prolonged periods of time. This is called Absenteeism, and many employees stay for a significant time in the reintegration phase, where they work in alternative workplaces for much fewer hours per week before going back to their old duties. The one-size-fits-all designs of reintegration processes have proved unsuccessful considering their prolonged duration. The organizational turbulence & increased costs for companies caused by this phenomenon highlights the need for customized interventions for employees coming back to work.

Research Gap: As such, the first gap that this study will try to address is the lack of understanding of how to customize these processes and how to support employees coming back to work. The adaptability and applications of Virtual Reality makes it potent to be used in the context of workforce reintegration. However, this indicates a second gap regarding whether and how Virtual Reality technologies can be implemented in the workforce reintegration. The novelty of this study and the lack of an existing clear-cut approach, lead to a third research gap of how to implement a Value Sensitive Design approach, to redesign reintegration processes, through VR interventions.

Research Objectives & Questions: The first aim of this research is to explore the values in the context of workforce reintegration as a new way of understanding how to create value-sensitive technologies. The second aim is to understand the potential of using Virtual Reality in the reintegration process to best cater to the needs of their end-users. Therefore, the present study will seek to answer the following main research question:

"How can the workforce be reintegrated back to work, by considering their values?"

Research Approach: The study employed a qualitative research approach using an adaptation of the Value Sensitive Design (VSD) framework. This included stakeholder mapping (direct & indirect), semi-structured value-oriented interviews, and VR user-testing sessions. The data was analyzed using a Thematic Content Analysis methodology.

Results: The stakeholder analysis revealed that the stakeholders that were mostly impacted by the technology were the ones with the least influence in the process. The data analysis unveiled that while VR showed potential for bridging the gap between

reintegration and regular work environments, it also revealed the need for customization. The study identified the following key values in regards with the workplace: *Organizational Support, Work-Life Balance, Autonomy, Safety, Physical Wellbeing, Mental Wellbeing, Purpose & Meaning Workplace Connection*. Moreover, the study identified *Privacy, Immersivity, Accessibility, Customization, Usability, Human Wellbeing* and *Autonomy* as values implicated in VR design either through their presence or their absence in the technology. The study found that VR could mediate certain work values as depicted into the Virtual Vitality Model (VVM) developed on this basis. However, trade-offs, for example, between *Workplace Connection* and *Physical Wellbeing*, are to be considered. The value of *Customization,* a currently underexplored value, was investigated through the VSD prism, and seems promising to not only redesign processes through redesigning technologies, but also make this process more human-centered and inclusive.

Recommendations: The study recommends implementing VR as a supportive tool in the reintegration process, emphasizing the importance of customization to cater to individual needs and contexts. Customization in the context of reintegration through VR should consider factors such as people's capabilities, experience with technology, their specific job duties and responsibilities. A transdisciplinary approach between managers and employees is essential for developing a more human-centric design that incorporates the values and needs of all stakeholders, particularly those most affected by the technology.

Conclusions: One of the key messages of this study, that despite people sharing similar values to a certain extent, their values vary among employees, work contexts, and even time periods. The study's strengths lie in its innovative methodology using the power-interest grid within VSD, the holistic approach on incorporating diverse stakeholder perspectives, and employing empathy and trust for data collection, leading to rich data. The weak external validity of this research should prevent us from generalizing the results to other populations and he cross-sectional design does not allow us to observe how VR usage impacts the reintegration process duration overtime. Job Satisfaction was a recurring pattern identified in the data, but it was outside the scope of this study. Future research can aim towards investigating how job satisfaction may impact the duration of the reintegration process and whether work values mediate this relationship.

1. Introduction

1.1 Rationale

Cabin attendants often experience high job stress due to various factors, some of which include long hours in confined spaces with low humidity, exposure in extreme environmental changes, frequent jet lag, changing schedules, demanding passengers, and frequent disruption of family and social life due to shift work (Ng et al., 2011). Previous work has shown that the aforementioned factors can often lead to work-family conflicts and burnouts (Chen & Chen, 2012), taking a toll on their wellbeing as well as lead them to be away from work for prolonged periods of time, a phenomenon called absenteeism (Schultz et al., 2009). The absenteeism rates in the aviation industry are reaching between 10%-15% for cabin crew employees. Almost half of them stay absent from their regular workplace for about 1,5 years, and its duration causes turbulence to the organizational processes and inducing incurring costs (KLM Ondernemingsraad, 2024).

In the context of the Netherlands, companies are mandated to provide their employees with a smooth transition method back to work after absenteeism (RVO, n.d.). Usually, an employer suggests changes to the way the employees can reintegrate back to work, by adjusting their work tasks and changing the amount of work hours and workdays that they need to work depending on the availability of alternative positions. This gradual return-to-work can be seen as a type of exposure therapy, where employees are gradually reintroduced to their main job responsibilities and the work environment while maintaining control over the process (Noordik et al., 2010). However, despite the measures of the Dutch employment law to ensure a smooth reintegration, the insisting high rates of absenteeism in the aviation industry showcase that the return-to-work processes that are currently in place do not serve their purpose efficiently. In fact, research shows that unsuccessful reintegration processes are often linked with people becoming sick again or even quitting. (Cancelliere et al. 2016).

Research has demonstrated a variety of technologies, practices and methods employed for the reintegration of employees back at work (e.g. use of software solutions, use of medication, use of motor rehabilitation) (Engdahl et al., 2023; Nieuwenhuijsen et al., 2014; Pransky et al., 2005). While each one of them comes with their own affordances and limitations, it is evident that reintegration processes in place often fail to serve the purpose of successfully reintegrating employees to work.

Recent innovations (products and processes) in the workplace show that technologies bear their own potential, especially regarding their capacity to design digital environments that consider the individual needs of their users and cater to those. The reason for that does not

lie upon the type of the technology per se; but rather, it mostly relates to the fact that digital environments allow for customization to individual needs and can incorporate numerous alternatives that are both time- and cost-effective as well as sustainable in the long-term (Bokolo, 2020; Rutkowski et al., 2020; Xie et al., 2021). Technological tools enable individuals to adapt each context and external requirements to the needs, abilities and goals of each person. For instance, Engdahl et al., (2023) unveiled that designing and implementing a digital solution in the reintegration process, through incorporating the stakeholders needs, helped the stakeholders to keep up with their thoughts and feelings and formulate goals and a plan for their work return. Indeed, the products that people use strongly influence their lived experiences and, in turn, their abilities to meet their aspirations (Davis & Nathan, 2015). As such, innovations that are being designed have a much bigger impact on people's lives rather than simply being efficient.

The idea to design innovations that consider the diverse needs, capabilities, and aspirations of humans started developing the designation of specific strategies and techniques that can assist researchers and designers to explicitly consider human values and incorporate them in the innovations (Davis & Nathan, 2015). Values are aspirations and ideas that matter to people and are worth striving for (Friedman et al., 2013; Taebi et al., 2014). To design such innovations, we need an approach that enables us to identify those values and address them appropriately. Such approach is the Value Sensitive Design (VSD) approach (Friedman et al., 2013) and provides a solid foundation for investigating conceptually, empirically and technically, the development of technologies that consider stakeholder needs. The approach situates the users in the center of technology development as it considers the values of the involved stakeholders. While a VSD approach can guide our efforts to identify diverse human needs, the technology can provide the platform to accommodate them.

Given that the one-size-fits-all designs of reintegration processes have proved unsuccessful, the need for customized interventions for employees coming back to work is evident. Also, the existing research is inconclusive in regards with one single approach for a successful reintegration and as such, the organizations need to provide more customized interventions to employees coming back to work (Fitzenberger et al., 2016; Heinrich & Judite, 2014; Nieuwenhuijsen et al., 2014; Noordik et al., 2011).

1.2 The context of the present study

The present study focuses on the case of KLM (Royal Dutch Airlines) aviation company and particularly on their issue of reintegrating people back to work. Following the Dutch employment law, KLM has several ways to reintegrate people back to work. Their current reintegration process for cabin crew consists of alternative work positions of limited hours in environments other than the airplane (see *Appendix Figure 2*). The traditional

reintegration processes that KLM has utilized so far do not seem to serve the intended purpose; the extended and prolonged periods of absenteeism have led the company to explore the potential of transforming these work-related processes through currently available digital tools such as Virtual Reality (VR) technology.

Virtual Reality (VR) provides visual and audio stimuli produced by a computer through a specialized headset/helmet and it can create the impression to the user that they have emerged in the virtual created environment (Garcia-Palacios et al., 2001) leading to a re-enforcing effect that the mind considers the VR as real (Krijn, Emmelkamp, Biemond, et al., 2004; Krijn, Emmelkamp, Olafsson, et al., 2004).

The reason for considering this technology has been its extensive use in cognitive behavioral therapy (CBT) for treatment of psychological disorders (Freeman et al., 2017; Klinger et al., 2005; Lele, 2013; McLay et al., 2011), and physical rehabilitation (Kim et al., 2020; Rutkowski et al., 2020) because the people immersed in VR have the power to control their experience, the intensity and the duration of it (Klinger et al., 2005; Mühlberger et al., 2003; Quero et al., 2014). These kinds of therapies fall under the scope of exposure therapies that aim to reduce anxiety or improve kinesiological problems. The adaptability and affordance of this technology (Bokolo, 2020; Hamad & Jia, 2022) makes it potent to be used in the context of workforce reintegration when they return to work after a long leave.

As such, the emergence of Virtual Reality (VR), in exposure therapy now has come within reach and this could be an unprecedented way for workers in high performance jobs to gradually return to their core work task which contributes to a reduction of sickness absence duration. So, KLM saw potential in VR technology as a supporting tool for the reintegration of the workforce when they return to work after a long leave.

The aim of the present study was to determine whether and to what extent VR can be of use for the reintegration process of returning cabin crew employees. As mentioned earlier, the purpose is not simply to use a technological tool for the sake of using technology but instead to explore the potential value of VR as a tool that can address the diverse needs of individuals and cater for them through customizing the digital tool's design. To determine whether and to what extent a technology can assist employees in certain work-related processes requires involving employees' perspectives on their own needs and values ensuring an inclusive approach and providing a platform for their feedback on customizing work-related processes to better meet their needs, abilities and aspirations.

However the current research is inconclusive of whether and how VR can meet the diverse needs of the reintegrating cabin crew employees. Therefore, the researchers stress the importance of setting the user in the center of design when designing VR technologies (Baniasadi et al., 2020; Freeman et al., 2017). This includes integrating employees' perspectives on VR's usefulness in their reintegration, ensuring an inclusive approach to

the reintegration process and providing a platform for their feedback on customizing VR to better meet their needs in this transition.

1.3 Research gap

Relevant literature indicates that there is not a universal approach to design successful reintegration processes and as such this necessitates adjusting to the individuals' needs and capabilities. Therefore, the first gap that this study will try to address is the lack of understanding in how to customize these processes and support employees coming back to work (Fitzenberger et al., 2016; Heinrich & Judite, 2014; Nieuwenhuijsen et al., 2014; Noordik et al., 2011).

The adaptability of Virtual reality (Bokolo, 2020; Hamad & Jia, 2022) makes it potent to be used in the context of workforce reintegration when employees return to work after a long leave, however such an endeavor has not been found in the research. Thus, this study will attempt to fill in a second research gap in regard to the potential of Virtual Reality technologies in the workforce reintegration.

Such an endeavor could be guided by the Value Sensitive Design approach. However, despite its theoretical solidness, to our knowledge, has not been applied in VR design for workforce reintegration. Subsequently, implementing a value sensitive design in the context of VR for work reintegration processes requires adaptation. Therefore, this study addresses a third research gap of how to implement a Value Sensitive Design approach, to redesign reintegration processes, through VR interventions (Baniasadi et al., 2020; Freeman et al., 2017).

1.4 Research objective & research questions

The research's first aim is to explore the values in the context of workforce reintegration as a new way of understanding how to create value-sensitive technologies. The second is to understand the potential of using Virtual Reality in the reintegration process to best cater to the needs of their end-users.

Therefore, the present study will seek to answer the following research questions:

"How can the workforce be reintegrated back to work, by considering their values?"

From this main question, further sub-questions arise to provide answers to the posed inquiry:

SQ 1: "What are the main values and concerns of the different stakeholders involved in work reintegration process?"

SQ 2: "To what extent could technology address these values and concerns?"

SQ 3: "How could the values and conflicts that may come up, be prioritized?"

2. Theoretical Background

2.1 Absenteeism & workforce reintegration

2.1.1 Causes and effects of Absenteeism on cabin crew

Absenteeism is the period during which the employees are away from their regular work duties (Schultz et al., 2009). Several underlying reasons may lead employees away from work, such as physical injuries or mental health concerns. Specifically, cabin crew employees may encounter situations that can cause health problems or distress in their personal life and psychosynthesis. Chen & Chen, (2012) identified that dealing with demanding passengers, the high job demands, long hours of flying and environmental stressors lead to significant job stress and increased rates of turnover intentions. Encountering such issues in the work environment often leads to seeing tasks, clients, or co-workers merely as necessary tasks to be completed, stripping away the human aspect, and as such, it can lead employees to distance themselves from their work (Kahn et al., 2006). These are indicative factors that may lead cabin attendants to a prolonged burnout, and prolonged absences from the workplace. Ng et al. (2011) mapped several work difficulties of cabin attendants and showcased their negative impact on job satisfaction (*see Figure 1*). Understanding these relationships is crucial to match a suitable type of

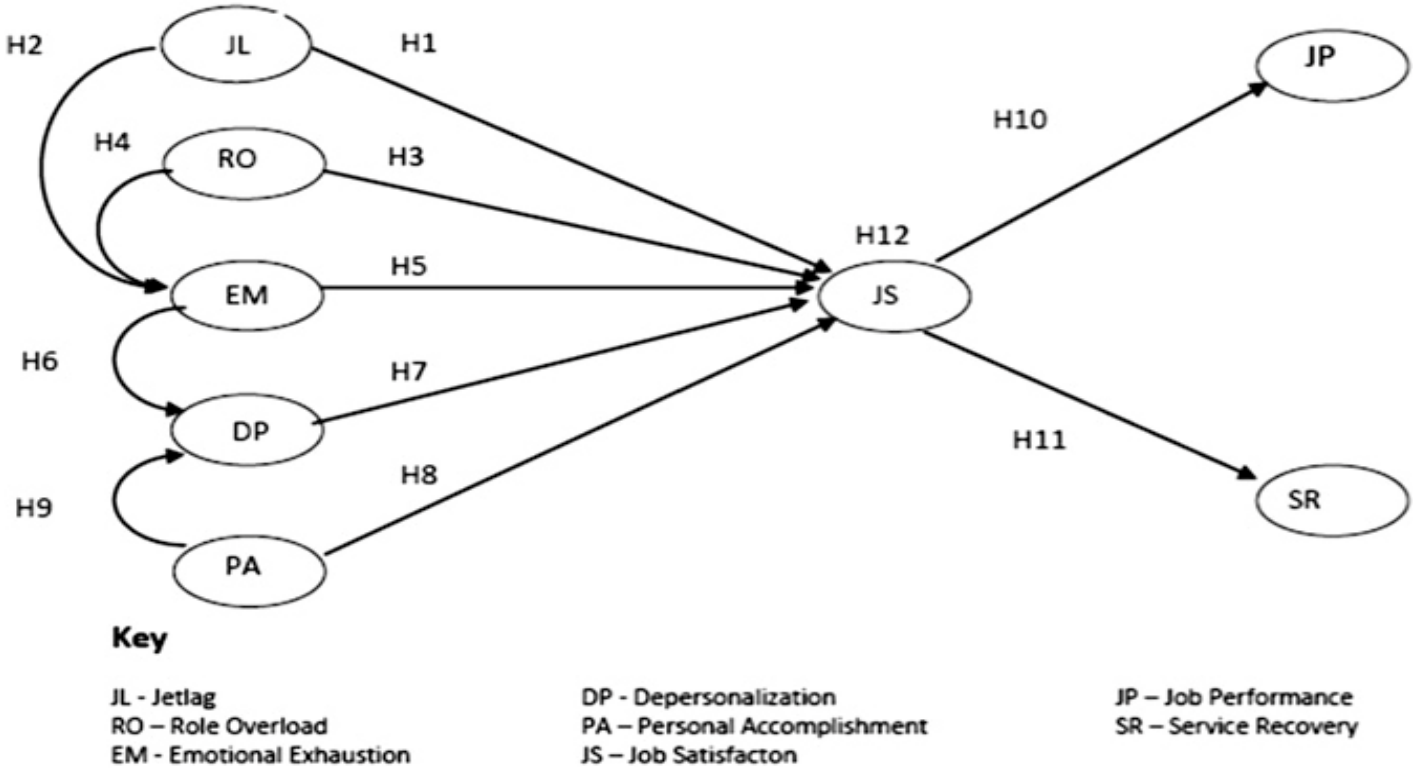

Figure 1: Antecedents and outcomes of flight attendants' job satisfaction, Ng et al. (2011)

reintegration process with the absenteeism reasons, since the latter could influence the effectiveness of the prior.

2.1.2 Types and effects of reintegration processes

Return-to-work processes are processes set by employers to facilitate the return of absent employees, before their full recovery, with or without certain job accommodations in place (Schultz et al., 2009; Schultz et al., 2007). Some of these processes are based on physical rehabilitation sessions or mental health treatments with pharmaceutical interventions (Arends et al., 2012; Dunstan & MacEachen, 2013; Nieuwenhuijsen et al., 2014; Pransky et al., 2005). Other methods involve reduced work hours and modified work tasks to make it possible for workers on long-term sick leave to stay connected to the workplace (Dunstan & MacEachen, 2013; RVO, n.d.). The case could also be that there is a combination of these options, depending on the reason for absenteeism. For example, in KLM, cabin attendants with burnouts are kept away from the stressful environment of the airport, and as such they conduct alternative work at nursing homes, as elder companions (see *Appendix B*). The reintegration processes that include alternative work tasks and have shown to have a positive effect on the returning workers' health and wellbeing (Schabracq & Cooper, 2002) while organization-wise, they seem to reduce both financial and human resources costs. However, improving employees' health may not be the only factor that plays a role in the success and efficiency of reintegration.

A longitudinal study conducted on employees in The Netherlands revealed that employees who experience dissatisfaction with their jobs tend to have higher rates of absenteeism in the future. Conversely, those who are absent from work are more likely to develop decreased job satisfaction over time (Ybema et al., 2010). This mutual influence suggests a cyclical pattern where dissatisfaction and absenteeism reinforce each other. These findings could be explained by the employees' diminishing feelings of self-worth and the lack of confidence due to not being able to recall certain work tasks, the lack of energy, the isolation from their colleagues and the distance from the company support network, (Marshall et al., 2007; Noordik et al., 2011). Moreover, factors like older age, being female, higher physical work demands (Cancelliere et al. 2016) seem to be associated with employees quitting their job after their sick leave or prolonging their reintegration period. These findings show that factors relating to the workplace responsibilities and duties may burden cabin crew employees that are mostly older females and as such impact their job satisfaction negatively.

Lockwood (2003) suggested that implementing programs that balance their work with their personal life, has the potential to significantly reduce absenteeism and contribute to employee sustainability by increasing job satisfaction. Engdahl et al., (2023) designed and implemented a digital solution targeting the reintegration process of employees by incorporating the views of several involved stakeholders in the reintegration (doctors,

managers, employees). This seemed to contribute to the ability of stakeholders to cope with thoughts and feelings and formulate goals or plans for the return of reintegrating employees.

The variety of reintegration processes (physical rehabilitation, medication for mental issues, alternative work positions, technology interventions) and the multiple dimensions that play a role in reintegrating employees back to work (physical concerns, mental health concerns, workload related reasons, job dissatisfaction) shows that there is no one method to ensure an effective reintegration process. It seems that instead of a single clear-cut approach for all, successful reintegration processes necessitate customization to the individuals' needs and capabilities.

2.2 Virtual Reality (VR)

Virtual Reality is a technology that provides a computer-generated 3D environment through small display screens placed near the users' eyes and induces also audio stimuli through a specialized headset. Due to the nature of the technology, it can create the impression to the user that they have emerged in the virtual created environment (Garcia-Palacios et al., 2001). The system tracks the position of the head, eyes and hands of the user creating a new sensation of direction and environment. Considering that VR is an artificial system, the program or scenario can be paused or stopped at any time allowing the person to process the experience and not to be pushed to their limits. Actions in VR feel real but do not have any consequences in real life and any mistake in VR can be easily corrected while VR also allows the user to be an observer without being actively involved or noticed. Aviation is a highly regulated sector that involves a lot of health risks and thus, VR technology is quite prominent there and shows promising results on transferring safety knowledge and safety trainings (Chittaro et al., 2018).

2.2.1 Characteristics of VR technology

As briefly mentioned earlier, the focus on exploring the potential of Virtual Reality in this context is because of its integrative and adaptable nature, allowing custom-made scenarios that could potentially cater to one's needs.

Given that VR is an option that allows custom-specific adaptation and the ability to design different scenarios for different purposes, it is not surprising that it has been already applied in various fields. Such fields include aviation trainings, for which the design process includes task analysis that aims to unveil the factors that should be involved in the training system during the design process, the scenario design and finally the technical development and implementation (Xie et al., 2021). Other fields include business product

design and follow a similar design method (e.g. designing 3D models in virtual; Bokolo, 2020). In these business-related cases, the use of VR spaces saved expenses in trial and errors, increased efficiency in organizational processes and reduced real-life risks. For mental health treatment applications, experiments on mental health diagnosed patients, with guidance from medical professionals, showed that this technology could greatly increase the options for psychological therapies, while enhancing treatment outcomes depending on the technology's ability to immerse the users into a new reality (e.g., cognitive behavioral therapy; Klinger et al., (2005), exposure therapy; Powers & Emmelkamp, (2008), stress-related treatment applications; McLay et al., (2011)). Moreover, Mora et al., (2023) researched women that had already returned to work after maternity leave, by conducting a mindfulness intervention and meditation through VR for their mental wellbeing. By providing an immersive 360-degree visual environment and ambient sounds the goal was to create a more engaging and immersive meditation experience. The experiment showed that such interventions may lead to reduced stress and anxiety levels, burnouts and promoting work-life balance. VR has also been extensively used in physical rehabilitation and showed potential on improving treatments due to its characteristics that included digital tasks with various difficulty levels, real-time feedback, and immersive and engaging content leading to a more standardized rehabilitation, (upper limb motor rehabilitation; Kim et al., (2020), low-back pain; Smits et al., (2022)).

VR has been utilized on these fields because of the perceived safety entailed with this technology. The immersive nature of a VR scenario can make it feel real while in fact it is not. This aspect of VR can give the person a shield of comfort that helps to overcome initial restraints (Powers & Emmelkamp, 2008). Furthermore, the fun factor of technology distracts the person from negative feelings and allows them to create a positive association with a situation while lowering the restraint to look for help if desired (Madshaven et al., 2021). Therefore, for cabin crew employees that are going back to work, VR might be able to introduce a “shield of comfort” against experienced feelings of insecurity and self-doubt due to being away from that environment for long.

Apart from mitigating the risks that may be entailed in real-life situations, the cost-effectiveness of VR is an important advantage that motivates companies to digitally transform several processes. For example, implementing certain training processes in VR, (e.g. emergency procedures, fire safety scenarios etc.), it can decrease the time and the cost of extensive setups, travelling, and human resources that are otherwise required in real-life settings (Xie et al., 2021). This component is crucial for the aviation sector, bearing in mind the fact that aviation companies have multiple offices and employees of several nationalities, living in different countries.

2.2.2 Ethical design practices for VR in health treatments and mitigating risks

Overall, Virtual Reality has been considered as a robust method in mental rehabilitation methods (Freeman et al., 2017) and a systematic review of reviews found no evidence that VR wasn't effective in treatment of mental health issues (Cieślik et al., 2020).

Still, despite the high effectiveness of VR in this area, professional counselors and therapists are concerned with implementing it because of their belief that this may make symptoms worse, and induce even further anxiety and stress, especially when dealing with stress-related conditions (Khatri, 2023). Moreover, experiments revealed that users of VR may experience side effects like cybersickness, a condition where the user experiences a motion sickness-like situation, and it is caused by nausea, visual discomfort, fatigue and disorientation. (Oh & Son, 2022). Also, headaches and eye strain were observed in prolonged exposure within VR environments (Baniasadi et al., 2020). Another risk that may be entailed with the use of VR is the absence of perception of the physical environment. The feeling of immersion in VR, which enables to experience emotional reactions and behavior as the real environment (Hudson et al., 2019), may lead to distract the users from physical obstacles and as such, end up physically hurting themselves. Therefore, there may be a concern regarding their wellbeing when they use such a technology on their own (Cieślik et al., 2020).

As such, ethical considerations in the design of these technologies are a critical step of the process to ensure efficacy, safety and responsible design practices of VR in rehabilitation contexts.

Researchers have recently delved into the values and the ethics that concern Extended Reality (XR) technologies. For example, Smits, Ludden, et al. (2022) highlighted the existing gap between the users' values and needs, and the design features of technologies for health purposes. In their research, Smits, Ludden et al. (2022), they developed and assessed a VR rehabilitation system for patients with long term health problems through an adapted "Guidance Ethics" framework. By conducting value-oriented interviews with patients and medical professionals, they derived the patients' values before using VR, such as self-identity, safety, and autonomy. In a latter stage, through workshops, they were able to pinpoint the effects of the VR on the participants, that included increased motivation for performing rehabilitation exercises, physical and cognitive benefits and reduction of fear and anxiety. The study highlighted that the VR intervention influenced patients' values, leading to positive changes in self-identity (e.g., better understanding of rehabilitation needs) and autonomy (e.g., feeling more in control of rehabilitation). However, there were also negative effects, such as feelings of fear and safety concerns in the virtual world. Therefore, VR technologies that are used for rehabilitation purposes need to be aligned with user needs through design improvements as well as support and guidance from therapists.

Following a Responsible Research and Innovation approach (RRI), Politis et al., (2020) employed the Participatory Design (PD) method to design and afterwards test a VR

environment, targeting for conversation skills training for vulnerable social groups, discussing the ethical implications and the role of stakeholder engagement. The study revealed that participants perceived VR as having the potential to serve its purpose for the particular social group and the researchers pointed how important it is for such technologies to upkeep the "one-size-fits-one" notion in order to meet the needs and preferences of their users.

XR technologies have raised ethical concerns about being invasive, exploiting user data, potentially leading to physical & psychological harm and involving ableist assumptions translated to non-inclusive features in the technology design, rendering it blind to disabilities (Greene, 2022; Spiegel, 2018). Thus, Duin et al. (2019) developed a content design framework for enhancing AR experiences, by highlighting the importance of values such as "authenticity, embodiment, empathy, accessibility, usability, experience, and immersion" as important design heuristics.

Radziwill (2019) developed the CoRe framework for XR technologies, based on the Value Sensitive Design approach, which tries to uncover the ethical implications of a particular mixed reality experience by drawing designer attention to issues of mental and physical wellbeing, user privacy, and proper disclosure and consent practices within mixed-reality design. Therefore, the integration of VR in the workplace and especially in the reintegration process, where the users will be people of vulnerable groups, presents some challenges that warrant careful examination.

However, to the best of our knowledge, there has been no integration of Virtual Reality technologies in the context of workforce reintegration, and this gives fruitful grounds to understand how to implement this technology in this context.

2.3 The emerging literature gap

The literature highlights a significant gap in the integration of Virtual Reality (VR) for workforce reintegration, particularly for cabin attendants. While VR technology has been extensively applied in various fields such as aviation training, product design, mental health treatment, and physical rehabilitation, using various design and evaluation methods, it has not yet been explored in the context of workforce reintegration. The literature indicates that it is important to explore the needs and concerns of the users, the cabin crew in this context, to design a reintegration process that fits them. This presents an opportunity to investigate how VR can be designed and utilized to support employees returning to work after periods of absenteeism, addressing both their needs and capabilities.

Despite the potential benefits of VR, such as cost-effectiveness, perceived safety, and the ability to create custom-made scenarios, there are risks and challenges that need to be addressed. These include concerns about VR-induced symptoms like cybersickness, the potential for increased anxiety and stress, physical safety issues due to the immersive nature of VR or privacy and safety considerations. Therefore, understanding these risks while harnessing the benefits of VR for workforce reintegration is a critical area requiring further research.

3. Methodological Background

The field of Human-Computer Interaction (HCI) studies supports that for a technological system to be widely accepted and to be effective, it must be designed with a user-centered approach (Issa & Isaias, 2022). This means customizing the system to the needs and capabilities of its intended users, meaning that users shouldn't have to think about the complexity of using a technology. As such, following this notion when designing technologies, seems promising when the users are people that belong into vulnerable groups and experience health-related issues, like cabin attendants undergoing their work reintegration process.

Until recently, technology was commonly regarded as value-neutral, meaning no subjective preferences were embedded into certain systems as they were only created to serve these needs and capabilities of the general population (Manders-Huits, 2011). However, what became evident in the HCI field of studies, is that designers inherently implement some of these subjective preferences when they design processes or technologies, even subconsciously. For example, taking into consideration the recent development of AI, it makes one wonder why AI assistants like Alexa, Siri, Google etc., have by default a woman's voice (Gupta & Mishra, 2022). This could be an indication of an integrated bias towards women's abilities to assist, rather than lead and can also lead to perpetuating stereotypes in the workplace and consequently in wider society. "*Values emerge from the tools that we build and how we choose to use them. Yet, in most of the current practice in designing computer technology and the related infrastructure of cyberspace, little is said about values*" (Friedman, 1996). But when designing technologies that affect people, the question is whose values should be considered, which values and how to do it in an ethical way (Friedman & Kahn, 2000)?

3.1 Value Sensitive Design

Through the field of HCI, the Value Sensitive Design (VSD) approach emerged. The VSD is a technology design approach that places humans' values in the middle of a technological design (Davis & Nathan, 2015). Values refer to goals and ideas that matter to people and they are worth striving for (Friedman, 1996; Friedman et al., 2013; Taebi et al., 2014). To do that, it follows a "*tripartite methodology*" which consists of three iterative phases:

- The **conceptual investigation** focuses on investigating the human values from relevant philosophical literature and those elicited from stakeholders. It contemplates how the technology might confer social benefits while simultaneously imposing negative impacts on stakeholders both direct (those who

use the technology) and indirect (those who are affected by other's use) (Davis & Nathan, 2015).

- The **empirical investigation** focuses on understanding the context that a technology is being used and prioritizing these elicited values of the stakeholders towards design requirements
- The **technical investigation** focuses on investigating the embedded values within the technology, identifying the technical limitations of these technologies in relation to values, and whether these can be addressed through the design requirements.

However, VSD been heavily criticized about its extended focus on the theoretical investigation of the values rather than their practical integration into technology design requirements (Davis & Nathan, 2015; Harbers & Neerincx, 2017; Umbrello & van de Poel, 2021). Umbrello and van de Poel (2021) attempted to tackle this shortcoming of the VSD by introducing a value hierarchy scheme as presented in *Figure 1*. The hierarchy is structured through two key relationships; 1) "*specification"* which denotes the process of breaking down higher-level elements into more detailed ones within the hierarchy, and 2) "*pursuit for the sake of"* referring to the link that connects lower-level elements, like design requirements, with higher-level elements such as broader norms and values (Umbrello & van de Poel, 2021). Their modified VSD, followed four iterative phases:

1. **Context analysis** investigates the socio-cultural and political norms that affect how values are understood both conceptually and in practice. It is also important to account for stakeholders' understanding and their sociocultural context to ensure the identified values align with theirs
2. **Value identification** that emerge from the technical design, the literature values related to the technology and the stakeholder's views
3. **Formulating design requirements** based on the previous two phases that comply both to universally accepted values of the specific technology, as well as the values of stakeholders.
4. **Prototyping** and testing the technology embedded with the formulated requirements.

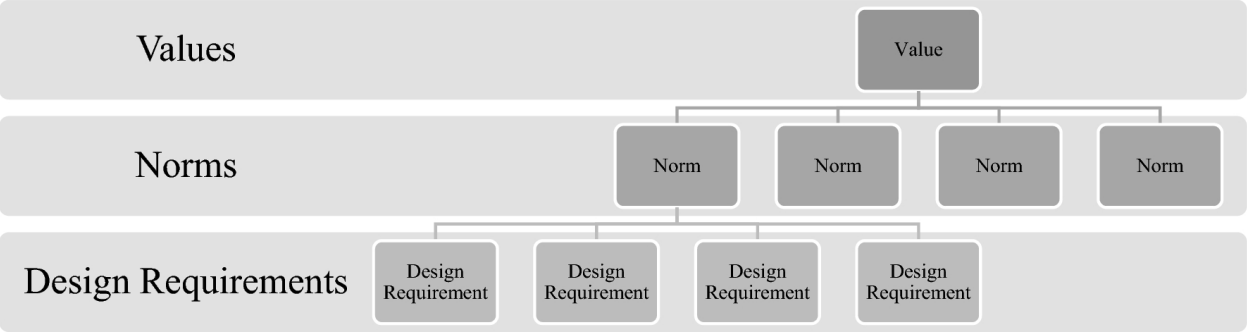

Figure 2: Value Hierarchy to Design Requirements (Umbrello & Van de Poel, 2021)

While this modified VSD approach attempts to bridge the gap of operationalizing values into design requirements, its application focuses on wider-sociocultural norms rather than context-specific and human-centered technology design. As such, further development of this approach is needed to shift away from the perspective of "one-size-fits-all" and create technology that can cater individual needs and capabilities.

3.1.1 VSD Applications in Virtual Reality

Several studies utilized theories such as the VSD to design inclusive technologies in the context of the workplace focusing on operationalizing the employees' values in the design process, (e.g. virtual assistants for workload harmonization in Harbers & Neerincx, (2017) and AI- based robot assistant in Vernim et al., (2022)), while others, utilized the framework to explore the effects of VR on rehabilitating patients' values (Smits et al., 2022).

Vernim et al. (2022) operationalized the VSD framework in the context of the workplace, focusing on the technical investigation of an AI-based robot assistant. They conducted the technical investigation of the robot, its functionality and the social values that this technology currently serves. Afterwards, they dived into an empirical investigation by conducting a stakeholder analysis, their interaction with the technology and with other stakeholders within that context and identified the workplace requirements. Then, for the conceptual investigation, they related the values that emerged from their previous analyses to universal values within the workplace. Finally, they revisited the technical investigations so that they could relate these values that have not been emphasized in the original design and frame them as future design requirements (e.g. the value of *wellbeing* à *the redesign should foresee a possibility to allow human interaction with other people like using headsets for communication*). A core criticism on this paper is that the views and perceptions of the direct stakeholders (users) concerning their work environment and their needs were not included in the empirical investigation, following a more technical focus. This approach, however, contrasts with the VSD approach that sets the user's values in the technology's center and this approach doesn't fit the aims of the current study.

On the other hand, Smits, van Goor et al., (2022) used the VSD, focusing on the empirical investigation to understand how VR can affect chronic patients' values and provides

actionable design recommendations aligning with these values. The study begun by identifying the values important to patients with chronic low-back pain (health, self-perception, safety, hope, autonomy, and social comfort) and then the patients were interviewed using semi-structured value-oriented interviews before and after using the VR application. These interviews focused on understanding the patients' value experiences and how VR affected mediated these values. Based on their empirical findings, the authors provided recommendations for the design and implementation of VR technology to align with the patient values. However, the study lacked the integration of other stakeholders' perspectives that could have been involved in the process (e.g. medical professionals that monitor the patients or the VR designers that were to update the VR software that was used) and no value trade-offs between the stakeholders were considered.

3.2 Values in design and methodological gaps

The concepts of values, norms and human needs are closely related. Brown & Lent (2005) highlighted the importance of differentiating the two concepts of values and needs, since they are used interchangeably. Values are goals and ideas that matter to people and aspire them to measure themselves, others and societies as a whole. Values can be moral (social standards of what is right/ wrong) social (e.g. wellness, equity, privacy, freedom, security, safety), aesthetic (e.g. beauty, taste, emotion, comfortability et.c) or epistemological (e.g. simplicity transparency, explainability etc). Overall, values can be distinguished to personal (ideals of one person) and cultural (for individuals as a part of a community, or the community itself) (van de Poel & Royakkers, 2011). Norms are defined as concrete formal/informal rules that prescribe what actions are required, allowed or forbidden regarding how people can attain these underlying values (van de Poel & Royakkers, 2011). On the other hand, needs are certain requirements (feelings, behaviors, actions) that people deem as necessary conditions to attain these values (Deci & Ryan, 2000).

There are several values that are often implicated in system design as shown in the table below (*see Table 1*) and they have been grouped because of their relevance. VR (Radziwill, 2019; Smits, van Goor, et al., 2022), and technologies next of kin, such as Augmented Reality (AR) (Friedman & Kahn 2000), Artificial Intelligence (AI) (Umbrello & van de Poel, 2021), have been researched through the VSD approach and briefly touched upon how they can serve the values of people better. Therefore, these values can prove to be relevant for designing VR technologies especially for the context of reintegrating employees back to work.

However, the variability of needs, norms and values indicate a significant limitation for using the VSD. The value system is heavily influenced by the environment (context), the socio-cultural factors (people) and the technology itself. These factors are constantly changing. As such, the values of different people in the same contexts or the values of

individuals in different contexts may be divergent. Considering that this study is conducted in an organizational environment where the decision-making, as well as the design and implementation of a technology can be a complex process, it is important that the perspective of other stakeholders and value trade-offs between the stakeholders are considered. These components are crucial for this study due to its transdisciplinary nature. This is why it is important for this current research to follow bottom-up value emergence process of the several stakeholders their values and concerns.

Moreover, the literature on VSD methodology, which emphasizes a human-centered design, indicates that it has not been applied to VR technology in the context of workforce reintegration processes. As such, this research seeks to adapt and implement the VSD approach to redesign not only the technology but also the reintegration processes themselves, ensuring they are customized to the unique needs of cabin attendants. So far and to the best of the researcher's knowledge, a holistic approach of VSD that can guide this dual focus on process and technological adaptation is underexplored and necessitates a comprehensive exploration including the views from all involved stakeholders and potential value trade-offs that may emerge. Therefore, the literature gap that this study will attempt to fill is how can we guide such an endeavor through the Value Sensitive Design approach.

Table 1: Values implicated in in VR design

Values	Definition	References
Human welfare, Health, Wellbeing, Psychological wellbeing, Physical wellbeing	Refers to people's physical, material, and psychological wellbeing.	(Friedman et al., 2013; Friedman & Kahn, 2000; Smits, van Goor, et al., 2022; Umbrello & van de Poel, 2021; Vernim et al., 2022)
Privacy, Justice and Dignity	Refers to the right to determine what information about oneself can be communicated to others; freedom from surveillance.	(Friedman et al., 2013; Friedman & Kahn, 2000; Smits, van Goor, et al., 2022; Umbrello & van de Poel, 2021; Vernim et al., 2022)
Universal usability, Accessibility	Refers to making technology usable and accessible for all people.	(Friedman et al., 2013; Smits, van Goor, et al., 2022)
Autonomy	Refers to being able to decide, plan, and act independently to achieve goals.	(Friedman et al., 2013; Smits, van Goor, et al., 2022; Vernim et al., 2022)
Informed consent	Refers to obtaining agreement with full disclosure and understanding.	(Friedman et al., 2013; Friedman & Kahn, 2000; Smits, van Goor, et al., 2022; Umbrello & van de Poel, 2021; Vernim et al., 2022)
Identity, Self-awareness, Meaning	Refers to understanding of who one is, and feel accomplishment through who they are.	(Friedman et al., 2013; Smits, van Goor, et al., 2022; Vernim et al., 2022)
Calmness, Hope	Refers to maintaining a peaceful psychological state and hoping to improve the current physical/ mental situation	(Friedman et al., 2013; Smits, van Goor, et al., 2022)
Safety	Refers to feeling physically, emotionally, and financially safe.	(Smits, van Goor, et al., 2022; Umbrello & van de Poel, 2021)
Social Comfort	Refers to having quality social interactions and not disturbing others.	(Smits, van Goor, et al., 2022; Umbrello & van de Poel, 2021)
Sensory comfort	Refers to having physical, audio, and visual comfort.	(Smits, van Goor, et al., 2022)

3.3 Proposed VSD for VR in the reintegration process

As mentioned earlier, the differentiation of needs, norms and values of people pose a significant limitation for using the traditional VSD since one-size values and design requirements cannot fit all. Moreover, the lack of VSD methodologies that can guide the dual focus on process and technological adaptation necessitates customizing the traditional VSD framework for this specific goal. A holistic approach of VSD that incorporates the views from all involved stakeholders and potential value trade-offs is underexplored but yet necessary to guide the design and implementation of technologies in the complex setting of an organization. As such, applying the VSD methodology in technology design is not a linear, but rather an iterative process depending on the context of the use of technology, the maturity of the technology itself and the people that influence by it. Therefore, based on the above, to understand how VSD can guide the implementation of VR interventions in the workforce the following framework is proposed (see *Figure 3*):

1. **An empirical factoring:** focusing on who are the direct and indirect stakeholders, their interactions with the technology, and their values and concerns related with the workplace and the workforce reintegration context.
2. **A technical factoring:** which will involve testing of the technology, to identify the values already embedded in the VR system, how this technology can mediate the values identified during the empirical research, and the problems around the functions and the usability of the design.
3. **A conceptual factoring:** to map these stakeholder values and identify the trade-offs & conflicts between them.
4. **An innovation refinement**: to derive technical and process requirements based on the prioritized values and trade-offs from previous phases.

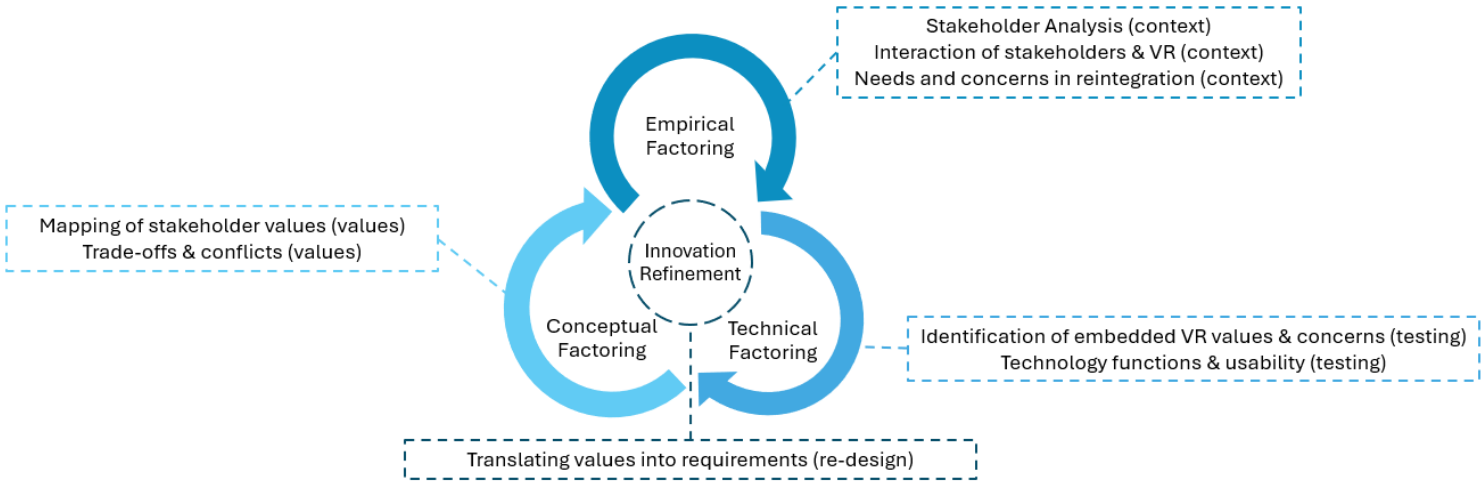

Figure 3: VSD for Virtual Reality in the workforce reintegration process

4. Methodology

4.1 Positionality statement

In qualitative research, the researcher is often set to explore concepts that are in their own area of interest. Sometimes this interest stems from a personal experience or social attributes (e.g. gender, sexual orientation, political beliefs, nationality etc.) that has a profound impact on the researchers' epistemological assumptions. Researchers are the tool of data collection so their perspective might influence the interpretation of the analysis results. That is why it is important to acknowledge their positionality and address their inherent biases. In order to do that, self-reflection and reflexivity is a core component of this process (Darwin Holmes, 2020).

It is worth noting that the researcher of this study comes from an IT developer-based background, therefore, he has a technical perspective throughout this research. This means that the focus will be on how this socio-technical system of people and VR can become more human centered through a set of values.

Due to the fact that the researcher's intersectionality (belonging to more than one vulnerable social group) there is a strong sense of social sensitivity and equity. Thus, he is sensitive and empathetic towards vulnerable social groups such as the participants of the research and he has an additional reason to prioritize the values and concerns of these stakeholders that are directly affected by this technology but have the lowest power to influence its design. Therefore, a point of consideration should be the objective value analysis and prioritization that may emerge from the data collection and analysis.

Even though the researcher is interning under KLM and the company has set some requirements for this research, there is no "desired" outcome that is expected from this study. Both parties want to improve and support these groups and the core values of the research lean strongly are strong towards social advocacy, equity and inclusion.

4.2 Research design

The exploratory nature of this research dictates qualitative research, conducting a case study involving mixed analysis in accordance with the case study guidelines from Eisenhardt (1989). This method was chosen because is ideal for inductive reasoning and theory building. The research tries to observe a contemporary phenomenon that happens in a real-life setting, with an aim guiding VR technology implementation in the reintegration process through a human-centered approach.

The unit of analysis of the case is the employees of a commercial aviation company, KLM.

The company's resources on Virtual Reality technologies (infrastructure, technical expertise, local knowledge), in combination with the adaptability and feeling of safety that such VR systems offer (Chittaro et al., 2018; Dick, 2021; Schmid Mast et al., 2018), were utilized to understand its potential on the reintegration process.

There are already some a-priory constructs in the VSD theory that helped to base the interview questions on better groundings as mentioned in *Chapter 3.* More-over inspiration for the research design, questions, and method of analysis was drawn by similar research (Smits, van Goor, et al., 2022). Smits et al. (2022) conducted value-oriented interviews including a VR intervention to understand the important values of patients in the context of chronic physical pain and how these values were mediated by the VR experience.

4.2.1 Sampling method

A total sample of 13 participants was recruited for this study and consists of several stakeholder that are involved in transforming the reintegration process of cabin crew employees as shown below *(see Appendix C)*:

- 9 Cabin crew employees under reintegration
- 1 Company doctor in the reintegration process
- 1 Virtual Reality manager
- 1 Cabin crew manager
- 1 Virtual Reality Designer

The cabin crew employees that were recruited for the study, currently undergo their reintegration process after absenteeism. As such, the employees were approached while working at the nursing home and after being explained of the research study, they were asked to come forward if they wanted to participate.

4.2.2 Data collection methods

For this research, there are a lot of variables of interest that are analyzed and multiple sources of evidence that needed to be triangulated in order to underpin the objectives of this research.

This case study consists of two phases:

1) **Semi-structured value-oriented interviews with the indirect and direct stakeholders** informed from an initial stakeholder analysis (*Appendix Figure 3*) took place.
    - The aim of the interviews with the indirect stakeholders was to gain understanding of their role in the context of workforce reintegration. These interviews pinpointed the values and motivations for the intended use of this technology. This enables to enhance the empirical factoring while also contributing to the conceptual factoring through mapping value trade-offs and conflicts.

    - The interviews with the direct stakeholders focused on understanding what is important to them regarding their workplace, their concerns and needs with the reintegration process. This information helped enrich the empirical factoring of the research.

2) **VR testing sessions,** with cabin crew employees under reintegration were conducted, with the prototype VR system to provide insight regarding the technical investigation of the research. Each VR testing session included the employee using the VR, the company doctor to ensure the medical safety of the participant and the researcher. The purpose was to express their views on VR in terms of usability and functionality and also for the researcher to gather data through observing their reactions while using this technology. Through this investigation, the aim was to derive the values already embedded in the VR system and the bottlenecks. A brief tutorial was introduced to all the participants before the start of the session, in order to support them on using the VR headset and navigate through the content.

Table 2: Participants and data types collected

Interviews	VR testing session observations
Cabin crew employees under reintegration (9)	Cabin crew employees under reintegration (9)
Company doctor in the reintegration process* (1)	Company doctor in the reintegration process* (1)
Virtual Reality manager (1)	
Cabin crew manager (1)	
Virtual Reality Designer (1)	
*Company doctor's insights and observations during their participation in the VR testing session are transcribed and utilized as qualitative data	

4.2.3 Virtual Reality application for the reintegration process

The developed VR application of KLM, called *Virtual Vitality* is a first-person view, 360° environment, consisting of pictures and videos, that shows the typical tasks of a cabin attendant (see *Appendix D*). The participant sees from the eyes of a cabin attendant that is at home, checking the flying schedule. Then they prepare for the flight, wearing their uniform, going to the airport, attending the pre-flight briefing meeting with the rest of the flying crew, boarding the plane, and reaching the destination. The goal of *Virtual Vitality* is to expose the reintegrating cabin crew in a typical day of work in order to make them recall the experience of being back to the workplace in a controlled and stressless environment. This approach shows similarities to typical Virtual Reality Exposure Therapies (VRET).

4.2.4 Extracting sensitive data through trust and empathy

Considering that the majority of the participants might have been encountering physical or mental challenges, it was necessitated to follow a cautious approach while extracting such sensitive data. During the data collection, several measures were taken to inspire trust to the participants. This was to ensure that they felt secure and comfortable sharing their experiences. First and foremost, the security and privacy of their data was emphasized, assuring them that all information would be anonymized to protect their identities. Moreover, the risks associated with the study were explained and how these risks would be mitigated through an informed consent form (*see Appendix F*). The researcher clearly communicated the purpose of the research, highlighting that it aimed to improve their working environment and provide a platform for them to express their thoughts and

concerns. This focus on their wellbeing and the betterment of their conditions was pivotal in fostering a sense of trust.

During the interviews and the user-testing sessions, the researcher demonstrated complete empathy, ensuring a supportive and understanding atmosphere. He was mindful not to push participants into answering questions that made them uncomfortable. By carefully observing their attitudes and reactions throughout the sessions, he was able to understand when to proceed with more sensitive questions respecting their comfort levels at all times. During the interviews, the researcher was reflecting himself on questions like : *Should I ask question (X) now ? / how open is this participant to answer question (X) truthfully / Is this person comfortable in answering question (X) in front of the company doctor?* , or shared similar self-experiences in order to connect with the participant on a deeper level, in order to build a sense of trust and honest connection. This empathetic approach was essential in building and encouraging open and genuine communication, and as such the interview sessions were customized for each participant. managing to enrich the quality of the data collected for this study.

4.2.5 Exclusion criteria

It is important to mention that the Federal Aviation Administration mandates that flight attendants must be fully able to use all five senses, as well as being physically able to move efficiently within a plane for safety purposes. Therefore, these characteristics pose automatic exclusion factors in terms of who would use the technology of VR in the context of cabin crew reintegration and thus who will be interviewed. Moreover, participants with pre-existing binocular vision abnormalities, epilepsy, severe clinical anxiety were excluded from participating in the VR session.

4.2.6 Validating the results

To ensure reliability a case study protocol was maintained, including an organized database to secure the data of the experiment, as well as a chain of evidence. For robust construct validity, as mentioned earlier, multiple sources of evidence were be used to triangulate between pre-existing literature & documentation and research observation data during the user testing session. Also, it is important to provide a draft of the case study report to the participants to ensure that it is in line with their experience.

5. Results

The data gathered were analyzed using thematic content analysis which enabled the identification of themes in the data in an inductive way. No a-priory concepts were used to code and analyze the data. The themes that emerged through the open coding represent patterns or meaningful responses in the data that are pertinent to the research question. This analysis followed the 6-step process outlined by Braun & Clarke (2006): transcribing the data, familiarizing with the data, generating initial codes based on participants' responses and grouping similar text units together to form provisional themes. Due to the fact that these text units could belong to multiple themes, they were carefully reviewed to ensure they comprehensively represented the data within each one and aligned with their respective definitions. This detailed approach allowed to extract meaningful themes relevant to the research objectives and the research questions. To help with this process, the software of ATLAS.ti was utilized. 821 quotations and 390 codes were generated during the analysis of 13 interviews (100 pages of transcripts) and observations from the user-testing sessions.

5.1 Stakeholder investigation - Empirical factoring

5.1.1 Stakeholder Analysis Results

Based on the stakeholder analysis (see *Appendix C*) we can derive a clearer understanding of who is the direct & indirect stakeholder of the Virtual Reality technology in relation with the reintegration process.

As direct stakeholders of the technology we identified the stakeholder groups that the technology is used by and targeted at:

- Cabin Crew

As indirect stakeholders of the technology, we identified the stakeholder groups that are not the direct users of they are impacted through the use it.

- Cabin Crew Managers
- VR Managers
- Inflight Services Director
- XR Department Director
- Government Agencies (UVW)
- Flow Reintegration Coordinators
- Reintegration Managers
- Nursing Homes
- Cabin Crew’s families

As both direct & indirect stakeholders of the technology we identified the stakeholder groups that even though they are not the direct users of the technology, the are using it in an indirect way.

- Company Doctors
- VR Designers

Following Bryson's (2004) stakeholder analysis technique, the power-interest grid, the following stakeholder map (see *Figure 4*) was constructed. This map presents the direct &

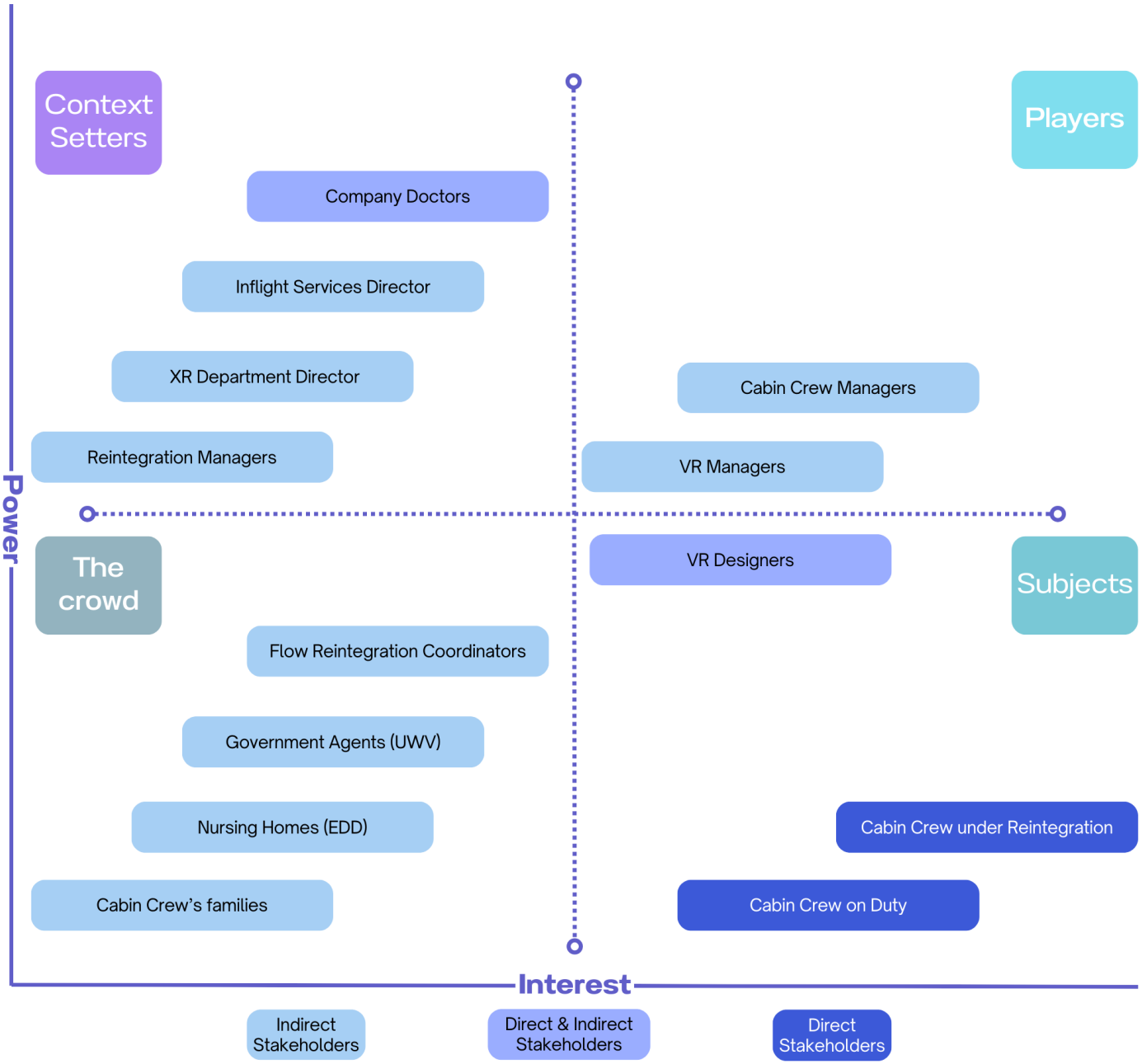

Figure 4: Stakeholder Power-Interest Grid

indirect stakeholders that are involved in the reintegration process. The x-axis (Interest) of the map represents the stakeholder's interest in the process at hand (implementing Virtual Reality technologies in the reintegration process of the cabin crew) while the y-axis (Power) shows the power to influence the process. The map is divided into 4 quadrants:

- The *players*, who have both an interest and significant power
- The s*ubjects*, who have an interest but little power
- The *context*, *setters* who have power but little direct interest
- The *crowd*, which consists of stakeholders with little interest and power.

5.1.2 Needs & Concerns in the Reintegration Process

5.1.2.1 Cabin Crew

The Cabin Crew members are **direct stakeholders** because they are the main users of VR in the reintegration process, by interacting with it physically, and this having impact on them both physically & mentally.

The interview questions (see *Appendix D*) explored the views and experiences of the cabin crew regarding their reintegration process in the nursing home.

5.1.2.1.1 Reintegration Process

Work-life balance: One of the primary themes that emerged is the importance of work-life balance that the reintegration process allows compared to a typical working set up.

> CC6: "*I'm sure I'm not working every weekend at this moment and that's fairly really great with the with the kids*"
>
> CC5: "*I mean, I can go to the baby, of course*."
>
> CC7: *"[..]but what I really enjoy is time with family and friends. And if they ask, are you available on this in this date? You can always say yes, every evening, every weekend. It's incredible. And so that's what I really enjoy."*

Autonomy and Flexibility: Another recurring theme was the sense of control over their schedules and the ability to adjust their work hours and tasks.

> CC6*: "[..] it is really nice for a longer period not to be subject of the scheduling"*
>
> CC5*: "So that and that really gives me a happy feeling. So I I'm really happy to come here and not have to worry that I go back home three days from now. So that's really exciting. And I love making music. I play a little bit the violin and the piano, so I'll*

take the instruments to different floors in the nursing home and amuse the people and they really like it. So for me it's win - win because I get to play, which is my hobby and they get to enjoy. And so for me, if the day is filled with music, then yeah, it almost feels like I'm a kid at the playground the whole day"

Physical wellbeing: Interviewees stressed the importance of having healthier sleeping habits during this period, a working environment without time and temperature differences, the possibility to take better care of their health, and the chance to focus more on healthy ageing.

CC4*:" Because now I'm feeling how it is to live a normal life and to sleep well without a time difference and would without all the differences in temperature."*
CC7: *"Uh, it was good because I finally can sleep during the night. Sometimes I do miss my job because sometimes I don't. But I mean, it has perks"*

Mental wellbeing: Interviewees also appreciated that during the reintegration process they had the ability to focus on their mental wellbeing.

CC3: *"I can also be in therapy now, but not only for this. [..] but, they are teaching me and helping me to get in touch with my feelings. [...] But sometimes when something like this happens or other things in life that affect your emotional health, I didn't know how to deal with it very well. And now I'm learning that. So, allowing these feelings, going through the process and it helps me with the healing process"*

CC6*: "I now have the distance to go back to myself. And the longer it takes, you really feel like the part why you like flying so much? Because it's your way of living. It's not just a job, it's so much more and so much larger and wider than than just that.*

Purpose & meaning: Among the things that participants perceived positively in the reintegration, they seemed to value the fact that this type of work gave them a sense of purpose and personal fulfillment.

CC1: "*I specifically like here is that what has been lacking with my job a bit is the thankfulness of the people here"*
CC3*: "it's a work that has in my view, a lot of meaning because these people here (in the nursing home) they are so grateful and so happy when you really give them attention and talk to them and ask them questions because these elderly people"*

Organizational support: In regard to the support provided by the company during the process, the majority of the employees expressed that both their managers and the company doctors had been understanding and supportive towards their problems.

CC1: *"So when I called in really sick they realize something was going on. So I guess that made it maybe a little easier. I have all the I have all the cooperation from the company, from my manager, from the doctor. [..], but the I felt a lot of backup that that made me feel very good. [..] And then (my managers) by telling me that there was no hurry, so I felt I could I could let go.*

Workplace disconnection: Employees also expressed concerns in regards with the setup of the current reintegration process in being disconnected from the airport context, duties and routines. Many of them felt worried that they had been disconnected from their workplace and thus, they felt uncertain about their transition back to work. This

CC5: *"I feel that I really like my job in the air but the longer I don't do it, the more I don't wanna go back. So I'm really (disconnected)"*

CC8: *"Well, when you're here, you're completely cut off with KLM airport and nothing. People here don't go on holidays anymore, and so you're only with your colleagues. So you're completely cut off."*

CC9: *"Because you're not working so long and it feels like a whole big thing. So you feel disconnected from your work."*

The following mindmap provides a visual overview of the themes and the links between the themes and the codes. The colors are used to indicate visually the connections and relationships between the themes and their codes (see *Figure 5:*)

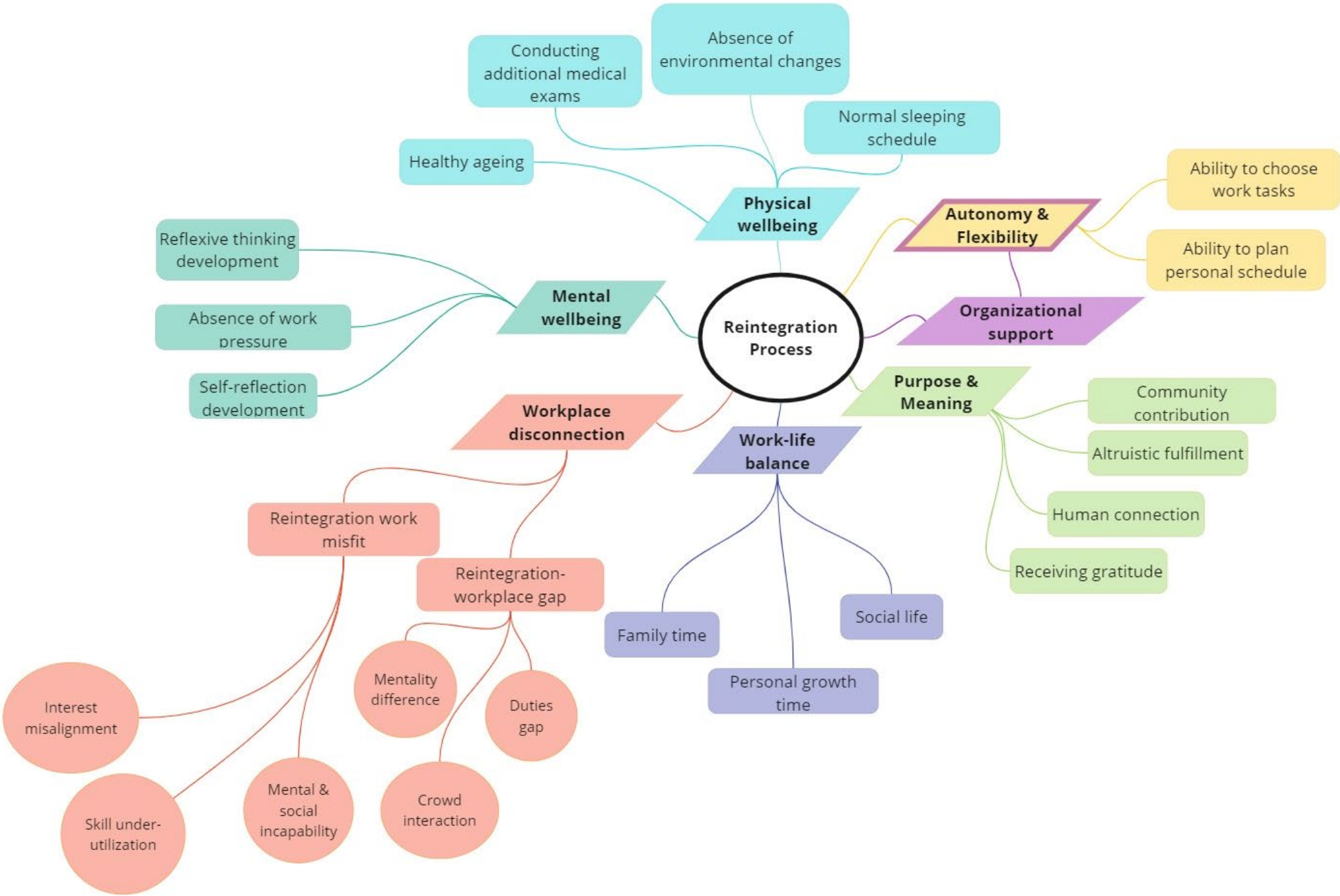

Figure 5: Cabin Crew Values and concerns in relation with Reintegration process

5.1.2.1.2 Returning to Workplace

During the interviews, the cabin attendants mentioned that in the workplace they enjoyed the component of interacting with other people and they valued the ability to occasionally use the overnight hotel layovers to different places around the world as some time for themselves.

Purpose & Meaning: The participants found that, to an extent, the human interaction at their work gave them a sense of fulfillment.

> CC1: *" I do like the the moment where I can create the atmosphere. Like for passengers, to set up the welcoming atmosphere and for the briefing the to set the feeling for colleagues to be comfortable so that that my makes me feel comfortable for some reason.*

Mental & Physical wellbeing: The cabin crew valued the ability of having work travel as an opportunity for them to have some personal space, relax and take a break from home stress.

> CC5: *"So, I also feel like an escape when I am going to work. [...] so somewhere there's almost a hunger for me to go to the hotel room (after the flight) just to sort of be alone." /* CC8: *"So when you are in your room you are happy again because you can take everything off. This is the best part, is the relaxation after work. No stress from home. You leave everything here and your work is done. Time to relax."*

However, several concerns emerged when cabin crew members were asked what concerns them in relation to returning to work. The main themes that emerged referred to:

Physical health concerns: People mentioned that due to the nature of the work they do, they have unhealthy sleeping schedules, and also there are concerned with their aging and proneness to physical injuries when returning to working as cabin attendants

> CC6*: "So, when you open a door, and a container, I cannot do it over my head right now because I am injured, but you have to do it a lot over your head because of the galleys, they are equipped liked that, and then the door does not open, the drawer does not open, that makes a lot of impact on your physical health"*
>
> CC6: "so *the flight back is always during the night, which is the time that your body wants to sleep and it's so frustrating*."
>
> CC7: *". So, our lack of sleep is very bad for your health, but we have colleagues who work full time and can do it easily. But if I ask like, could you sleep in advance before the night flight? They say "yeah, I had three hours of sleep" and I am like OK, that's the difference"*

Mental health concerns: A reoccurring theme is the pressure that comes from their work duties due to time pressure or the necessity to deal with overwhelming feelings.

> CC1: " *You know, when you arrive in the BMC, have so many minutes for the briefing you have to go to the aircraft and then the security is full. The time is ticking here and you have to be at a certain time there, and this is, without you yourself realizing, I realized it when I became sick, that the time pressure is always there, that makes me for some reason feel stressed"*
>
> CC4: *"Any part of flying cannot be compared with the mental impact with the job on ground. Our whole life, the area around the airport is already confronting us on so many parts.* [..]*You have to cope again with a lot of prickles, noise and people walking around you and you really have to be fit for that."*

Unhealthy work culture: A very common theme emerging from the data referred to the emotional and physical burden that the overexertion culture of the position imposes, e.g. the incapability of having family/social/personal time when working, the absence of ingenuity with themselves and with colleagues, the peer pressure and performance guilt.

> CC6: *"So, if you are working, that means that you skip a lot of things in the evenings you're not worth anything anymore, so everything you do is always a choice you always have to choose today I work I cannot do anything else, tomorrow if I do one little thing then. So, all the things that I would prefer to do with all the time that I do not fly. However, when you fly, it's all limited. Everything you do is limited and adapted*."
>
> CC5: *"I would feel sort of, yeah Poker face, I guess. I feel like I'm sort of faking It/ caring a secret slash pretending I'm fine and that everything's OK. [..] This is very much small chat. Feel like there's always a lot of poker faces in the briefing. This is very blah, blah, blah."*
>
> CC3*: "Sometimes you come in a destination and it's a short stay like 24 hours and everybody goes and do his thing, you never know what happened. So always good to give your phone or room number and sometimes we don't do that. I think that is very important if somebody gets sick, because you know anything can happen. So yeah, I think genuine communication and getting in contact and stay in contact with your colleagues is very important.*

CC4*: "It is the culture, but also our characteristic to be focused on the job. We want to be the best for our bosses, never go on striking and every time we want to do the best, to get more results, to get more money for them, and I don't know why. That's me, I'm blue. We are all blue, like Smurfs, brainwashed like that*

CC1*: "We have a lot of people who continue flying when they're actually sick*

Organizational shortcomings: The interviewees disclosed their concern in regards with issues that emerge due to the absence of attention to the unfunctional flight materials or the inflexible flight roster, organization-wise.

CC6*: "Because of a lot of catering material doesn't work very well in the last years even before the coronavirus, the quality and the status of the material gets worse and worse and worse. So that makes that when you open a door, and a container [..] a lot of impact on your physical health. But there is a lack of technicians so it's more important to have the aircraft fly, and of course sure to be safe but the catering material is not even a priority."*

CC5: *"You know, because often we go (to fly) of course, even though we were in a fight with a partner or even though something is going on, you still go and unfortunately the reason is the unflexible roster. "*

Job unsatisfaction: An important finding during the interviews was that more than half of the participants mentioned that the satisfaction that they received from their work in the air shifted.

CC1*: "Yeah, I've been working for 20+ years. So OK, I've been doing it a lot and well recently for some reason the joy went away a little bit. / CC8: "I don't miss it, I am okay here [..]. Yeah, I don't (want to return to flying). I'm OK here (in ground work) because I know what I have right now, but I also know what the job is."*

CC9*: "And I think for everybody that's flying like 20-25 years, we all have the same feeling (of not wanting to fly) before we go into the flight nowadays. because we changed."*

Concluding, the following mindmap was created to show the links and connections between the themes. The colors show conceptual connections between the themes and relate to the concepts of *Figure 5.*

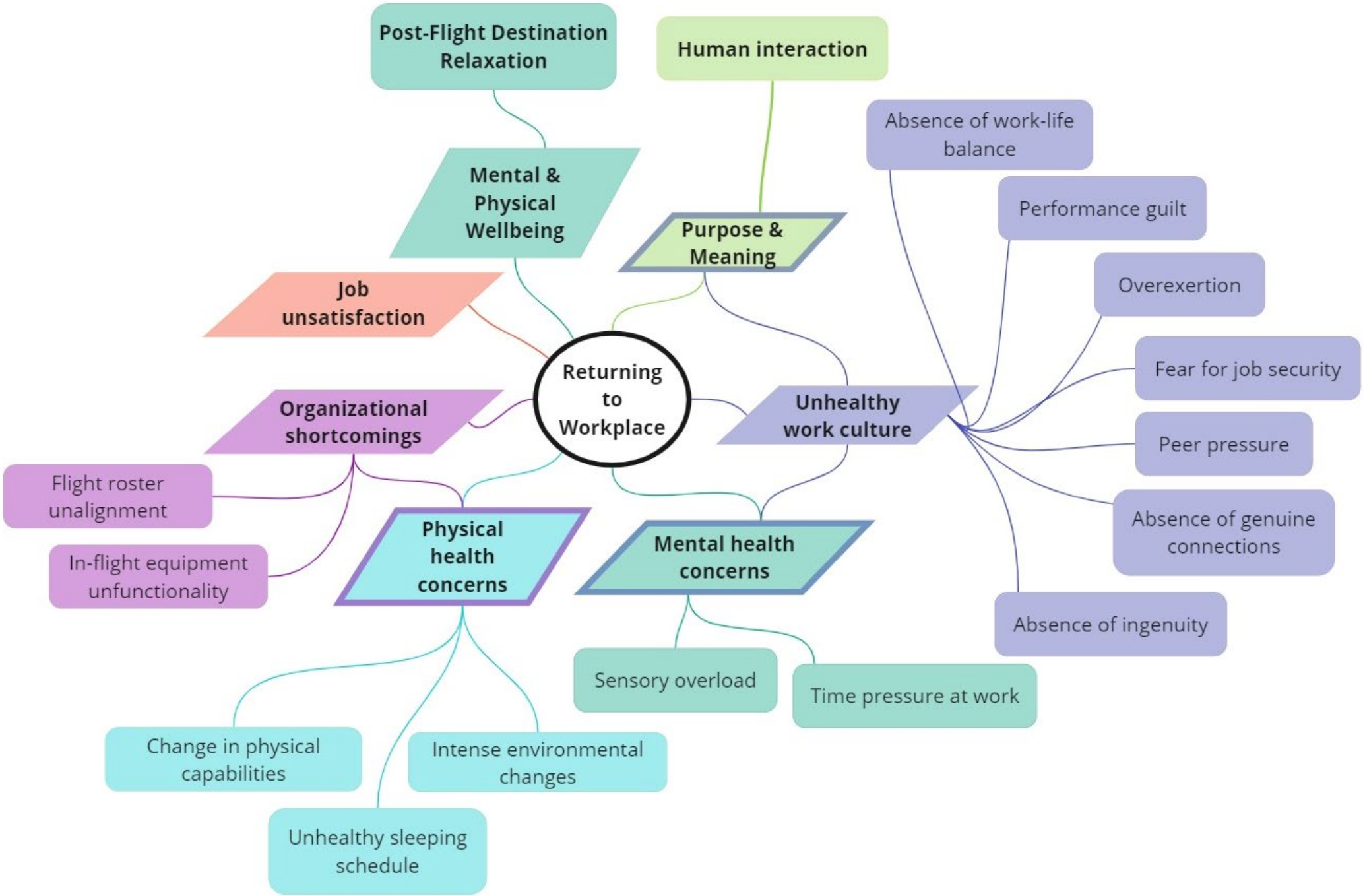

Figure 6: Cabin Crew Values & Concerns in regards with Returning to Workplace

5.1.2.2 Rest of Stakeholders

5.1.2.2.1 Company Doctor results

The CD belongs to the **direct and indirect stakeholders** of the design, because even though they are not in direct physical touch with the technology (indirect stakeholders), they can derive insight for the reintegration stage of employees directly through observing the patients' reactions while in the VR environment. In a way, they use the VR as a diagnostic tool (direct stakeholders).

Since the company doctor was present during the VR sessions, the interview questions (see *Appendix D*) focused on understanding the perceived concerns of the doctor in regards with the reintegration process in the nursing home and their values related to the whole reintegration process. During the user-testing sessions, the company doctor observed how the users interacted and reacted with VR and as such, that person was asked about the usability of the technology from their own perspective.

Employee Wellbeing: one of the main themes that emerged from the company doctor is to ensure the health and safety of their employees before returning to work.

> *"What I tell them (my patients) is that they need to get their physical condition better and their mind in a good state and a lot of extra things that they have inside, out. But after that, it is safe to (return back to work) fly."*

Collaboration & Trust: To facilitate a good reintegration, the company doctor found the component of trust with the patient to be very important in the process. As such, the company doctor's perspective refers to the employee's attitude towards the reintegration which plays a significant role in getting them back to work.

> *"What's very, very important is the connection. So there's trust and people believe in your relationship. To build that up. So if there's trust it can create a good plan. [...] "So you build up something so together (with the CC) you working on coming back to work. Uh, I think that's the most important part for a successful reintegration"*

Workplace Connection: The company doctor recognized the existence of absence of connection with their regular work duties, when cabin attendants are in the reintegration process.

> *"Because what we know and the cabin attendants are always 100% off work if they are sick. They are straight away out of the job there and they have no connection feeling with their colleagues and the work. [..] So they are always away from work straight away and it gives distance because you cannot fly just a little bit."*

5.1.2.2.2 Cabin Crew Manager results

The Cabin Crew Managers (CCM) are **indirect stakeholders** of the VR in the reintegration process, since they don't physically interact with the technology, neither they are indirect users of technology, however the implementation of VR in reintegration could directly impact their work by improving the quality of support they can provide to their employees and by contributing to reduce absenteeism rates.

Employee autonomy in reintegration: The cabin crew manager mentioned that the reintegration process is designed to offer people the ability to choose how to reintegrate back to work and this is very important for them.

> *"I think we are a very social company, so we give people space to let the (reintegration) process run. So that's very important. "*

Employee wellbeing: The cabin crew manager mentioned that one of their main responsibilities is to focus on the long-term wellbeing of their employees.

> *"(I try) that all the environment safety, health, everything is ready, set and go so that people can grab it, use it and do it. [..] so I also want our cabin crew members to feel fit and vital, and that we give them everything they need to have a good work environment"*

Unhealthy work culture: The cabin crew manager perceived the work culture in the position of the cabin attendants as problematic. This was due to the lack of communication and collaboration between cabin attendants and their superiors. Moreover, the difficulty in integrating a growth culture in this position was considered worrisome for the employee's sustainability as they age. At the same time, it was perceived that the loose boundaries in the reintegration process may sometimes be misused to extend or repeat the absenteeism duration.

> *"This is very difficult. That's also on the dynamic that if you're a ground manager, but you focus, your people are in the air. So how do you stay in contact? So, engagement is very important, but how do you engage from such a distance?"*
>
> *"I think we as a company we should have stricter rules also, more on the process. We're not focused on the process. We're on the people's side which is completely nice and good, but you also need to set boundaries. We don't set boundaries. [..]. But I have to say most of our employees are all better before we fill in that form and that's the problem. So they're better and then a couple of years later, they do the same absenteeism again."*
>
> *"I don't see the levels we need from them to become a focus on an all-around strategy. They just focus on the passenger and on the culture of the cabin crew on*

that specific flight and not on what the company needs in the long term. [..] There are educational budgets and tracks for them to grow but they don't utilize them. This is very difficult."

Workplace disconnection during reintegration: The interviewee recognized the existing gap between the reintegration process and the work environment.

> *"Because uh, it's very difficult for a cabin crew member to relate to their own work (while reintegrating) if their own work is on 10,000 feet, how are you going to bring them back? [...] There is a big gap between other work (nursing home) and your own work. You cannot work for 10 minutes in the air and just go back."*

5.1.2.2.3 Virtual Reality Manager results

The Virtual Reality Managers (VRM) are **indirect stakeholders** of the VR in the reintegration process since they don't physically interact with the technology in this context, and they are not the users of technology. However, the implementation of VR in reintegration could impact their work through the financial cooperation with the IS department, and create the opportunity to innovate further the technology and digitize traditional process (indirect stakeholders).

Employee wellbeing: Through this project, the VR manager's value is to provide self-awareness to the employee before returning to their regular workplace

> *"If you are not ready (to go back to work) but very proud, but you say you are ready and you don't want to lose face, people go back to work too soon. And that's one of the most important things, because if you say, "I'm really apprehensive" this is a real emotional thing that could mean you are not ready to go back because if we send you back too early you might relapse again. That is what we try to do. [..] but now we've got a tool, at least that's we're trying to make, that can pinpoint if you're ready or not."*

Employee autonomy in reintegration: Another value for the VR manager is to provide the ability to the employees to reintegrate in their own terms.

> *"And also, it is important for us to give the control back to rehabilitate on your own terms."*

"It might also help you normalize the process for yourself because it's coming closer. So, you, instead of being confronted with getting on the bus, sitting in front of the building, can do this in your own pace. [..] So yeah, you know, the idea is is to give you back the control."

Customization: An important value for the VR manager is creating a VR product that prioritizes the needs of each reintegrating employee, through being inclusive in the needs of the users, immersive, while maintaining their privacy.

> *"[..]and that's why we are doing also this to find out, if something needs to be changed or if something concerned you just so we have a (VR) product that fits you."*

> **"***I think it would be a good idea to gather some information like how much time users spend in each step within the VR so we know what to improve, because now we don't have any data on it"*

Innovation: One of the motivations of the VR manager is the digitization of traditional organizational processes.

> *"So, the goal is for everyone to have their own headsets or something like that and for you to be in the procedures, not just noting down and to see them into 2D[…] That is what's happening right now, there are scenarios that you can follow procedures in a cockpit, digitalize processes so you don't have to be there. There are also a lot of different trainings"*

Unhealthy work culture: The VR manager recognized the difficulties in the work culture and duties of the cabin crew

> *"We've seen that we take a lot of people and then within three years, a lot of people, they stop. It's because they come across real difficult passengers. So, you take a lot of issues the whole time you know, they are constantly asking you questions."*

> *"[…] there's that kind of pressure in our company, and it stays like that every year."*

5.1.2.2.4 Virtual Reality Designer results

The Virtual Reality Designers (VRD) are **direct and indirect stakeholders** of the VR design since they are physically in touch of the VR when they need to change it or update it (direct stakeholders), but they are not the users of the technology (indirect stakeholders). The themes that emerged from this stakeholder group were the following:

Customization: The motivation of the VR designer is to enhance the user experience by allowing for a more personalized interaction with the virtual environment.

> "*So of course you it would be nice if there's personalization. If there's things that really are for specific target groups or things that are just different, like intercontinental flights European flights because they are different, they have*

different preparations, different group sizes. So, you want to be able to offer those kind things, customization"

Usability: An important value that the VR designer integrated while designing the system was for the environment to be easily operated through intuitive motions by the end-user without any technical issues.

> *"Making sure that it's simple to use in order to not have to explain too much. There's the hand gesture too. All you have to do as a user is to look at your hands and rest it, which I hope you would intuitively do anyway because you're like "oh, I see my hands." And then and then the menu pops up. So the goal was to make it simple to use"*

Purpose & Meaning: The motivation that was integrated into the VR in the design phase was helping and supporting colleagues

> *"I liked it (working in this project) mostly because I guess the easy answer is that I expect that it will help people, so that's nice that you can work on something that helps people."*

> *"So, I also try to imagine being a person with a problematic shoulder and I tried the VR and then I wonder if I would push myself a little bit further if this was my moment to show that I am further than I should be? Just because I want to and because I don't really feel the weight. So, would I dig my own grave basically?*

Mental Wellbeing: The VR designer acknowledged the incorporation of measures to mitigate potential risks related with the VR, like being accidentally overexposed to traumatic trigger points, and the system was built based on mental health treatment techniques.

> "So normally you would take a photo like a nice picture that shows to what chapter you're gonna be. But we had to take into consideration that we're exposing them (users) to pictures on things that they might not be ready for yet. And what I said a little bit before that the app should not trigger stuff accidentally. So there was quite some time in testing that you didn't press (next) twice accidentally, which sounds very normal for any app that you use in your daily life but the ones that do sometimes make stuff, they know that it can happen very easily. "

> *"It is focusing on people with other stress related issues but not the same kind of diagnosis where I searched out of interest, how is MDR for example used in the burnout. So now basically what this project is doing is extending that to both seeing whether the exposure in itself, is indeed there."*

Physical Impact: : The VR designer acknowledged potential risks related with the that might distract the users from their physical pains.

. *"VR is also used a lot in distraction for pain which is in this case interesting, Are you focusing someone on their limitation or are you distracting them because you still put them in the plane and that is the probably overwhelming. I don't know what side that is going to flip to. This is sometimes an advantage, sometimes not. Not when you want to evaluate if someone is pain-free."*

To showcase the intricate relationship between the themes that emerged from the rest of the stakeholders, the following mindmap was synthesized (*see Figure 7).* Triangles represent the stakeholders that express certain concepts, while squares represent these concepts or the absence of them in the context of work reintegration. A lot of these concepts among stakeholders are shared either by all, or by subgroups. The main shared theme among all the stakeholders is the *Mental & Physical Wellbeing* of the employees. These shared themes among stakeholder are presented with a bordered square connected to the interested stakeholders. It is important to consider that even though there is a significant power and interest difference among these stakeholders in the organization (see *Figure 4*), they are still all employes within the company. As such, even though during the interviews they refer to the cabin crew members, it is important to keep in mind that such a concept also is important to them. Again, the colors show conceptual connections between the themes and relate to the concepts of *Figure 5* and *Figure 6.*

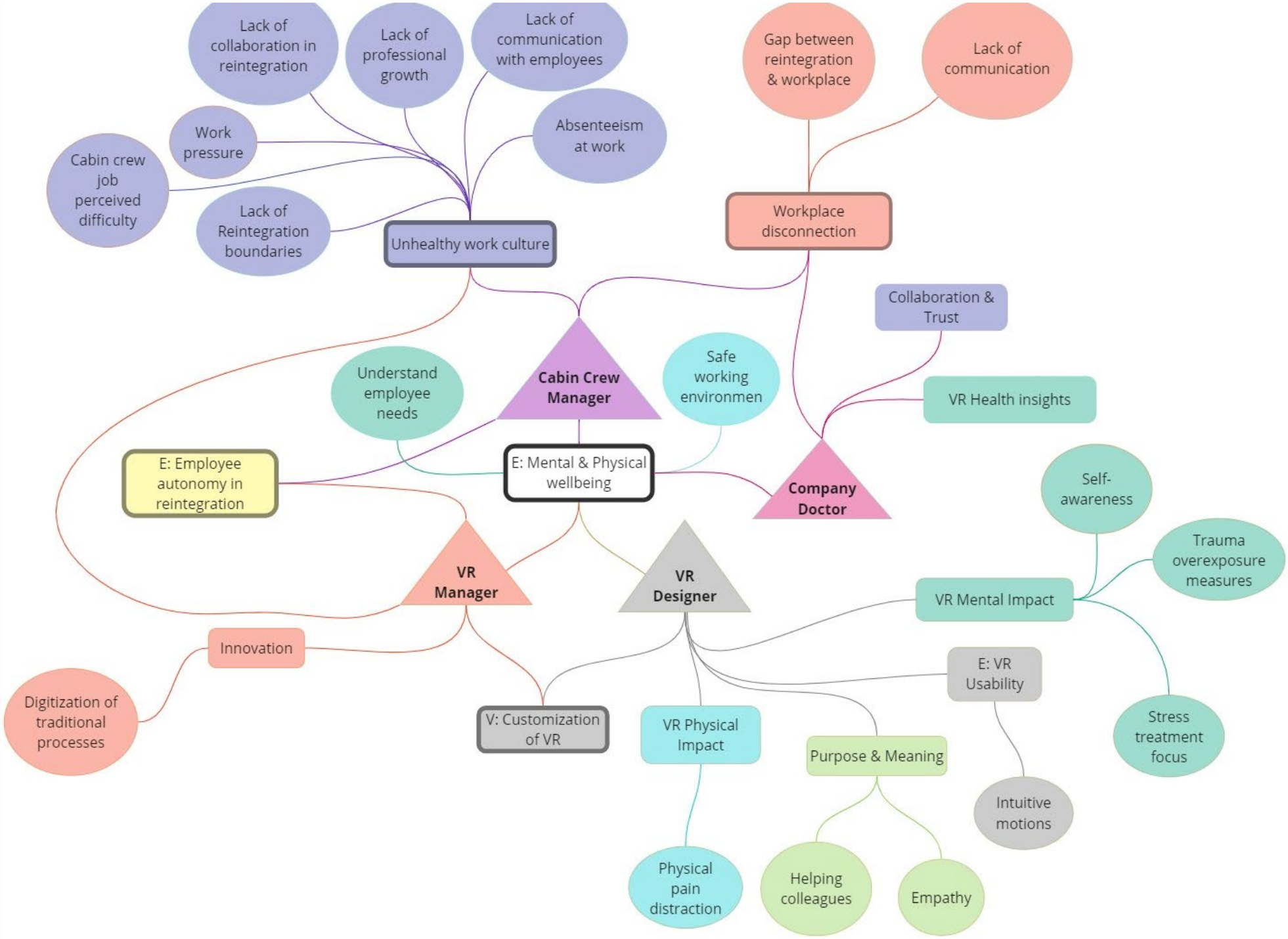

Figure 7: Stakeholder Values and Concerns implicated with Reintegration process and Virtual Reality

5.2 Virtual Reality investigation - Technical factoring

The user testing sessions revealed two main categories of themes that are important to differentiate. Virtual Reality Impacts resemble concepts that emerged during the interviews with all the stakeholders because they relate to human values. As the name of the category indicates, it shows the impact that a VR intervention can have on the users. On the other hand, VR Characteristics are the technical characteristics of the technology, and they resemble values related to technical system design.

5.2.1 VR Impact

Mental Wellbeing: Interviewees reported that by using VR they were able to understand their feelings about returning to work, got insight in their stage in their healing journey, and also felt that this intervention contributed to their mental recovery.

> CC1*: "And this gives me the feeling that I was, uh, expecting. So, for me that means that this is a good. Uh, already a good test. But it helps. So crazy. This is also the feeling it's generating"*

> CC2: "*After this (the session with VR), I think I'm ready to go back. It sounds like it".*

> CC4: *"You know that the gap between flying, and my personal feelings is getting more and more wide. After this VR experience, it feels like I am confirming myself."*

> CC3**:** *Yeah, I'm surprised that that now these feelings are coming back again. So, I think it's very helpful to know it in advance or even just to go home in this afternoon and just think about it. It's different than if you haven't experienced it yet, and you have to deal with it in your (redacted) room, you are like surprised. But now I'm not surprised anymore, now I know if I'm OK, maybe I get sad if I go back to work, or maybe not. I think this is very helpful. Just to be this step to be an option. Yeah, maybe it's something to think about when I go home as well. So, when & if you do this like a standard thing in a real integration process, I think it's helpful that people can think about the things that are going to happen in the journey because sometimes you don't know until you experience it"*

Safety & Control: People in the VR environment mentioned that they perceived a feeling of safety in the environment and control over their own reintegration process by avoiding real-life consequences of returning to work.

CC1: *"It just shows also my concern and exactly how I thought I would feel when I entered the BMC for the first time. But now I can do it at home instead of being there in my uniform, more safely […] And in this situation with VR again you copy that situation without all the consequences. If it doesn't work, it's alright (no harm done)"*

CC3: *The (virtual) environment is nice. Its cozy. Most of the times it's crowdy here (BMC), people coming and going. But you know, I like the atmosphere as it is.*

Workplace Connection: People reported that they were reconnected to their regular workplace after the VR session, through perceived physical sensations, their invoking feelings of being back to work, and being able to remember their work duties and tasks in an instant.

CC8: But *there's nothing here that you can prepare for like you can already start intervening with KLM anymore. So, I thought VR is really nice. You can do that here too, there are many empty rooms. You can start by doing this (the VR) slowly or I don't know right now, what's on the on the thing on the VR, but still be here and I think that's nice.*

CC5: *"I can feel the smell of the airplane again!!!! (surprised). I can smell it. It's funny, isn't it? The coffee too! Wow!"*

CC8**:** *"I remember I have to do the flight safety again. [..] The funny thing is, I said that before, being here makes that you're sort of completely cut off with the work you do. But now when I am looking at it, I'm back in an instant, checking if everything is done according to order."*

Thus, VR could be used to bridge this perceived gap of within the process before moving from the current reintegration process in a nursing home, towards the airport.

Mental impact: It was observed that people in the VR were exposed to traumatic experiences that triggered some kind of emotional response, either by being exposed to environments relating with their reintegration reason or inducing some kind of fear.

CC1: *"Can I take the headset off for a minute? *gets emotional*, I just don't understand whats happening to me. *cries and takes some time* [..] It's uh funny, that's exactly how I imagined that if I would see an empty plane or empty BMC, I would be OK with it. But now (in the VR) as soon as I see the people coming in or feel the start of the flight and it makes me nervous. [..]"*

CC5: "*I get that if I stand up, I'm not gonna fall. I realize that I'm in the room, but I cannot see my feet."*

Physical impact: Some participants had a motion sickness-like experience in VR, which is visually induced instead of the actual movement, but also tried to do movement that triggered physical pain in their body not considering their physical health problems.

> CC2: *greets the virtual passengers coming in the plane* I feel like I'm getting a little sick - dizzy.
>
> CC9: *"(tries to look around in the 360o environment and stops) It is a little bit difficult for me to do this while sitting due to my (condition). "*

Health insights from VR: During the VR user-testing sessions, the company doctor could pinpoint the reintegration stage and the mental state of the patients.

"So why not use VR. Because work is a big stressor especially if you have psychological problems, work is a stressor because it's demanding, and then you can. So, you can expose them to the job and see what's happening inside their head."

"If you have somebody in your speaking in your consultation and you ask, how did you find the VR and what was happening, that already gives insights. For me, there were no surprises. I know that for some people it was amazing even overwhelming. I can really use the tool as I expected it to be to see the steps in reintegration. You get that feedback straight away from every person you know, as a company doctor, in what do they need to make a good plan reintegration plan."

To CC1: " *This is the process, it (your reaction in VR) shows the place you are. A few weeks ago, this reaction would have happened when you saw the bus, or the first picture. I hope you can be comfortable with this"*

To CC2: *Your journey there are a lot of things that you're being like. Ohh that's not the problem. Or maybe that might be the problem. Ohh no, that seems to be OK as well. So, well, what's she doing here? Umm, you are ready to move on.*

To CC3: "I feel like with your regular doctor you have to discuss this, but the information you gave it shows what's happening, it's very easy to solve for you. So, if you want to go back to work, and because the problem is not that you don't want to do the job, but you are afraid of the circumstances in the airplane (while flying) and you cannot change that because it has to do with the environmental conditions in the air."

5.2.2 VR Characteristics

Entertainment: During the VR experience, users expressed views that showed that they found the environment funny and enjoyable.

CC5: **Starts laughing hysterically* This is really funny. Nobody really wants to admit they do it, but we all do it. Like, (when the crew asks you) "-what did you do? - No, I was just studying, you know? - I played the violin" and then you just die-hard binge-watching everything 24/7 so I think this is very real!*

Immersivity: The users felt the sensation that they were deeply involved within the virtual world to the point of detachment from reality.

CC1*: "Well, the look of it feels real and it's obviously not my house, but yeah, you're like, it's in your heart"* / CC6: *"Still it's really great that you have really impression to be there. Like the technology is good"* / CC7: *"I really enjoyed it. It is very realistic. It really takes me there, even that we are just chit chatting in between and I know I'm not there. I completely forgot this space. I'm completely gone that was very funny."* / CC8: *"It makes you feel that you're there."*

Accessibility: Participants with vision conditions (myopia) used the VR wearing their glasses, or use it while sitting on a chair, without the necessity to walk around in the physical environment and navigated in the VR with both left and right hands

CC7: *"Does it work with glasses, or I need to remove them? (Yes, it works)"*

CC4: *"It feels more safe to be sitting"* / CC2: *"Yeah. Can I sit down? It feels better*

Customization: During the user testing sessions, it was observed that people experienced some technical shortcomings that referred to more personalized features that fit their experience and their needs:

- **Content concerns**
  - Lack of long-haul flight journey scenarios - CC5*: "What aircraft is this? (737) Yeah, I don't really fly that anymore… Sort of strange. I only international so the feeling is not as real. So, it's more like a visit for me. I don't really feel triggered."*
  - Lack of a busier work-environments when the full scenario is chosen – CC8 *"This is really empty. Especially since I chose full. However, it is never this quiet maybe very late at night. Yeah, well, for me, personal, this is not realistic"*
  - Lack of acoustic stimuli on the surrounding environment – CC9: *"It's very quiet now like if you're flying alone."*
  - Lack of in-flight related content – CC3*: "Uh, so where is the flight? Where is the flight? Short flight? Very short flight"*
  - Lack of additional content during the transition from the plane towards the hotel room – CC5: "*Oh, I am at the hotel room already? That's a big step. That's*

funny that's really, really fast. No bus, no check-out! […] I can just imagine for other colleagues this would be a big gap."

- **Lack of interaction**
  - Preference for self-navigating through the environment (BMC, plane, gate) – CC2: *"Can't I go there? *Points to go to a certain position in the building*"*
  - Lack of interacting with the flight schedule tablet – CC3: *"Oh yeah, can I grab it (the tablet)?"*
  - Lack of interacting with in-flight objects (ovens, catering trolleys, luggage cabinets) – CC6: *"I would also like to do the physical part, opening stuff."*
  - Lack of interaction with passengers – CC6: *"Yeah, to be walking towards the passengers and five different people asking you things at one time. These are maybe the things that you have to get used to it."*
- **Usability difficulties**
  - Another step for passengers coming in – CC8: *"Yes, I would like that because I thought that the next step was the passengers coming in, that's why I pushed the next button."*
  - Empty-full option difficulty -CC8: *"Overall it was easy to use, except in the beginning the full and empty option. I could not get that right"*
  - Tutorial necessity for VR (360o degrees, gestures, standing up) – During the session, the researcher had to explain to every participant the environment, the gestures to navigate around the environment and when the users should stand up or sit down depending on the scene.
- **Lack of accessibility**
  - Lack of a lower point of view – CC2: "*Oh my god!!! This is funny! It's a little, scary, it scares me! Because I think so high. I know I'm here (in a room sitting), but it feels like I'm a on top of there (the couch inside the VR)."*
  - Inability to use the VR with any other finger than the pointer – During the sessions, it was observed that users were trying to navigate in the VR using their middle finger, but the system wouldn't respond to it.
- **Lack of engagement**
  - Preference for less steps & faster content - CC2: *'Yeah, this takes a little too long for me. All the small steps to the briefing. I'm like, OK, I look around and then I like to continue, be there. It's takes too long. Should I stay for the whole briefing?"*

Figure 8 is a graphical representation of the links and connections between the concepts data. Again, the colors show conceptual connections between the themes and relate to the concepts shown in *Figure 5,* Figure *6 and* Figure *7.* The gray-colored concepts refer to the VR Characteristics, while the rest refer to the VR Impacts and relate with the concepts derived from the rest of the interviews with the Cabin Crew

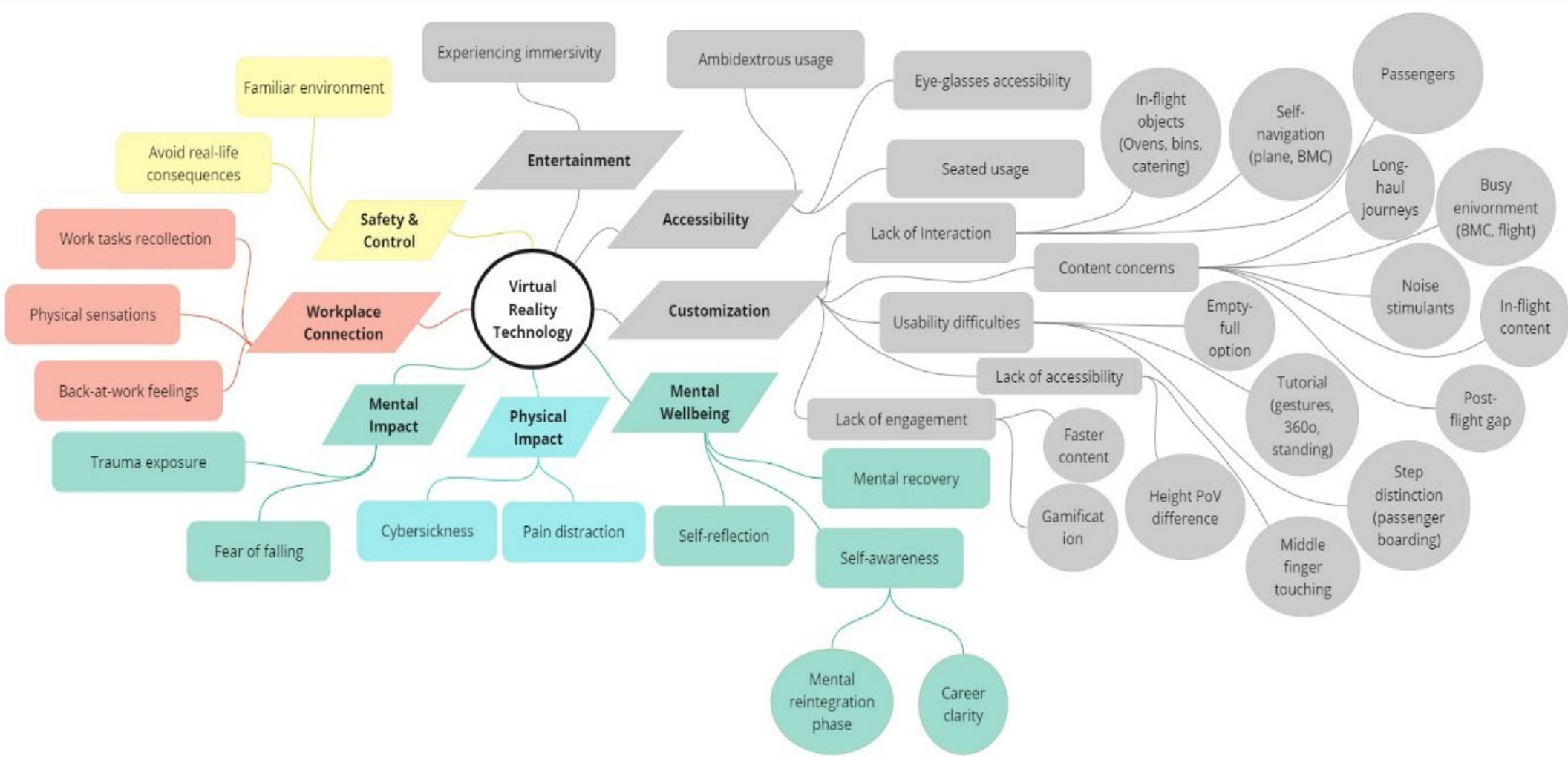

Figure 8: Values & Concerns implicated with Virtual Reality

5.3 Synthesizing the Virtual Vitality Model

Several underlying concepts worth striving for thus, identified as values, were discovered during the empirical investigation. Values such as ***Organizational Support, Work-Life Balance, Autonomy and Safety, Physical Wellbeing, Mental Wellbeing, Purpose & Meaning*** and ***Workplace Connection*** emerged as important for the stakeholders. Moreover, the values were sometimes discernable via the absence of them. Again, these values emerged as concerns in regards with returning to the cabin crew work duties.

Moreover, during the technical investigation, values such as ***Mental Wellbeing, Privacy, Autonomy, Usability, Accessibility*** and ***Immersivity*** emerged as important for the VR technology while designing it or values that the stakeholders found important to be designed into the technology through discerning their absence like that of ***Physical Wellbeing*** and ***Customization.***

5.3.1 VR's role in Reintegration

The results showed that VR holds potential to significantly support the reintegration process through its ability to mediate certain values that pertain within this context. It emerged while synthesizing the emerged values and shows the impact of the reintegration process and the return to work on certain values, and how these may connect with job satisfaction. The emergence of the aforementioned work values and the perceived absence of pressure, organization-wise, to return to work, were crucial for the cabin crew to feel comfortable in the reintegration process. It also highlights the impact of the Virtual Reality intervention on the emerged work values and the reintegration process overall (see *Figure* 9). In the following paragraphs the relationships of the intervention and the values will be explained.

5.3.1.2 VR and *Mental Wellbeing*

An important value that VR has the potential to mediate, is that of *Mental Wellbeing*. The VR intervention offered the participants the ability to self-reflect on their feelings and on the stage of their reintegration and at the same time the company doctor was able to derive insight on their psychological state and provide advice for their next steps. Moreover, the VR system was perceived as particularly beneficial for people that their absenteeism explicitly relates to psychological concerns. In relation to this, an astonishing finding was that even for participants that their absenteeism reason was not explicitly related to mental health issues, the VR intervention revealed underlying psychological burdens that could impact their return to work

> CC3: *At this moment, I didn't know that before going into this interview that it (the VR) would give me this reaction or that I would get this (psychological) reaction or when I go to a hotel for work, I never thought about it and like it's now happening [..]. So, I have learned something today, it gave me insight in my own reintegration."*

5.3.1.3 VR and *Autonomy & Safety*

The results indicated that the Virtual Reality intervention can mediate to the *Autonomy & Safety* value. This value was shared among the CCM, the VRM and the CC for several reasons. The VR design offered the ability to its users to navigate where they want to be, around the environment by choosing the scenes that they want to encounter, instead of having to follow all the journey from beginning to end. Offering such a tool to reintegrating employees and providing them the freedom to use it how they see fit, is in-line with the concept of *Autonomy* that the organization strives to achieve

> [CCM: *"I think we are a very social company, so we give people space to let the (reintegration) process run. So that's very important. "- VRM*: "*And also, it is important for us to give the control back to rehabilitate on your own terms."]*

Furthermore, the current design of VR doesn't keep track of any personal information related to the user, neither any data about how the user utilizes the software (e.g. for how long they stay in a particular step, or which step has the lowest engagement rate). As such the *Privacy* that is embedded in VR bolsters the *Autonomy & Safety* of the user.

5.3.1.4 VR and *Workplace Connection*

During the data collection, the cabin crew mentioned that while they were in VR they felt that they "*returned to work in an instant*". VR showed potential of leading to a significantly higher self-efficacy through helping the cabin crew remember their tasks, their feelings at work and even trigger plasmatic physical sensations in the plane environment. As such, the VR could compensate for the lack of *Workplace Connection* of the reintegrating employees during reintegration.

5.3.1.1 VR and *Physical Wellbeing*

The VR session didn't provide conclusive evidence in regards with the value of *Physical Wellbeing*. People with physical problems thought that it could help them understand how they would feel in the plane since it triggered physical sensations while at the same time, some of the users experienced cybersickness, and as such, this could have a negative impact into their *Physical Wellbeing*. In this context, interaction with objects within the VR environment was a reoccurring concept during the user testing. However, VR lacked the functionality to interact with objects within the environment. It is important to mention that during the interviews, it was revealed that several users were encountering motor-related issues, and their movement capacity was limited. As such, interactive features could directly impact the *Physical Wellbeing* of the users since that even though one cannot feel the weight in VR, the movements are still the same and the user is able to understand if they can at least perform the movement.

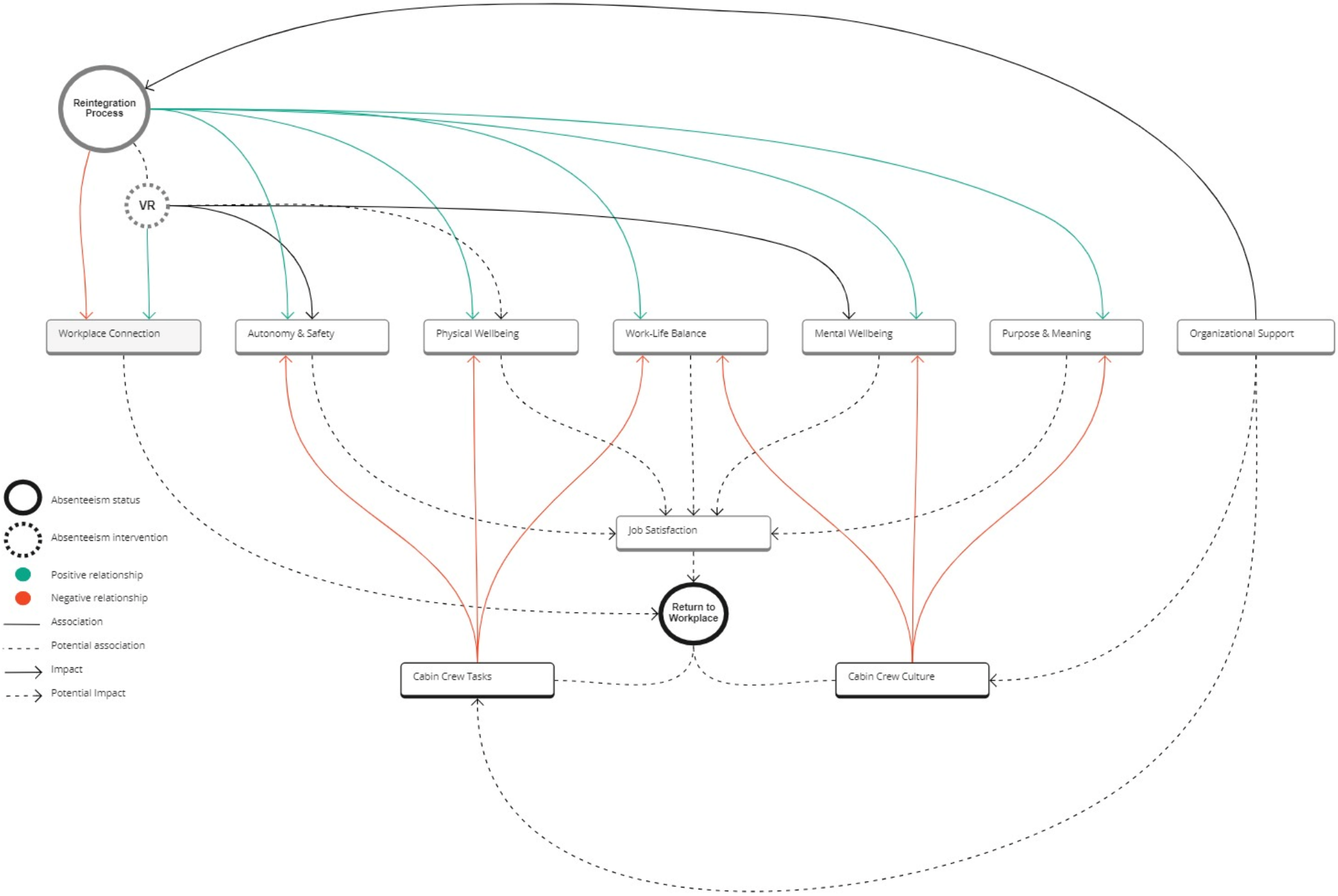

Figure 9: Virtual Vitality Model (VVM)

6. Discussion – Conceptual factoring

The present study aimed to understand the potential of customizing workforce reintegration processes through the intervention of VR following a Value Sensitive Design approach. The study unveiled several values that people hold important in their workplace that proved to be crucial for a satisfying and sustainable work experience for the cabin crew members of our sample. The findings from the empirical factoring suggest the values of *Autonomy & Safety, Physical Wellbeing, Mental Wellbeing, Work-life Balance, Purpose & Meaning*, *Workplace Connection,* and *Organizational Support*. Prior work on the topic has also documented few of those values in the workplace (Vernim et al., 2022) through the use of AI. The VR intervention revealed that technology can facilitate some of these values i.e. *Mental Wellbeing, Workplace Connection, Autonomy & Safety* in the reintegration process, however further development is needed to provide a fully customized reintegration process.

Some of the values that this study unveiled, like *Physical Wellbeing* and *Mental Wellbeing*, are values that have been quite extensively explored as meaningful universal values and as such technologies at work, have and should incorporate (Friedman, 1996; Friedman et al., 2013; Friedman & Hendry, 2019; Vernim et al., 2022). However, this study questions this claim that values are "universal" because they can be interpreted in multiple ways depending on the context and the person's perspective as the results indicated. To be precise, during the interviews, the participants could not really pinpoint what their values are. Consequently, they usually referred to their needs, like for example what was missing from their workplace or the VR. This is because what stakeholders factually consider important is different than what they should regard as important. (Manders-Huits, 2011). This realization led to redefining the concept of a value as "**principles that can be derived from norms and needs and can be discerned via their absence**".

The fact that people do not necessarily attribute the same meaning to certain values is apparent when comparing how people conceptualize the same value across different contexts. For instance, the values of *Physical Wellbeing* for cabin attendants refer to a healthier sleeping schedule while for workers in agriculture, *Physical Wellbeing* might involve not working outdoors during summer heatwaves. Given that the meaning of certain values greatly depends on the workplace context, diving into the needs and the concerns of the end users could lead to more concrete ideas of how to make Virtual Reality technologies more value-centered for each context. As such, we can argue that designing these values into technologies which consecutively are integrated and used into work processes, can inherently redesign these processes to be more value-centered.

6.1 Customization

Following a value-centered system design approach implies that we consider these needs to design the technical system. For instance, if the aim is to design Virtual Reality software for inexperienced people, the designers should try to implement intuitive motions to fulfill values such as *Usability* (Stephanidis, 2001). Or if the aim is to design an AI system that focuses on values such as *Fairness*, one can design safeguards that prevent the introduction of biases in the decision-making process already before the system design (Friedman & Nissenbaum, 1996; Umbrello & van de Poel, 2021).

The findings of the present study indicated that physical and mental wellbeing, autonomy, privacy, accessibility, usability, customization, and immersivity were elements that the participants identified as important for the VR. This is in line with prior research on the topic that has illustrated the same elements as values in the field of VR (Friedman et al., 2013; Friedman & Kahn, 2000; Smits, Ludden, et al., 2022). These values have in common that they aim to tailor solutions to meet individual needs and concerns. Methods of technology design that attempt to incorporate those values are characterized by an approach focused on customization. Customization transcends specific contexts and time boundaries and creates a dynamic of constant change because needs and capabilities are ever-evolving and context-dependent. When customized technologies are implemented into a certain process, they integrate these needs into the process as a whole. The affordance of such technology to adapt to the needs of its users and constantly evolve (Garcia-Palacios et al., 2001; Holden, 2005; Lele, 2013; Schmid Mast et al., 2018; Xie et al., 2021), shows a significant potential on customizing tools to the users' needs. As one such technology, VR bears the capacity to cater to the diverse and changing needs of individuals, leading to more effective and inclusive workforce reintegration processes. This highlights the importance of *Customization* as a value, a finding which was identified in the present study.

To our knowledge, there is no prior work on the field documenting *Customization* among the values that are implicated in a system design process. However, customization is particularly important as it can be more than merely a technological option. In fact, it can be used as a dynamic design value that operationalizes other values based on the needs and capabilities of the end-users and makes reintegration processes more tailored to diverse needs of individuals. Its importance becomes more apparent when considering the Stakeholder Power- Interest grid (see *Appendix Figure 3*) showcasing a context where the end users (like the cabin crew) had decisions made for them by other stakeholders with higher power. Customization accounts for the needs, priorities and interests of stakeholders, especially of those who are most impacted but may have the lowest power as

individuals. Adopting the value of *Customization* in the design process of VR encapsulates the ethical mission of serving the highest impacted stakeholder needs and it can create fruitful grounds for a more inclusive and supportive workplace processes. Research has shown that prioritizing the needs of certain stakeholders can be challenging and conflict among stakeholders can occur (Bryson, 2004; Davis & Nathan, 2015; Manders-Huits, 2011) but *Customization* can be employed by responding to this challenge, which greatly depends on the users' needs, the specific context, and the time point.

6.2 Physical Wellbeing

Physical Wellbeing was not the purpose of the current design, because the VR wasn't designed to fulfil this need. However, during the VR session, some participants facing physical problems indicated the technology could help them understand whether they are able to conduct certain movements in the plane if it had some features that supported this value. Indeed, this insight is in line with existing literature that indicates that Virtual Reality interventions are used to understand the impact they can have in the physical wellbeing of patients with physical impairments (Smits, van Goor, et al., 2022) or even for physical rehabilitation (Kim et al., 2020).

On the contrary, Virtual Vitality lacked interactive features to do so, and was not able to cater to the physical concerns of the cabin crew. The concept of interaction however may be able engage users even further creating a more immersive and realistic virtual experience (Hudson et al., 2019) but it raises questions in regards with how important it is to implement such feature in the technology. Cabin crew that are absent due to motor problems usually undergo several sessions of physiotherapy, or surgeries to recover from their injuries and as such VR may not add significant value for current process. Moreover, the cybersickness (Oh & Son, 2022) that some cabin attendants experienced when being immersed in VR and the effects this could have, like becoming dizzy and losing balance or becoming nauseous and vomiting, should be taken into consideration when implementing this technology in sensitive groups. These approaches necessitate physical interventions with specialized doctors and the current results are unclear on how VR could contribute towards customizing a reintegration process that focuses on physical rehabilitation.

6.3 Mental Wellbeing

Another key finding of the present study was the usefulness of VR towards the cabin crew's perceived *Mental Wellbeing*. Few of the participants of our study had an intense emotional

experience when they were exposed to the VR environment that simulated real work setups and processes. The exposure to the airport environment through the VR simulation induced emotional responses to the few of the participants that according to them, they were not aware they would experience. Thus, it provided them the opportunity to gain awareness of what would yield unpleasant emotional responses in their work setup. This finding corroborates previous research documenting the effectiveness of VR technology in stress-related situations that showed that VR was effective in stress-induced exposure therapy (Freeman et al., 2017). As such, VR could be useful for the identification of mental struggles related to certain work processes, especially in pinpointing aspects or stages of the work that yield intense unpleasant emotional responses, yet in a safe and controlled environment where people are not at risk of being exposed professionally and personally. VR could indeed prove helpful in the context of workforce reintegration of the cabin crew where people may have been absent from work due to burnouts, or stress-related concerns (Chen & Chen, 2012; Ng et al., 2011). This would give them the time as well as a safe environment to adapt to situations and processes according to their own pace.

It is also important to note that in some cases the participants experienced fear under certain circumstances that related to VR scenarios (e.g. too high viewpoint). These are points to be considered when designing virtual environments that resemble real ones. In fact, VR gives the possibility to adapt those aspects to individual needs and allow participants to slowly move towards more real-like conditions in the work set-up. Prior work has shown that VR can be used as a supporting tool in therapy for anxiety related conditions without replacing traditional treatments (Cieślik et al., 2020; Freeman et al., 2017). This approach can lead to enhancing *Safety* in the reintegration context since through using VR, employees can relive experiences without facing real-life consequences that can even further impact their wellbeing.

6.4 Workplace Connection

A key finding of this study is the concept of Workplace Connection. This concept has been studied extensively in the context of the workplace and how its absence can impact employees (Marshall et al., 2007) but not from the prism of VSD. *Workplace Connection* is a value that encompasses the social connection of the cabin crew with colleagues and mental connection with the work duties and responsibilities. It closely resonates with the values of *Social Comfort* (Smits, van Goor, et al., 2022; Umbrello & van de Poel, 2021) and *Identity & Self-awareness* (Friedman et al., 2013; Smits, van Goor, et al., 2022; Vernim et al., 2022) because for the cabin crew, it is important to be in contact with their colleagues since they work in teams, and to be aware of their work tasks due to the high responsibility that is entailed with it. Literature indicates that prolonged times of isolation from the workplace

can lead to reduced feelings of self-worth and confidence, resulting from difficulties in remembering specific work tasks or experiencing decreased energy (Noordik et al., 2011) and this is confirmed by the results.

Even though they were away from their regular workplace for a long time, the results from the use of VR showed that the cabin crew was able to reconnect with their work environment only to a certain extent. Participants expressed that they had difficulties over certain dimensions and aspects of the design. For example, the airplane in Virtual Vitality was a narrow-body aircraft, while a lot of the users were accustomed to working in wide-body airplanes The reason for that could be that the VR environment was not adjusted to their specific work experiences which showcases the necessity of customization of such tools.

It is important to note that participants of the study indicated that the technology they tested lacks interactive features, which they thought could help them understand whether they can do certain motions in that environment. However, this entails the risk of people conducting moves that they shouldn't when they are inside the environment, especially people with physical problems that may be distracted of their pain and hurt themselves further without realizing it. This points out an important tradeoff between *Workplace Connection & Physical Wellbeing*.

Another important point to note is that VR does not fully mediate *Workplace Connection*, such as providing social comfort. However, since the current reintegration process of KLM employees in the nursing home involves socializing, implementing features of socialization among users within the VR may not be necessary when VR is used as a supportive tool for work reintegration.

6.5 Purpose & Meaning

It should be noted that our findings illustrate another important value for cabin attendants in the workplace, that of *Purpose & Meaning.* This value was identified in the current reintegration process in the nursing home where helping the elderly contributes to finding purpose and meaning in their job. The fulfillment the employees receive is understandable as helping others seems to indeed evoke positive emotions and satisfaction (Sheldon et al., 2001). In line with our findings, Vernim et al., (2022) showcased that the value of *Purpose & Meaning* is important to be present in the context of technological interventions in the workplace. While the fact that working in a nursing home provides purpose and meaning is a positive part of the current reintegration process of the cabin crew employees, it is not relevant nor further facilitating their re-integration to their own type and context of work that is working as cabin crew in an aircraft with different tasks and responsibilities.

6.6 Autonomy & Safety

A key finding of the present study was the value of *Autonomy & Safety* that emerged. *Autonomy* has been a widely researched human value (Friedman et al., 2013; Smits, van Goor, et al., 2022; Vernim et al., 2022). Indeed, prior work has confirmed that user autonomy is an important value that matters in the technology's design (Friedman, 1996). In the current context, something that certain stakeholders found important was to implement VR in reintegration so that employees can integrate in their own terms, at their own houses even. However, it was highlighted that such accommodation should always take place under appropriate supervision. That is to mitigate the risk of overexposing themselves to experiences that evoke intense unpleasant emotional reactions or cause them overstimulation. However, there is not any indication in literature that VR can have such an impact. Still, in this specific case, that risk is eliminated as the use of VR system is only allowed when the employee is accompanied by a medical specialist. This could be another example of a trade-off between the values of *Autonomy & Safety* and *Mental Wellbeing*.

7. Recommendations – Innovation refinement

Overall, VR showed potential in mediating several values that are important to employees for reintegrating back to work. However, we are aware that the cabin crew is a very specific subset of employees, and due to their health status in the reintegration process and their potential past experience with VR, they dictate specific requirements to be implemented into the technology. Indeed, the purpose of this section is to propose tailored requirements that cater to the needs and capabilities of the cabin attendants, with the aim of integrating their values in the technology. Therefore, due to the specificity of the context, the technology may be lacking if the organization aims to generalize its use in other contexts as well (e.g. cabin attendant onboarding processes). Moreover, it is important to mention it is unclear on how VR could contribute towards customizing a reintegration process that focuses on physical rehabilitation and as such, careful considerations need to be considered on using this technology and software for this purpose as well.

7.1 Design requirements for Virtual Reality

Based on the findings and discussion presented above, this section will explain how the value of *Customization* can be translated into design requirements for the VR Developers and the improvement of the virtual reality software.

7.1.1 *Customization* through Accessibility

One of the main values that can be operationalized through *Customization* is making technology accessible for the cabin attendants using the technology.

- ➔ Virtual Vitality's point of view isn't customized to each individual's height. Cabin attendants have different heights and currently, the point of view in VR is designed to the measures of an average Dutch male person. Thus, it should be designed to incorporate the difference in heights that cabin attendants might have.
- ➔ Currently, users are only able to use the menus and navigate within the environment through the index finger. However, some users may intuitively use other fingers to navigate through digital environments. A design that incorporates intuitive motions should include the ability to use other fingers (thumb, middle finger) as well.

7.1.2 *Customization* through Usability

Another value that can be operationalized through *Customization* is making technology easy to use for the cabin attendants.

- ➔ Due to the extensive use of VR in various trainings in the aviation industry, cabin attendants might have experienced virtual environments in the past. However, this doesn't hold true for all of them. As such, Virtual Vitality should consider the potential inexperience of users and provide guidance to them in regards with the gestures for navigation, with the 360º environment that they can explore, and with the steps that dictate a standing stance.
- ➔ Using buttons within the virtual environment don't trigger a physical sensation that in real-life could help people understand the way of operating them (e.g. sliding or pressing a button). As such, they should be designed to in such a way that it is clear how to press them (e.g. Empty-Full button option).
- ➔ The content (pictures & videos) in each step should be distinctively separated according to a logical thematic (e.g. at the boarding step: cabin crew boarding, and passenger boarding should be distinct).

7.1.3 *Customization* through Identity

One important value implicated in VR design is that of Identity. Cabin attendants should be able to reexperience their work identity through the use of VR and feel accomplishment through who they are and what they do in the environment. As such, *Customization* could be used to operationalize the value of Identity.

- ➔ Virtual Vitality currently doesn't represent the full extent of the work identities and duties of the cabin attendants. The design of the VR should incorporate features that identify to the work duties of the cabin attendants (e.g. incorporating long-haul flight scenarios in the software, content during the flight, content on deboarding, content on transitioning from the plane towards the hotel).
- ➔ The VR should also incorporate features that identify to the work experiences of the cabin attendants (e.g. incorporating busier and more crowded environments of the airport, BMC, pre-briefing room, gate, airplane)

7.1.4 *Customization* through Immersivity

Immersivity is a key VR characteristic that differentiates this technology from other digital systems. It can be linked with the values of *Workplace connection, Physical wellbeing, Mental wellbeing* since the feeling of immersion that the users can experience can have a significant impact on their feelings, perceptions and progress in their reintegration. As such:

➔ The design of the VR should incorporate features that can make the cabin attendants more immersed to the experience (e.g. incorporating interaction with in-flight objects, interaction with the environment around the plane/ BMC, interaction with passengers)

7.2 Managerial suggestions for the workplace

Based on the findings and discussion presented above, this section will explain how managers can create a more effective and supportive reintegration process that leverages the benefits of VR technology while addressing the specific needs and values of their employees. To do that, it is important for stakeholders such as Cabin Crew managers, VR designers and medical professionals to collaborate with the reintegrating employees to regularly evaluate and improve the effectiveness of VR interventions through employee feedback and adjust their reintegration process accordingly. Moreover, it is important to ensure that employees have access to necessary resources, such as mental health support that can include VR interventions.

7.2.1 Adopting an Empathetic Approach

Even though the reintegrating cabin crew members perceived that they had the organizational support they needed from the company, some of them noted that certain challenges in their workplace are not being considered. As such it is important to encourage managers to demonstrate empathy and recognize the challenges employees face during reintegration. Therefore, it is important to engage with employees to understand and incorporate their evolving needs and values, ensuring that the reintegration process and their concerns returning to work, remain relevant for them addressing their needs and capabilities.

7.2.2 Fostering Genuine Communication

The hesitancy of cabin crew employees communicating directly to their colleagues' potential problems that they might face in their reintegration or their work, enhances uncertainty on steps that need to be taken for a more supportive environment. Therefore, it is important to provide a safe and honest environment where both managers and employees feel comfortable discussing their concerns and experiences to facilitate a better collaboration. Moreover, due to the fact that the flight crew changes every flight, there is little chance between cabin crew to establish strong professional bonds. As such, it is recommended to try establishing and evaluating the effect of long-term team

assignments for cabin crew members to facilitate the development of deeper professional relationships by creating consistent team rotations over extended periods.

7.2.3 Developing a Sustainable Employment Growth and Career Transition Plans

The aging employees in combination with the challenges of a cabin member's duties, seem to create a difficulty for both KLM and the employees to upkeep the employees' career sustainability. Therefore, it is important to develop comprehensive career transition plans for cabin crew members, outlining potential career pathways within the organization, taking into consideration the physical demands of the job as employees age. Also, KLM could benefit by establishing educational and training programs tailored to the needs of the company and the career goals of cabin crew members by enhancing their qualifications and skills, enabling them to transition into other positions with equivalent salary levels as they age.

7.2.4 Fostering Work-Life Balance

The importance of work-life balance for cabin crew employees is being affected by the instability of the cabin crew's work schedule. Having a work-life balance has been documented by previous literature as an important component that could reduce absenteeism rates and increase job satisfaction. As such, it is important to create work arrangements that can facilitate a healthier work-life balance, by offering flexible work schedules & tasks.

8. Conclusions

8.1 General conclusions

The present study delved into the perspective of catering to diverse needs of end users through digitally enhancing their work reintegration process. The research explored the values of the employees in the context of work reintegration process after absenteeism and how technology can mediate these values. Employing an adapted Value Sensitive Design (VSD) framework to fit the purposes of the study, it sought to uncover specific design interventions that could shift the design development towards a more human-centric approach instead of the "one-size-fits-all" approach that to date has been widely adopted in system design.

The empirical factoring of a case study in KLM, an aviation company, examined the workforce reintegration process from the perspectives of various stakeholders with different power and interests in the project. The cabin crew, as the most impacted stakeholders from changes in their reintegration, were not involved in the decision-making process when creating a technology which was targeted for them. As such a lot more attention was given to understanding their values and concerns. Following an inductive analysis approach, the following 7 work values were identified: *Organizational Support, Work-Life Balance, Autonomy and Safety, Physical Wellbeing, Mental Wellbeing, Purpose & Meaning* and *Workplace Connection*.

The technical investigation focused on understanding how technology such as VR can mediate the values of the stakeholders in work reintegration. It showed that Virtual Reality can mediate values such as *Workplace Connection*, *Mental Wellbeing* and *Autonomy & Safety* and potentially may be able to mediate *Physical Wellbeing*, while no attention was given to *Purpose & Meaning*. There are certain risks and tradeoffs that stakeholders need to contemplate depending on what their goals are.

Moreover, during technical factoring, several values emerged as important for the current Virtual Reality design. These include *Privacy*, *Usability*, Accessibility, *Physical and Mental Wellbeing, Autonomy* and *Customization*. Most of those values have been already reported in the existing body of literature. However, the value of *Customization* is a unique contribution of this research, especially due to its potential to facilitate a human-centered and inclusive approach both to technology and to process design.

The conceptual investigation unveiled that different stakeholders have different motivations, cognitions and resources and as such the values that each one is striving for

are different. This is why, to understand and prioritize values, there is a necessity for a trans-disciplinary and inclusive approach in decision-making between medical professionals, managers, tech designers and end-users. Of course, fostering knowledge and involving multiple stakeholders in decision-making entails higher complexity. However, approaches that consider and consult humans and their diverse needs and capabilities are the only viable and sustainable solution in the future. Technology developers and organizations are required to adopt more inclusive and needs-based approaches in the workplace if they aim to improve their reintegration process and VR technologies.

8.2 Strengths, limitations & future directions

This study has several strengths and limitations. Reflecting upon them is crucial for guiding future research. By understanding the strengths, future researchers can build upon these methodologies and approaches, enhancing the quality and impact of future studies. Conversely, acknowledging the limitations provides insights into potential challenges and areas for refinement, which can help to tackle similar issues in future research.

An important strength of the study is the methodology employed. There are various methodological aspects that are worth reflecting on.

One of those is the innovative approach that the study utilized. The approach involved the incorporation of the power-interest grid for the stakeholder analysis methodology within the VSD context. The choice of the specific methodology showcased the current neglect of the end-users in the process of designing a technology that targets them. The approach of VSD that the study utilized expanded our understanding of the importance of a methodology that places the employees in the center of a design process that affects them first and foremost.

Another methodological aspect of this study that is noteworthy, is its focus on multiple stakeholders' perspectives as it collected data from the cabin crew employees undergoing reintegration process, cabin crew managers, VR managers, VR designers, and medical professionals. The existing body of literature has mostly focused on a certain type of stakeholders when investigating the process of technology design and the values to be mediated by certain technological features. Instead, the present study integrated the views and perspectives of various stakeholders involved, a choice that helped us gain a more holistic view and a deeper insight into the needs, interests, concerns and considerations of each group of stakeholders. Such information is necessary when aiming for balancing between the effectiveness that the corporation world aims for and the needs, capabilities and aspirations of individuals working for it.

It is also worth mentioning that when it comes to a qualitative methodology that involves human interaction with the participants, the practicalities and technical aspects of the data collection are not the only things that influence the process and its outcomes. An often overlooked yet crucial aspect of a methodology is that of the attitudes and values of the involved researcher(s). In the present study, the research team that designed and conducted the interviews prioritized the wellbeing of the participants as well as providing them with a safe environment. This was evident by the rich and insightful empirical data that such an attitude of empathy and sensitivity enabled us to have access to. Participants felt and expressed it in their interviews, that the context provided allowed them to open up and let themselves be vulnerable. The sensitive data they shared through interviews, and user-testing sessions confirm that they felt comfortable and secure enough to communicate their thoughts and feelings to the interviewer.

Another important point to highlight is the way in which the data collection tool in the present study served more than the purpose of merely extracting data. The findings point out an interesting pattern identified that was neither among the aims nor among the expected outcomes. The interviews and the user-testing sessions gave the chance to the participants to reflect upon their experiences in a safe and confidential space. They had the opportunity to share their views, express their thoughts and concerns, and be given the space to vent. Those elements of the process, according to the participants, made them more aware of their own feelings and thoughts over certain issues which they hadn't had the opportunity to do up to that point. Having someone to talk to about those issues, getting the right questions and feeling considered and heard was enough to ameliorate the largely unpleasant feelings that they had accumulated over time due to their long absence from work. This points out the capacity that certain tools for research can function not only as data collection tools but also as self-reflection tools for participants. In turn, this highlights that research's impact is not defined only by its results but also it can be a dynamic tool to give back to its participants. The dialogic and participatory design of the methodology employed should be considered more by future researchers if we aim for research efforts that not only seek to utilize participants but also be useful for them.

This study has also several limitations that should be considered. Given that the present piece of research is a case study, the sample might not be representative of the general population as it only involved the stakeholders of the specific company under study. The weak external validity should prevent us from generalizing the results to other populations and the workplace values may be different among employees that work in other countries or other industries. One of the main findings of this research and one of its key messages is that despite people sharing similar values to a certain extent, needs and capabilities vary among employees, work contexts, and even time periods. Especially when it concerns exceptional processes such as reintegration after long absences from work, the design of the transition process needs to consider what the employees of a certain context need. That

is to be done by involving them in the design process while adopting a VSD approach to explore their values, rather than seeking universal values or one size fits all recipes.

An important limitation of the study is its cross-sectional design which prevents us from capturing changes over time. As the revised definition of the concept of value implies, values are neither universal nor stable constructs. Instead, they might vary among individuals and across different contexts and time points. Unfortunately, the cross-sectional nature of our study does not allow us to observe and document issues such as potential changes over time or how VR usage impacts the reintegration process duration, and how it mediates job satisfaction through values. Future research could consider longitudinal research design to explore such questions.

A constraint of this study was also that it didn't explore how the embedded design values in Virtual Reality (e.g. *Privacy, Usability, Human Wellbeing, Autonomy* and *Customization*) separately influenced the emerging work values (*Autonomy and Safety*, *Physical Wellbeing*, *Mental Wellbeing*, and *Workplace Connection*). Such an exploration could provide guidance on how to prioritize the integration of certain VR values over others.

The present study provided several points for problematization that need to be considered in future research. One such point to be considered is the positive self-selection process via which the participants were recruited. The already existing positive attitudes of the participants towards using Virtual reality may be context specific given that often cabin attendants and pilots are already familiar using technologies like VR, AI, and monitoring devices for other purposes (e.g. during their training, to test new equipment, to simulate emergency situations within safe contexts). Therefore, the perceptions and attitudes of the specific sample on using this technology might be considerably more positive than employees in other workplaces. Introducing technology as an alternative or a supportive tool for work-related processes might encounter more obstacles in other populations.

Another issue to be raised is that our study focused mostly on values and did not expand much on the concept of Job Satisfaction. Job Satisfaction was a recurring pattern identified in the data. Even though values were not explicitly connected with Job Satisfaction in the context of the present study, future research could consider exploring further whether and to what extent employee's values play a role in their job satisfaction. The emergence of the theme of job satisfaction as a prominent concern of the employees lends support to literature that links the work difficulties of the cabin crew with decreased job satisfaction and job performance as partly explained by values common with the ones identified in our study(Chen & Chen, 2012; Ng et al., 2011; Ybema et al., 2010). Due to the cross-sectional nature of the present study, such a pattern cannot be observed but it can be among the aims of future research that wishes to investigate how job satisfaction may impact the duration of the reintegration process and whether work values mediate this relationship.

Future research should also reflect upon a certain aspect of the Value Sensitive Design, that is the threshold required to identify who the indirect stakeholders are within a specific context. This has been raised as a concern regarding the approach that lacks a clear framework on how to select indirect stakeholders (Davis & Nathan, 2015). The threshold to determine the indirect stakeholders is indeed a constraint. However, having a rigid framework that draws clear and finite boundaries on who can be considered as an indirect stakeholder in all existing workplace contexts would be not only unrealistic but also contradictory to the foundational premise of the approach about the need to be responsive to the diversity of individuals and the various workplace contexts. The flexibility that the approach encompasses is what makes it adjustable and adaptable to any context and responsive to diversity and differences across individuals both on a micro and on a macro level. What could possibly be of use is more guidance on the various dimensions and aspects that need to be considered when identifying who the indirect stakeholders might be in each case. Future research could invest efforts in exploring the issue across different samples with the further aim to help researchers in what they need to consider in order to obtain sufficient information.

A final point for further problematization is that of comparing and prioritizing values from different stakeholders. It might be important for researchers interested in further investigating the topic to question who decides which values are to be prioritized. If the values of employees are in conflict with values of their employers, is it ethical that the values being prioritized in a system design are the ones of those who hold the power to make decisions? It could be meaningful to consider setting certain principles in terms of the prioritization of certain stakeholder values in system design, for instance having wellbeing and safety as undisputable priorities. Even though researchers claim that VSD should be complemented with an explicit ethical theory (Manders-Huits, 2011) this demands an in-depth analysis in Philosophy, which is outside the scope of the current study. However, future research could consider addressing those concerns and building a conceptual foundation for practitioners.

8.3 Societal relevance

The present research is important for several reasons. As people spend on average one third of their lives working, it is essential for organizations to encompass the mentality of creating inclusive workplaces that aim for people's wellbeing and sustainability. Acknowledging the fact that within every organization there are power structures in place it is important for people being in positions of decision making or in position that can influence decisions to realize that those power structures could easily result in the needs and capabilities of employees being overlooked. Especially of those that don't have a direct

impact on high-level decision-making processes that target them. Advocating for an inclusive approach in decision-making contributes to creating a more equitable society.

Referencing Sustainable Development Goals (SDG) (UN, 2015), by studying the implementation of Virtual Reality for reintegration, through the lens of the needs of vulnerable employees, this research directly aims toward the following goals:

- Good health & wellbeing (Goal 3)
- Decent work and economic growth (Goal 8)
- Promote and foster inclusive innovation (Goal 9)
- Reduced inequalities (Goal 10)

Figure 10: Sustainable Development Goals of this research

8.4 Academic relevance

Overall, this study contributes to the scientific understanding of how researchers can approach the implementation of Virtual Reality Technologies into Return-To-Work practices. The academic contribution lies in three main areas:

- understanding the values of returning-to-work employees in their workplace and how to potentially mediate some of these values through technology
- understanding how to design value-sensitive technologies and how through the implementation of those technologies we can redesign value-sensitive work processes incorporating various stakeholder views
- and finally, how creating an atmosphere of empathy and trust in the research process can enhance the breadth and depth of the data provided in qualitative studies. In this case research becomes a dynamic tool that enables the participants of the study to get back from the process instead of merely contributing to it.

8.4.1 Extending the VSD application to VR in workforce reintegration

This study extends the application of the VSD framework specifically in the context of VR for workforce reintegration. Previous applications of VSD have primarily focused on general technology design like Artificial Intelligence or Virtual Reality, and they focused on the values derived solely from either conceptual and empirical or technical investigation. However, the current VSD approach investigated the reintegration process more holistically, incorporating the power-interest grid as a stakeholder analysis methodology. This showcased the VSD's ability to redesign not only technologies but also processes through considering the values of the individuals involved in that context. This comprehensive methodology ensures that the values identified through the several stakeholders are effectively translated into technical design requirements enriching the VSD framework itself with practical and context-specific insights.

The study found that the participants when asked what they held important in their life (their values) they usually referred to things they deemed necessary for their wellbeing (their needs). This observation led to the finding that, without expressing their needs, one couldn't defer to their values. Therefore, needs drive the formation of values, values create norms that regulate behaviors and rules within a context that lead to fulfilling collective needs. This is why ethical design frameworks such as the VSD and the Value Hierarchy (Umbrello & van de Poel, 2021) should incorporate the concept of needs of the individuals when developing designing requirements that make technology inclusive.

The research also demonstrated how *Customization* can be operationalized in VR design by tailoring virtual environments to the specific experiences and needs of cabin crew members. As such it introduced *Customization* as an essential value within the VSD framework, emphasizing its importance in creating adaptable and user-centric VR environments. This addition addresses a significant gap in existing VSD literature, which often lacks a focus on Customization and sets a precedent for future research on personalized technology design.

8.4.2 Theoretical contributions to the understanding of workforce reintegration

The study contributes to the theoretical understanding of workforce reintegration by providing a comprehensive model of work values that are significant to employees during the reintegration process i.e. *Organizational Support, Work-Life Balance, Autonomy & Safety, Physical Wellbeing, Mental Wellbeing, Purpose & Meaning, and Workplace Connection.* Highlighting their interconnectedness and relative importance to different stakeholders, not only aids in understanding these values in the specific context of cabin crew reintegration but also offers a replicable model for other researchers to apply in different work reintegration contexts. By prioritizing the values and needs of employees into technology design, the study showed that proposed technology interventions are grounded in actual user experiences and concerns, making the reintegration process more

customized to them. This empowers the notion that there is not a one-size fits all in the reintegration process and that *Customization* is imperative for this context, making the findings of the study relevant and applicable. Therefore, this model can be used as a foundation for future studies exploring similar contexts or developing new reintegration processes and technologies.

8.4.3 Enhancing the rigor of VSD and qualitative studies

This study enhanced the methodological affordances of VSD by incorporating empathy and cultivating an atmosphere of safety and trust between the interviewer and the interviewees during the interview process. While that might be considered a given, sometimes the concept of being professional can be as well understood, and thus operationalized, as being distant, inexpressive and unresponsive to people's emotional reactions during an interview process. The specific example of our study showed that such an approach is other than ethical and meaningful, especially when gathering data from people that may be in vulnerable states. This allowed for access to data that enhanced the quality of the empirical investigation because they were characterized by honesty, transparency, and genuine interest in improving the current set up of the reintegration process and their return to work.

Moreover, the research results showed that during the interviews and the user-testing sessions people were able to reflect upon their current situation, giving them a judgement-free space to vent, share their views and experiences. This shows how qualitative research's impact is not defined only by its results, but it can also be a dynamic tool to give back to the participants of the study.

8.5 Practical relevance

The study provides practical insights for VR Designers, Managers and Medical Specialists on how to implement VR-based interventions that can be customized to meet the specific needs of employees. This customization ensures that reintegration processes address individual concerns and preferences, which can lead to a smoother transition back to work. By customizing VR scenarios to reflect actual work environments (e.g., narrow-body vs. wide-body aircraft), the study provides practical insights into creating more realistic and immersive experiences that can help employees better prepare for their return to work.

Moreover, design recommendations for customizing VR are provided for enhancing the usability and functionality of these systems. This includes ensuring that the VR environment is intuitive, easy to navigate, and free from technical issues, which can significantly improve user experience and engagement

The research confirms the potential of VR in stress-induced exposure therapy, which can help employees with stress-related concerns. This practical application allows company doctors and mental health professionals to consider VR as a tool to pinpoint problems and provide targeted treatment. It potentially can also make the reintegration process more efficient and could be considered for improving the mental wellbeing of employees or burnouts. While the current VR technology may not fully address physical wellbeing, the research suggests potential applications in physical rehabilitation. By customizing VR environments to simulate physical tasks and exercises, organizations could support employees with physical impairments during their reintegration process.

Finally, the research provided insights and guidelines that organizations can implement to customize their reintegration processes and support the long-term career development and wellbeing of their employees.

8.6 Relevance to Management of Technology (MoT)

MoT approaches the exploration of technology as a socio-technical problem that affects people on an individual, intra-organizational, interorganizational and wider societal level. It studies how innovation can be effectively integrated and managed within real-world complex organizations to achieve both their business goals and objectives for society. The implementation of Virtual Reality in the workforce reintegration process requires analysis and understanding of both technical and social aspects to obtain a comprehensive view of the characteristics of the technology and its interaction with people and organizations. Therefore, this study that examines how Virtual Reality can be leveraged to achieve not only business objectives, but also broader societal goals such as good health & wellbeing, sustainable employment and reduced inequalities, is highly relevant to that field.

The courses of Inter & Intra Organizational Decision Making, Social and Scientific Values, Digital Business Process Management, Technology Dynamics and Research Methods gave me the perspectives that were needed to enhance this study towards multiple dimensions. These subjects gave me the opportunity to understand that technology can cause and at the same time address wider wicked problems, through mediating or hindering certain human values and how these may be unconsciously incorporated into technologies and business processes. They also provided me with tools to approach complex problems in a more structured and empirical way by adhering to research guidelines and creating new knowledge.

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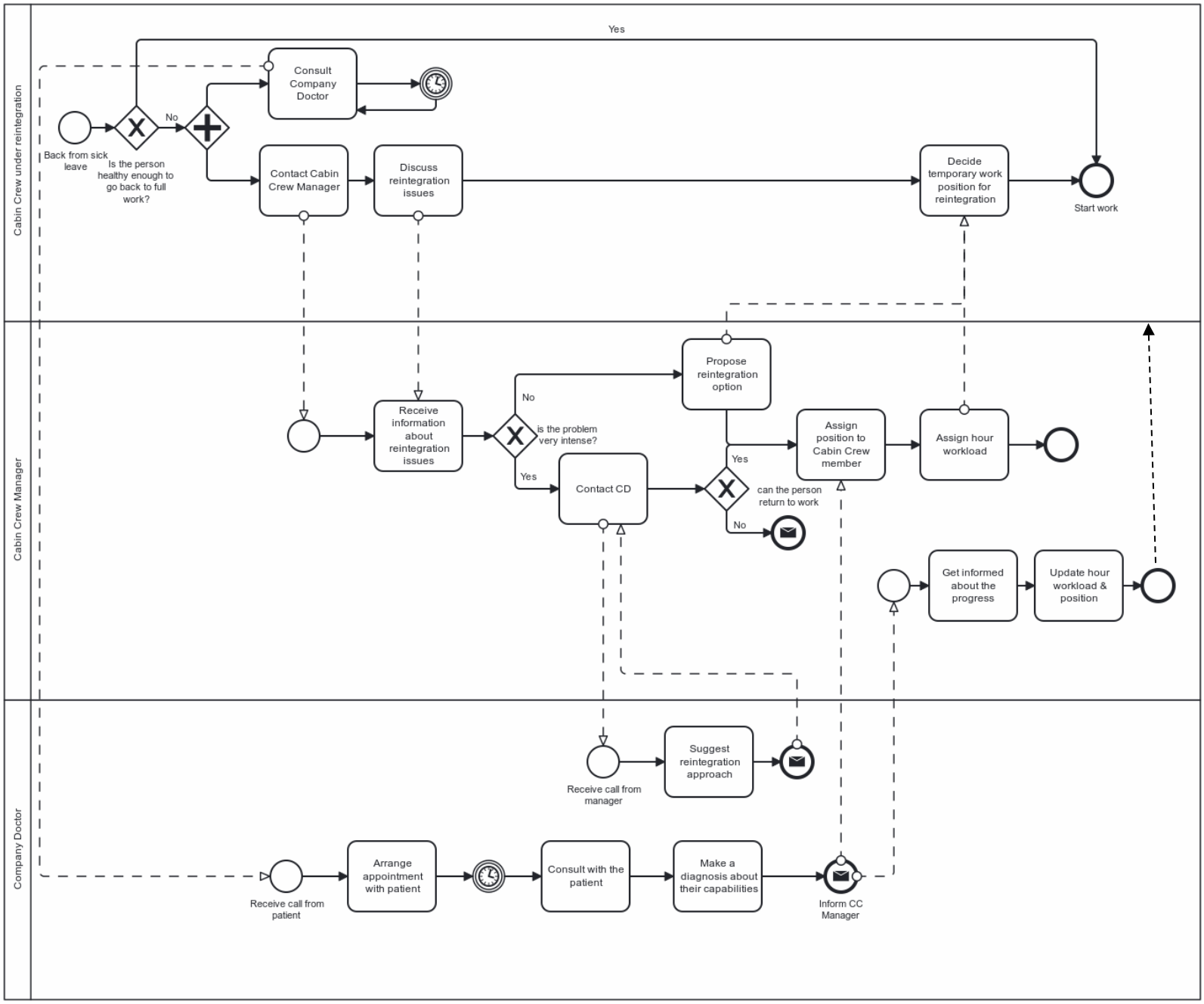
Appendix A: Reintegration process in KLM

KLM currently has multiple ways to reintegrate people back to work after a leave, depending on the preference of the employee, as well as the recommendation from the company doctor. Before they return to their main duties, they conduct alternative work to available positions that fit their reintegration needs for limited hours per week. Gradually, alongside the company doctor and the cabin-crew managers, these hours are increased,



Appendix Figure 1: Decision-making process for the reintegration of KLM cabin crew, after their absenteeism

and the reintegrating employees are relocated to positions that have a closer proximity with their main duties until they are deemed physically and mentally ready to return on-board.

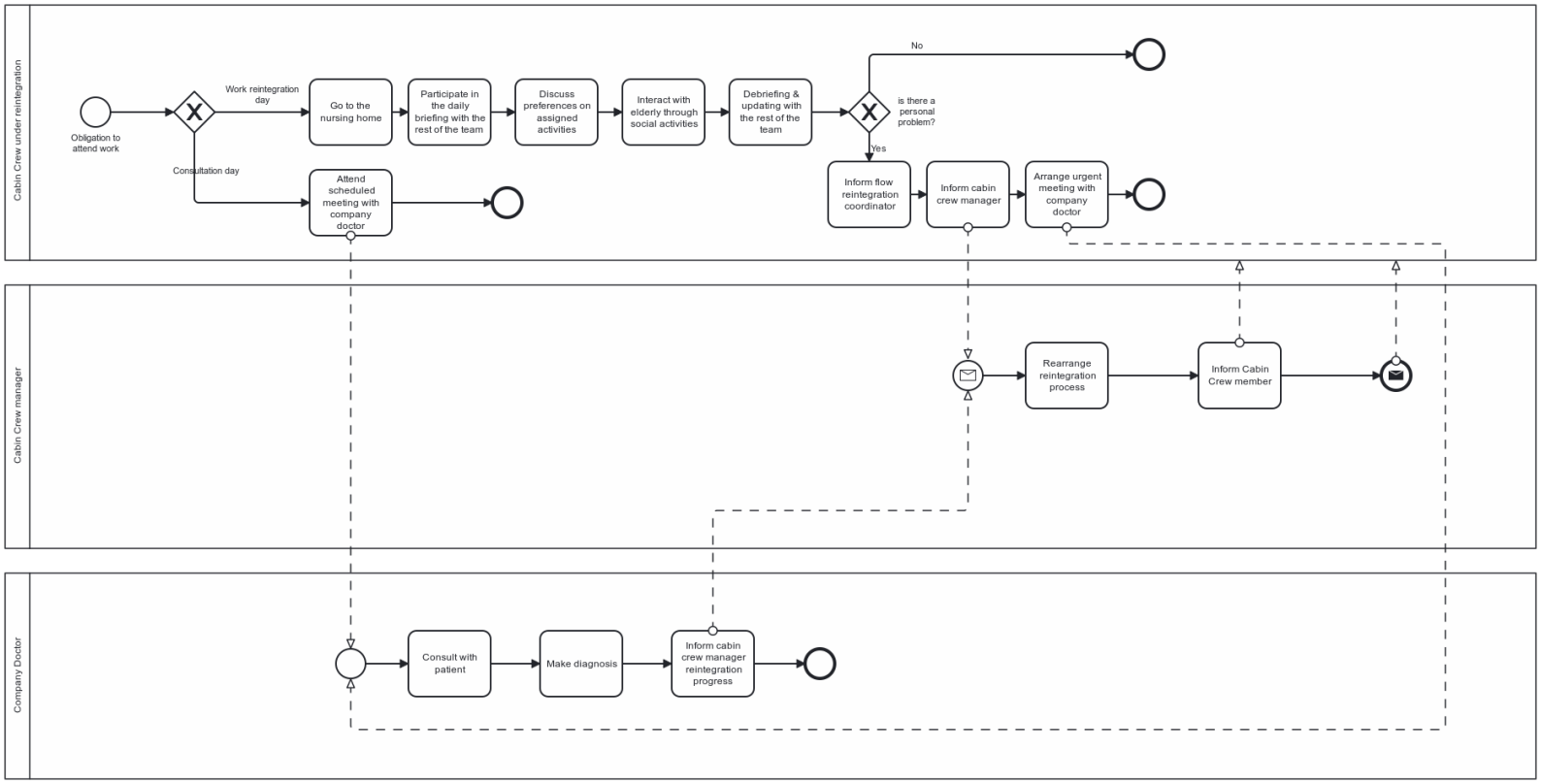
A brief representation of the decision-making process for the initiation of the employee reintegration process is visible on *Appendix Figure 1.* People have the options to undertake a temporary work position that may be:

- Administrative positions (e.g. office work)
- Airport positions (e.g. working at the airport lounge)
- Temporary companions in nursing (elder) homes

The majority of the cabin crew choose to follow the third option as temporary work. The main reason behind this specific assignment is the low stress associated with this environment, which helps with their psychological recovery. Moreover, the social interaction that is entailed with this position seems to be enjoyable and fulfilling to them.

In this process, they are assigned as temporary companions of elderly people in nursing homes for a few hours per day, couple of days per week, depending on the doctor's advice. During this process, the reintegrating employees spend time with the elderly, engaging in social activities such as talking, walking, biking or playing games with them.

Throughout this process, the employees engage frequently in evaluation sessions with third-party medical professionals, who determine the progress and the state of the employee in terms of their readiness to reintegrate back to work (*Appendix Figure 2*).



Appendix Figure 2: Typical KLM employee reintegration process in the nursing homes

Appendix B: Stakeholder analysis

For the purpose of the empirical investigation, to conduct the stakeholder analysis, two phases took place:

- ➔ **Primary informal discussions** with the main people involved in the project: to understand who should be interviewed (stakeholders)
  - **Design process of the VR software** (VR Manager)
  - **Step-by-step reintegration process of absent employees** (Cabin Crew Manager and Flow Reintegration Coordinator) **(**Appendix Figure 1 & 2.)
- ➔ **Formal interviews** with some questions revolving around the power & interest relationships between the different parties to confirm the findings from the informal discussions. This resulted in identifying the level of power & interest of the different stakeholders, as well as the level of proximity that the stakeholders have in the VR (direct/indirect stakeholders).

Then, the during the formal interviews, some questions revolved around understanding the power & interest relationships between the different parties and aimed to confirm the insights from the informal discussions. The synthesis of the results is the following:

- ➔ The Cabin Crew was not involved in the design process of the Virtual Vitality
  - **Insight 1:** The cabin crew under reintegration had no power in the design process of the VR for the reintegration. – VRD: "*There wasn't (an extensive involvement of the cabin crew) because they were mostly there to be the actors that we needed to create the content. […] When we made the content, which is of course a big part that's related to the question, we did this with, people that during that period were reintegrating. But at the same time, they didn't really do that much. It was mostly us just trying to imagine what they would need to see and there was, of course, a plan (which places to film). So those steps were thought of and they came from a collection from the VR manager and the company doctor. I think I sometimes mention something that should be in there and other people from the team. But their (Cabin Crew's) involvement could have been more*"
- ➔ The Extender Reality (XR) Department of KLM is employed by the Inflight Services Department (IS), to explore the potential of using VR in the reintegration period of the cabin crew. Thus, this insight revealed that the relationship between IS & XR department is that of client-supplier.
  - **Insight 2:** The client (IS Department) has a higher power and interest to make requirements for the project result and the supplier (XR Department) has to fulfill these requirements or negotiate what he can deliver.

➔ Within XR Department, there are multiple people involved with a stake in this project. The VR Manager operates as the negotiator for the parties involved regarding the technical feasibility of the requirements and has the ownership of the project. Then, to initiate the project, internal funds needed to be allocated and thus this process involved the XR Department Director and the VR Designers. Therefore, the decisions regarding the acquisition of the project were made from the XR Director. These requirements were then communicated to the VR Designer in order to plan and deliver the content.

- **Insight 3:** From this process it became clear that the XR Director has the power to "kill" the project. The involvement in the VR design process is not extensive. -VRM: "*Yeah, well, all possibilities with VR are endless depending on the budget we can get from the business. "*
- **Insight 4:** The VR manager has a higher power in the decision-making process of requirements than the VR Designer, that simply implements them on the VR. -VRD: "*I'm the developer, so I do the programming of the concepts that the stakeholders come up with. I think in this case it was the VR Manager, but I'm not even sure because that is not within my role. I think he came up with it, but I wouldn't be able to say for sure […], I'll share my thoughts, I'll share my ideas but I'm not in charge of them. So, what then happens with those things is not up to me."*

➔ Within IS Department, there are multiple people involved with a stake in this project. The Cabin Crew (CC), Cabin Crew Managers (CCM) belong to the IS department. The CCM operates as the negotiator for the IS department involved regarding the objectives and has the ownership of the project. Then, to initiate the project, internal funds needed to be allocated and thus this process involved the IS Department Director. Therefore, the decisions regarding the approval of the project were made by the IS Director. More specifically each CCM is responsible for certain CC employees and their reintegration process.

- **Insight 5**: The IS Director has the power to "kill" the project however the involvement in the redesign the VR for the reintegration process is not extensive.
- **Insight 6:** CCMs have higher power in adjusting the requirements of VR for the reintegration process of employees.
  -CCM: *"In terms of who decides the requirements, that will be the business, which will be me. I'm responsible for the cabin crew and their managers, but also the company doctor.*

➔ The Company Doctor (CD) plays the role of the gatekeeper between the CC and the CCM. If the company doctor decides that this reintegration process is not appropriate for the employee, then the CC Manager is obliged to comply with the doctor's orders.

If the CD deems that content is not appropriate or may cause distress to their "patients" can also kill the project.

Insight 7: The CD is placed as the one who has the highest power in the implementation of VR in the reintegration process -CCM*: The company doctor is very important because if they think that it's a health issue, I will not do it. So, they are the gatekeepers and I will listen to them anytime"*

➔ The CD is interested in the wellbeing of their patient but doesn't yield so much interest or knowledge in the technical implementation of Virtual Reality technologies thus, his interest in the project is less

- **Insight 8:** The CD has lower interest in the project than the VR Manager, VR Designer and CCM. - CD: *"I know that there can be trigger points on patients and so they are very important things. But I'm just a part of it, in the advising role. Because I know the stories/ details of sickness. The VR is a technical thing so I can't say anything about the technicalities of it."*

➔ CC Managers are quite invested in the project due to the potential it might hold to reduce the reintegration duration and reintegrate employees successfully.

- **Insight 9:** The interest of the CCMs is higher in the VR project, since they are the clients of the project and invest on it.

➔ The governmental agency (UWV) sets rules and regulations in regards with the quality of reintegration. However, their involvement and interest in this project is minor.

- **Insight 10:** UWV has no interest in the VR incorporation in reintegration. -CCM: "*Actually, like if you're sick for two years, you as the business, you fill in a form of your employer who is sick and then you get you get salary for your employee. It depends on how your reintegration was successfully done by the criteria of the UVW, but other than that, they aren't involved in the reintegration process*"

For the current modeling, certain assumptions are made.

Assumption 1: Flow Reintegration Coordinators are responsible for the day-to-day activities and the schedule of the reintegrating cabin crew in the nursing homes. The use of VR from the Cabin Crew in the reintegration process might influence their work duties, because they would have to incorporate the VR intervention sessions in the day-to-day schedule/ activities.

- **Insight 1:** Flow Reintegration Coordinator are not involved to a significant degree and not impacted by the implementation of VR in the reintegration process.

Assumption 2: Reintegration managers are responsible for creating alternative work positions for employees that are to reintegrate back to work. The use of VR from the Cabin Crew and the incorporation of it into the reintegration process won't affect their ability to find a suitable positions for the reintegrating employee.

- **Insight 2:** Reintegration Managers are not involved to a significant degree and not impacted by the implementation of VR in the reintegration process.

Assumption 3: The nursing homes are the alternative work environments that some reintegrating CC employees work. Due to the VR intervention, the availability of these employees might change. However, the services provided by KLM employees to the nursing homes, are not part of the nursing homes' official services, and the reintegrating employees simply provide extra help.

- **Insight 3**: The nursing homes are not involved to a significant degree and are not significantly impacted by the implementation of VR in the reintegration process

Assumption 4: The cabin crew families are in immediate contact with the reintegrating employees. The VR intervention could impact the reintegrating employees and by proxy impact their families as well. However, they are not into the organization and quite far from the decision-making process to influence the VR implementation in reintegration.

- **Insight 4:** The Cabin Crews' families are not involved to and are not significantly impacted by the implementation of VR in the reintegration process

Based on the above insights we can derive a clearer understanding of who is the direct & indirect stakeholder of the Virtual Reality technology in relation with the reintegration process.

As direct stakeholders of the technology we identified the stakeholder groups that the technology is used by and targeted at:

- Cabin Crew

As indirect stakeholders of the technology, we identified the stakeholder groups that are not the direct users of, but they are impacted through the use it.

- Cabin Crew Manager
- Inflight Services Director
- XR Department Director
- Government Agencies (UVW)
- Flow Reintegration Coordinators
- Reintegration Managers
- Nursing Homes
- Cabin Crew's families

As both direct & indirect stakeholders of the technology we identified the stakeholder groups that even though they are not the direct users of the technology, they are using it in an indirect way.

- Company Doctors
- VR Designers

The main conclusion that we can draw from the stakeholder map, is that the people with the highest interest in this process, and for whom such a technical system is to be implemented and used by (Cabin Crew), had the lowest impact to influence the process. This highlights the importance of shifting the design perspective from a technical focus, towards a human-centric approach and becoming more inclusive in such an organizational context.

Moreover, the stakeholder map shows the different disciplines that are involved in implementing projects within the organizational context and how important it is, especially for such projects to adopt a transdisciplinary approach on decision-making.

Appendix C: Empirical & Technical analysis

C.1 Cabin Crew analysis

C.1.1 Reintegration Process

Work-life balance: One of the primary themes that emerged is the importance of work-life balance that the reintegration process offers the cabin crew under reintegration.

- **Family time:** A reoccurring theme is having the ability to spend time with family.

  CC6: "*I'm sure I'm not working every weekend at this moment and that's fairly really great with the with the kids*"/ CC5: "*I mean, I can to go to the baby, of course.*"/ CC7: *"[..]but what I really enjoy is time with family and friends. And if they ask, are you available on this in this date? You can always say yes, every evening, every weekend. It's incredible. And so that's what I really enjoy."*

- **Social lifetime:** The ability to engage in social activities with people other than family and outside work

  CC8: *"For me it is nice that I can schedule social things, that I can have a plan and say, "I can come to your birthday party", things like that."*

- **Personal growth time:** Many participants expressed the value for personal time to pursue individual interests. One participant specifically mentioned

  CC4: *"And I started an education program in the meantime, since I was sitting at home. And so, it's a very important and different part of my life now"*

Autonomy and Flexibility: Another reoccurring theme was that participants appreciated having control over their schedules and the ability to adjust their work hours and tasks.

- **Ability to plan their personal schedule**:

  CC6*: "[..] it is really nice for a longer period not to be subject of the scheduling"*

- **Ability to choose their work tasks:**

  CC1: "*Yeah, here at the nursing home, I do not have the schedule of the flying stress of the planning of the flights. so, the fact that that part is gone for a while is very good [..]. So, I am managing my time and managing everything that I can do. [..] You*

can really, when you find your way here, you can really choose what is good for you."
CC5: "So that and that really gives me a happy feeling. So, I I'm really happy to come here and not have to worry that I go back home three days from now. So that's really exciting. And I love making music. I play a little bit the violin and the piano, so I'll take the instruments to different floors in the nursing home and amuse the people and they really like it. So, for me it's win - win because I get to play, which is my hobby and they get to enjoy. And so, for me, if the day is filled with music, then yeah, it almost feels like I'm a kid at the playground the whole day"

Physical Wellbeing: Interviewees highlighted the importance of their current healthier lifestyles and their physical recovery due to healthy sleeping habits, absence of intense and constant environmental changes, ability to taking care of their health, and focus on healthy ageing.

- **Absence of environmental changes:** The absence of circadian disruptions (jet lag) and the physiological responses to temperature changes (climate adjustment).

  CC4*:" Because now I'm feeling how it is to live a normal life and to sleep well without a time difference and would without all the differences in temperature."*

- **Normal sleeping schedule:** People found important that they can regulate their sleep habits

  CC7: *"Uh, it was good because I finally can sleep during the night. Sometimes I do miss my job because sometimes I don't. But I mean, it has perks"*

- **Conducting additional medical exams**: During reintegration, interviewees managed to

  CC1: *"so it was good to be away and being here (in the nursing home) made it possible to do a lot of other additional exams that I needed."*

- **Healthy ageing:** Participants mentioned they were able to make small changes in their daily life in order to live longer and better.

  CC8: *"Well I can start looking and caring more for myself now. When I was younger, you know, I was on six hours of sleep, or 4 hours sleep, and I had no problem. But now when I get older, and my body gives me signs that I have to take care of myself."*

Mental wellbeing: Interviewees mentioned that during the reintegration process they had the ability to focus on their mental wellbeing. Therefore, the following subthemes contributed towards improving their mental health.

- **Absence of work pressure:** The absence of work pressure emerged as a crucial factor for improving mental health and reducing stress.

  CC1: *"let's say tensions are rose within my body, so it was very you useful to be away from KLM and from the pressure, let's say, and the things you have to do to be able to have other investigations and relax and not think about the work"*

- **Self-reflection development:** Participants mentioned that it was important to them that they were able to analyze what has happened in their lives and where they are now.

  CC3: *"I can also be in therapy now, but not only for this. [..] but, they are teaching me and helping me to get in touch with my feelings. […] But sometimes when something like this happens or other things in life that affect your emotional health, I didn't know how to deal with it very well. And now I'm learning that. So, allowing these feelings, going through the process and it helps me with the healing process /* CC6*: "I now have the distance to go back to myself. And the longer it takes, you really feel like the part why you like flying so much? Because it's your way of living. It's not just a job, it's so much more and so much larger and wider than than just that." /* CC7*: "So since I'm not flying for months, then I started thinking what's really important and what's not"*

- **Reflexive thinking development:** During this process, people had the ability to self-assess and adapt to circumstances as they are happening by looking inwardly as well as outwardly.

  CC8: *"So now I have to started, you know, used to being more relaxed even though in my nature as well I am really impatient."*

Purpose & meaning: When people were asked what they do enjoy/value during their reintegration work is the fact that this type of work gave them a sense of purpose and personal fulfillment.

- **Receiving gratitude**

  CC1: "*I specifically like here is that what has been lacking with my job a bit is the thankfulness of the people here" /* CC3*: "it's a work that has in my view, a lot of meaning because these people here (in the nursing home) they are so grateful and so happy when you really give them attention and talk to them and ask them questions because these elderly people"*

- **Altruistic fulfillment**

  CC4: *"I like it because I feel that you can mean something to people here. This work (in the nursing home) is meaningful. Its more fulfilling than flying because then (while flying) you work with people that already are happy and you know it's another dimension. And here you really feel that you can mean something to your seniors from our country."*

- **Human connection**

  CC2: "I really like it here (in the nursing home). Because I have one, one (elder) woman, I have a nice connection with and uh, it feels a yeah, I feel grateful, its fulfilling."

- **Community contribution**

  CC6: "[..] they (the company) are doing this for free (sending reintegrating employees to help in the nursing homes) but they pay us and they do not get any money from this. This is all giving back to community. [..] it's all psychological. I felt something, giving value. So, I felt I was doing my part, even if this was just a little one. I did what I could. And I think it's really helpful"

Organizational support: When participants were asked whether they felt supported during this process from the company, the majority of the expressed that both their managers and the company doctors have provided understanding and support towards their problems.

CC1: *"So when I called in really sick, they realize something was going on. So I guess that made it maybe a little easier. I have all the I have all the cooperation from the company, from my manager, from the doctor. [..], but the I felt a lot of backup that that made me feel very good. [..] And then (my managers) by telling me that there was no hurry, so I felt I could let go."* CC3: *"I had very good contact (with the company) [..]. But also at this moment, when we are a bit further in this whole process, if I call or send an email, they always reply and they always say like hey if you need something, if you want something, just tell us. I never felt any pressure. They were like, "OK, easy" while I was like, "OK, when I can I do something? I'm at home" like and they are "Just relax, you know? You need to stay at home a bit". But yeah, it's very good contact also with KLM. Also, with the KLM Doctors Abroad in [redacted]. At every destination we have doctors. We had everyday contacts, so that was also important for me. I felt like they got my back"* CC6: *"so they (company doctors) give you more perspective but I think I'm lucky with my company doctor. And I feel protected by her*

to say, "well this is what you can do now" and even though I would really love to do but more, but for now, it's just this"

However, several concerns emerged regarding the reintegration process.

Reintegration – Workplace gap: During reintegration, people were concerned with the significant difference in tasks, responsibilities and expectations between the two job positions.

- **Duties gap:** The reintegrating employees reported that there is a considerable gap in their duties and responsibilities between the reintegration work and their regular workplace.

  CC8: "*But if you start going back from here, you go from absolutely nothing to the airport. [..] There's nothing in between. So, if for example now say OK, I can go back, then I go from this (the nursing home) to a uniform on the airport and do everything again. So, there's nothing in between. So that would be nice if there would be, you know, like a sort of a bridge, yeah."*

- **Crowd interaction:** It was reported that the intensity of interaction with people between the nursing homework and aircraft work is significantly different.

  CC6: *"And when you walk through the aisle (of the plane) and everybody's asking for something. I think you have to get used to that since where we come from (the nursing home). Next month I'm going to work at the airport, and then I'm going to be in the crowd again. And I'm going to be with people asking you stuff, and I really want to get used to that again."*

- **Mentality difference**: The cabin crew described that there is a difference in the behavioral and cognitive attitude in the two states.

  CC9: *"I didn't expect to be out of it (work) for so long because I'm on the ground since [..]. But as well for me now it's difficult to think about flying and when I have to go back. So, if it's not mentally difficult yet, it will get mentally a little bit. It's a big step"*

Reintegration work misfit: People reintegrating in the nursing home as alternative work, perceived that there is a poor fit between this position and their intellectual, social skills or interests.

- **Skill underutilization:** Some findings mentioned that the skills of individuals could not be applied in the context of a nursing home.

CC3: "*But I also worked at communications, so somewhere there's also I need to be more like on an intellectual level, more challenged. But that is only possible if you have more hours that you can work. And here, for now it's only for four hours.*"

- **Interest misalignment:**

  CC7: I'm an outdoors person, so if you put me inside a building, it costs me twice the energy than, I think, for somebody who works in office, and he's used to it. So, I'm completely drained when I go back home[..]. So, you know that the thing is, I can go outside when the weather is good and then I take a wheelchair or the bicycles. That would help me the most. [..] Cycling helps me in my mental state. This environment (the nursing home with ill colleagues) makes me maybe ill. My recovery slower, but it's what they offer."

- **Mental & social incapability**

  CC8: "[..] depending on how long you are here for or which people you get to meet, but most of the time this is the end station for some people. People die here. So that, sometimes you know, you have a bond, you get to know people, and then they die. And that's sometimes difficult. I have to say goodbye." / CC4: "Because you know for me, when you're in reintegration, you're trying to keep the people little bit away from you, like don't come to near to me. And you do that here"

Therefore, the overall theme of **Workplace Disconnection** emerged. People were concerned that they felt disconnected from their workplace because they would have to return to it at the end of their reintegration journey.

CC1: *"They gave me the time to reintegrate. And for me it's good to be in contact with the company because otherwise it's easy to lose connection. [..]. So now you feel disconnected a little bit by having this back up (work in the nursing home), but you still feel like I'm part of KLM." /* CC4: *"[..] So I am wondering how it will be to step in that world again. The gap between this work and working at Schiphol is getting bigger and bigger the longer you are here. So that is my main question, how will I react, how will I feel?" /* CC5: *"I feel that I really like my job in the air but the longer I don't do it, the more I don't wanna go back. So, I'm really (disconnected)" /* CC8: *"Well, when you're here, you're completely cut off with KLM airport and nothing. People here don't go on holidays anymore, and so you're only with your colleagues. So, you're completely cut off. Now for some people, that's fine. /* CC9: *"Because you're not working so long, and it feels like a whole big thing. So, you feel disconnected from your work."*

D.1.2 Reintegration Process

During the interviews, the cabin attendants mentioned that in the workplace they enjoyed the component of interacting with other people and they valued the ability to occasionally use the overnight hotel layovers to different places around the world as some time for themselves.

Purpose & Meaning:

- **Human interaction:** A frequent remark that emerged during the interviews in regards with the workplace was the interaction of the cabin crew with passengers and colleagues.

  CC1: *"I do like the the moment where I can create the atmosphere. Like for passengers, to set up the welcoming atmosphere and for the briefing the to set the feeling for colleagues to be comfortable so that that my makes me feel comfortable for some reason. /* CC5: *"Yeah, my colleagues definitely. Because if we see that here at the EDD as well in briefing, it's pretty much the same sort of scan each other and then we say "Oh yeah, I would like to go with you because you sort of feel good with that person" and so it is on-board, you can hope that your buddy is somebody you can work with well" /* CC6: *"You can see your colleagues, you talk about the airline or whatever and what goes on. So, it's good to do that. It works both ways.".*

Mental & Physical Wellbeing:

- **Post-Flight Destination Relaxation**: The cabin crew valued the ability of having work travel as an opportunity for them to have some personal space, relax and take a break from home stress.

  CC5: *"So, I also feel like an escape when I am going to work. [...] so somewhere there's almost a hunger for me to go to the hotel room (after the flight) just to sort of be alone." /* CC8: *"So, when you are in your room you are happy again because you can take everything off. This is the best part, is the relaxation after work. No stress from home. You leave everything here and your work is done. Time to relax." /* CC9: *"Yeah, that's the hotel. This is the nicest part. Because then you can rest and have little time for yourself. Yeah, I really missed this part. Because it's very nice to have some time for yourself [...]. So, I do miss that because I have a lot of time and things at home now."*

However, several concerns emerged when cabin crew members were asked what concerns them in relation to returning to work. The main themes that emerged referred to:

Physical health concerns:

- **Change in physical capabilities to cope with demands**: People mentioned that due to aging or physical injuries they are concerned about their capacity to return to working as cabin attendants

  CC6*: "So, when you open a door, and a container, I cannot do it over my head right now because I am injured, but you have to do it a lot over your head because of the galleys, they are equipped liked that, and then the door does not open, the drawer does not open, that makes a lot of impact on your physical health"* / CC8: *" When I was younger, you know, I was on six hours of sleep, or 4 hours sleep and I had no problem. But now when I get older, and my body gives me signs that I have to take care of myself. I have to go to sleep."* CC9: *"And especially after you're flying like 20 years. And that's a really costs a lot of energy and maybe after so many years of flying, it's something that's naturally building. Because in the beginning you like everything and you like all the destinations and nothing is too hard and especially when you're having a like a lot of problems with your body, like the back pain and it costs a lot of energy."*

- **Unhealthy sleeping schedule:**

  CC6: "so *the flight back is always during the night, which is the time that your body wants to sleep and it's so frustrating.*"/ CC7: *". So, our lack of sleep is very bad for your health, but we have colleagues who work full time and can do it easily. But if I ask like, could you sleep in advance before the night flight? They say "yeah, I had three hours of sleep" and I am like OK, that's the difference"/ CC*8: *"Yeah, because lack of sleep and I think that's the biggest issue."*

- **Intense environmental changes:** climate, time difference, and jet lag are perceived to impact the physical health of the participants.

  CC3: *"but just sort of not have the jet lags is really tough, all your shoulders can sort of drop down immediately (when not flying). I mean now I have recognized [..] but it's totally different than when you have real jetlag and come back" CC*4: *"I'm feeling how it is to live a normal life and to sleep well without a time difference and would without all the differences in temperature. So yeah, I am concerned how it will be to go in that process again"*

Mental health concerns:

- **Time pressure at work:** A reoccurring theme is the pressure that comes from needing to complete a high volume of work in a short period which is perceived to have an impact on their mental health.

CC1: " *You know, when you arrive in the BMC, have so many minutes for the briefing you have to go to the aircraft and then the security is full. The time is ticking here and you have to be at a certain time there, and this is, without you yourself realizing, I realized it when I became sick, that the time pressure is always there, that makes me for some reason feel stressed" /* CC5: " *This is the extremely stressful busy part, to do the checks (onboard) and the catering and sort of store your stuff.*"

- **Sensory overload:** People were concerned with the necessity to deal with overwhelming feeling due to excessive noise, movement, and other stimuli in the workplace.

  CC1: *"I've had it once before and then everybody's looking at you and then you have to get off the flight and somebody takes over your place that brings a lot of complications. Which make makes the pressure even higher."* - CC4: *"Any part of flying cannot be compared with the mental impact with the job on ground. Our whole life, the area around the airport is already confronting us on so many parts.* [..] *You have to cope again with a lot of prickles, noise and people walking around you and you really have to be fit for that."* CC9*: "It's a lot of noise. I still have to get used to the noise"*

Unhealthy Work Culture:

- **Absence of work-life balance:** People perceive the existence of a trade-off in the work, highlighting the incapability of having family/social/personal time when working and vice versa.

  CC6: *"So, if you are working, that means that you skip a lot of things in the evenings you're not worth anything anymore, so everything you do is always a choice you always have to choose today I work I cannot do anything else, tomorrow if I do one little thing then. So, all the things that I would prefer to do with all the time that I do not fly. However, when you fly, it's all limited. Everything you do is limited and adapted*." CC7: *"And I mean you can do this job either way, but if you work full time, but you don't get much energy to do things at home"*

- **Absence of ingenuity:** Employees reported the need to mask their true emotions, character, worries, and problems while at work to maintain a professional facade.

  CC5: *"I would feel sort of, yeah Poker face, I guess. I feel like I'm sort of faking It/ caring a secret slash pretending I'm fine and that everything's OK. [..] This is very much small chat. Feel like there's always a lot of poker faces in the briefing. This is very blah, blah, blah."* / CC4: "*It's also sort of and then a role you play when you're working"*

- **Absence of genuine connection:** The participants mentioned the superficial nature of interactions with their colleagues that don't contribute to a supportive work culture.

  CC5: **"***And sometimes when I speak with colleagues and I tell them that they don't understand because they say like "you have* (reduced) *children, how can you work full time, and you do this, and you got the extracurricular hobbies". And I really to not go there because I will probably break down, which is not an option right now (cries)***"** / CC4: **"***the purser will say most of the times you can call me if something happens or this is my room, but nobody really does it. But you could go missing for 24 hours and nobody would really know until you don't show up for the briefing. Yeah, you could be mentally sick or physically sick, and nobody would really notice until you show up at the lobby and sort of to your flight back"* / CC3*: "Sometimes you come in a destination and it's a short stay like 24 hours and everybody goes and do his thing, you never know what happened. So always good to give your phone or room number and sometimes we don't do that. I think that is very important if somebody gets sick, because you know anything can happen. So yeah, I think genuine communication and getting in contact and stay in contact with your colleagues is very important."*

- **Peer pressure:** The cabin attendants were concerned with the perceived pressure they experience due to a judgmental attitude from other company employees in regards with their working status.

  CC4: *"A lot of people also from here outside (that are currently active) are also asking "are you already two months, three months at home with this?" You know it feels like looking down on you, social pressure. [..] And then they say we are one family; we have to do it for each other. Because when you are sick, you cannot do it (call in sick) because another colleague is standing by, and she has to come. Maybe she doesn't really want to come. So, I have to go to work."* / CC9*: But it always looks for the outsider like you have a really easy job, but that's not. Everybody working for KLM understands that, however even to them, sometimes I have to defend myself that I'm flying 50%, with all the obligations I have with my family and everything at home. It's not really easier for me than for another colleague who's flying 100% without children or relationship."*

- **Performance guilt:** Participants mentioned their feeling of perceived pressure associated with the idea of not being able to meet colleagues or bosses' expectations.

CC4*: "It is the culture, but also our characteristic to be focused on the job. We want to be the best for our bosses, never go on striking and every time we want to do the best, to get more results, to get more money for them, and I don't know why. That's me, I'm blue. We are all blue, like Smurfs, brainwashed like that."* / CC5: *"(If I am sick) I do see myself going anyway, just to sort of also show goodwill and not to be at home, calling sick and then and then my superior to decide on the spot that that I'm not in the best spirits. Well, at least I know I didn't cause it. It was apparent that I was not good enough."* CC4: *"They (reintegrating colleagues) already say, "OK, I can fly" but in one month, they go into work, and they are not totally ready. So, I could see it here that this person was not ready, but they had the feeling like they had to go (to fly). Especially the men are feeling guilty"* / CC6: *"I'm somebody who is loyal to the work, I really feel the urge from inside, [..] and I used to feel guilty (gets emotional starts crying) but now when I put the pressure back on me, I understand that I have to stop pushing."*

- **Fear for job security:** People expressed their concern in regards with the stability of their employment when disclosing some type of malaise.

CC1*: "So and within KLM still with certain amount of people, our mindset that you have to be afraid for the doctor or for your position or for your future. [..] We have a lot of people who continue flying when they're actually sick because they don't want to lose their schedule, or they have to their job [..] they are ill but they are afraid of not having their contract with less hours*." CC5: "*It is a bit scary because I've heard so many colleagues that would talk and say {well, I don't feel so good, but I go (to fly), but I did not leave things home so well}. And then when the purser would sometimes say, {you know what, I decide you're not flying today}. So, then we sort of we decide to not really say anything."*

- **Overexertion:** The cabin attendants referred to their trait of pushing their physical or mental capacities too far while working.

CC1*: "We have a lot of people who continue flying when they're actually sick "/* CC3: *"I want to do a lot of things and cetera but then on the downside, I sometimes think I did too much or something affected me"* / CC5: *"Well, like I said before, I've been sort of, you know, holding on. Looking at my life now, I am thinking where can I sort of let go? Never really.* "CC8: "*Still I know, that's part of the job even though I'm not always there. But I choose this profession so I know that can happen, but for me, me personally the following happens. I go in the flow when I am flying."* / CC9: *"[..]especially when you're having a like a lot of problems with your body, like the back pain and it costs a lot of energy and it's, uh, so sometimes you end up flying with pain."*

Organizational shortcomings: The interviewees disclosed their concern in regards with issues that emerge due to the absence of attention within their regular working environment.

- **In-flight equipment unfunctionality**: Participants were concerned with the functionality of the materials within the plane due to lack of sufficient repair.

  CC6*: "Because of a lot of catering material doesn't work very well in the last years even before the coronavirus, the quality and the status of the material gets worse and worse and worse. So that makes that when you open a door, and a container [..] a lot of impact on your physical health. But there is a lack of technicians so it's more important to have the aircraft fly, and of course sure to be safe but the catering material is not even a priority." /* CC7: "*Because the BMC, where we report, that's not the problem. That's the front door. So, if people like that, when they know what's in the house, it brings up emotion [..]. Imagine being in a completely full flight going to Accra in Ghana, and then, you know, you've got a bin luggage problem and you've got delays. That gives me stress and maybe the toilet is broken, and the catering material is not ok, or not enough. The entertainment system, if it is an old Airbus and old configuration, so half of it is broken. That gives me stress. So that's what is behind these front doors."*

- **Flight roster unalignment**: The cabin crew was concerned with the alignment between their work schedule (long-haul / short haul flights) and their personal needs and physical capabilities.

  CC4: *"Yeah, the longer flight with more people is more like "pfff how am I going to cope with this, to manage this long day". /* CC5: *"You know, because often we go (to fly) of course, even though we were in a fight with a partner or even though something is going on, you still go and unfortunately the reason is the unflexible roster. "/* CC6: *"I am happy not to have the fuss, all about making the schedule and all the impossibilities that it gives. So, I am glad to miss that [..]. So, for once, it is really nice for a longer period not to be subject of the scheduling and the frustrations that you sometimes have with the planning of your flights" /* CC9: *"You also don't like to go away at 6:00 o'clock in the evening and knowing you have to make a flight of 12-13 hours." So, everybody has that."*

Job unsatisfaction: An important finding during the interviews was that more than half of the participants mentioned that the satisfaction that they received from their work in the air shifted. CC1: "*Yeah, I've been working for 20+ years. So OK, I've been doing it a lot and well recently for some reason the joy went away a little bit.* / CC8: "*I don't miss it; I am okay here [..]. Yeah, I don't (want to return to flying). I'm OK here (in groundwork) because I know what I have right now, but I also know what the job is." /*

CC9: *And I think for everybody that's flying like 20-25 years, we all have the same feeling (of not wanting to fly) before we go into the flight nowadays. because we changed."*

Concluding, the following mind map was created to show the links and connections between the themes. The colors show conceptual connections between the themes and relate to the concepts of *Figure 3: Reintegration process mind map.*

C.2 Company Doctor analysis

Since the Company Doctor (CD) was present during the VR sessions, the interview questions (see *Appendix D*) focused on understanding the perceived concerns of the doctor in regards with the reintegration process in the nursing home and their values related to the whole reintegration process. During the user-testing sessions, the company doctor observed how the users interacted and reacted with VR and as such, that person was asked about the usability of the technology from their own perspective.

The CD belongs to the **direct and indirect stakeholders** of the design, because even though they are not in direct physical touch with the technology (indirect stakeholders), they can derive insight for the reintegration stage of employees directly through observing the patients' reactions while in the VR environment. In a way, they use the VR as a diagnostic tool (direct stakeholders).

Employee Wellbeing: one of the main themes that emerged from the company doctor is to ensure the health and safety of their employees before returning to work.

"People are on sick leave or not yet, but the come to me when they need preventive advice to prevent them to become sick."

"What I tell them (my patients) is that they need to get their physical condition better and their mind in a good state and a lot of extra things that they have inside, out. But after that, it is safe to (return back to work) fly."

Collaboration & Trust: To facilitate a good reintegration, the company doctor found the component of trust with the patient to be very important in the process. As such, the company doctor's perspective refers to the employee's attitude towards the reintegration which plays a significant role in getting them back to work.

"What's very, very important is the connection. So, there's trust and people believe in your relationship. To build that up. So, if there's trust it can create a good plan."

"So, you build up something so together (with the CC) you working on coming back to work. Uh, I think that's the most important part for a successful reintegration"

"What concerns me is the the mentality about sick leave and about reintegration. [..] Why do you not take your own responsibility about health? I think the responsibility on their side is externalized to someone else (to the organization). I think they should take more responsibility for their own health and a traject of reintegration. It's very important for me if people come with their own plan and, uh, some people are really passive and they don't know if cabin attendants say" I'm sick now, but maybe I could do something else" that gives already a really different way of how you go on with reintegrating."

Workplace Connection: The company doctor recognized the existence of absence of connection with their regular work duties, when cabin attendants are in the reintegration process.

"Because what we know, and the cabin attendants are always 100% off work if they are sick. They are straight away out of the job there and they have no connection feeling with their colleagues and the work. [..] So they are always away from work straight away and it gives distance because you cannot fly just a little bit."

Health insights from VR: During the VR user-testing sessions, the company doctor could pinpoint the reintegration stage and the mental state of the patients.

"So why not use VR. Because work is a big stressor especially if you have psychological problems, work is a stressor because it's demanding, and then you can. So, you can expose them to the job and see what's happening inside their head."

"If you have somebody in your speaking in your consultation and you ask, how did you find the VR and what was happening, that already gives insights. For me, there were no surprises. I know that for some people it was amazing even overwhelming. I can really use the tool as I expected it to be to see the steps in reintegration. You get that feedback straight away from every person you know, as a company doctor, in what do they need to make a good plan reintegration plan."

To CC1: "*This is the process, it (your reaction in VR) shows the place you are. A few weeks ago, this reaction would have happened when you saw the bus, or the first picture. I hope you can be comfortable with this"*

To CC2: *Your journey there are a lot of things that you're being like. Ohh that's not the problem. Or maybe that might be the problem. Ohh no, that seems to be OK as well. So, well, what's she doing here? Umm, you are ready to move on.*

To CC3: "I feel like with your regular doctor you have to discuss this, but the information you gave it shows what's happening, it's very easy to solve for you. So, if you want to go back to work, and because the problem is not that you don't want to do the job, but you are afraid of the circumstances in the airplane (while flying) and you cannot change that because it has to do with the environmental conditions in the air."

C.3 Cabin Crew Manager analysis

Unhealthy work culture:

- **Absenteeism at work:**

"I am a manager of health & focus on people sustainability. [..] So, I like working with purpose. But I also have a commercial goal. I'm busy with reducing absenteeism rates. The duration of the absenteeism is really long. […] We want our people to be on the aircraft. […] But the problem, that's energetic. So, it's mainly mental health and yeah. What we see is that female cabin crew members between the age of 50 and 65 are our highest range of absenteeism. And our absenteeism rates is between 10%-15% and 45% of them is absent for ~1.5 years."

- **Lack of communication with CCs:**

"This is very difficult. That's also on the dynamic that if you're a ground manager, but you focus, your people are in the air. So how do you stay in contact? So, engagement is very important, but how do you engage from such a distance?"

- **Lack of collaboration in reintegration:**

"I think that we have we could and should have more focus on all the stakeholders in the reintegration process. To work better together.".

- **Reintegration boundaries abuse:**

"I think we as a company we should have stricter rules also, more on the process. We're not focused on the process. We're on the people's side which is completely nice and good, but you also need to set boundaries. We don't set boundaries. [..].] . But I have to say most of our employees are all better before we fill in that form and that's the problem. So they're better and then a couple of years later, they do the same absenteeism again."

- **Lack of growth culture:**

"I don't see the levels we need from them to become a focus on an all-around strategy. They just focus on the passenger and on the culture of the cabin crew on that specific flight and not on what the company needs in the long term. [..] There are educational budgets and tracks for them to grow but they don't utilize them. This is very difficult."

"Cabin crew is getting older, and I think we have to be a good company to give them everything they need to do their work even if you're older. [..] So you need the operational manager , which is the purser/ senior purser, to, umm educate them on what the company wants and needs umm, so you have a good future.[..] It would be very nice if you are not able to be a cabinet then anymore that you go, for example to the KLM business class lounge or do some ground work."

Employee autonomy in reintegration: The cabin crew manager mentioned that the reintegration process is designed to offer people the ability to choose how to reintegrate back to work.

"I think we are a very social company, so we give people space to let the (reintegration) process run. So that's very important. "

Employee wellbeing: The cabin crew manager mentioned that one of their main responsibilities is to focus on the long-term wellbeing of their employees.

- **Understand employee needs**

"I think we should for future to do better in regards of what are really the needs of the cabin crew. [..]. So that's really my focus for the upcoming year to check with data. It is important to understand whether this is what they need instead of what we think that their needs are."

- **Safe working environment**

"(I try) that all the environment safety, health, everything is ready, set and go so that people can grab it, use it and do it. [..] so I also want our cabin crew members to feel fit and vital, and that we give them everything they need to have a good work environment"

Workplace disconnection during reintegration

- **Gap between reintegration & work**

"Because uh, it's very difficult for a cabin crew member to relate to their own work (while reintegrating) if their own work is on 10,000 feet, how are you going to bring them back? [...] There is a big gap between other work (nursing home) and your own work. You cannot work for 10 minutes in the air and just go back."

- **Lack of communication during reintegration**

"They (reintegrating employees) only have contacted once every two months with their manager, because if you're sick, you talk to a reintegration officer. [..] So I believe that

the contact with their own manager should be more frequent like every two weeks."

C.4 Virtual Reality Manager analysis

Employee wellbeing: Through this project, the VRM's value is to provide self-awareness to the employee before returning to their regular workplace

"If you are not ready (to go back to work) but very proud, but you say you are ready and you don't want to lose face, people go back to work too soon. And that's one of the most important things, because if you say, "I'm really apprehensive" this is a real emotional thing that could mean you are not ready to go back because if we send you back too early you might relapse again. That is what we try to do. [..] but now we've got a tool, at least that's we're trying to make, that can pinpoint if you're ready or not."

Employee autonomy in reintegration: Another value for the VR manager is to provide the ability to the employees to reintegrate in their own terms.

"And also, it is important for us to give the control back to rehabilitate on your own terms."

"It might also help you normalize the process for yourself because it's coming closer. So, you, instead of being confronted with getting on the bus, sitting in front of the building, can do this in your own pace. [..] So yeah, you know, the idea is is to give you back the control."

Customization: An important value for the VR manager is creating a VR product that prioritizes the needs of each reintegrating employee.

- **Inclusivity:** *"[..]and that's why we are doing also this to find out, if something needs to be changed or if something concerned you just so we have a (VR) product that fits you."*
- **Immersivity:** *"the person in the video needs to look more into the camera for it to be more realistic."*
- **Privacy:** "*I think it would be a good idea to gather some information like how much time users spend in each step within the VR, so we know what to improve, because now we don't have any data on it"*

Innovation: One of the motivations of the VR manager is the digitization of traditional organizational processes.

"So, the goal is for everyone to have their own headsets or something like that and for you to be in the procedures, not just noting down and to see them into 2D[...] That is what's happening right now, there are scenarios that you can follow procedures in a cockpit, digitalize processes so you don't have to be there. There are also a lot of different trainings"

Unhealthy work culture:

- **Cabin crew job perceived difficulties**

"We've seen that we take a lot of people and then within three years, a lot of people, they stop. It's because they come across real difficult passengers. So, you take a lot of issues the whole time you know, they are constantly asking you questions."

- **Work pressure**

"[…] there's that kind of pressure in our company, and it stays like that every year."

C.5 Virtual Reality Designer analysis

Customization: The motivation of the VR designer is to enhance the user experience by allowing for a more personalized interaction with the virtual environment.

"*So of course you it would be nice if there's personalization. If there's things that really are for specific target groups or things that are just different, like intercontinental flights European flights because they are different, they have different preparations, different group sizes. So, you want to be able to offer those kind things, customization"*

Usability: An important value that the VR designer integrated while designing the system was for the environment to be easily operated by the end-user without any technical issues.

- **Intuitive motions:**

"Making sure that it's simple to use in order to not have to explain too much. There's the hand gesture too. All you have to do as a user is to look at your hands and rest it, which I hope you would intuitively do anyway because you're like "oh, I see my hands." And then and then the menu pops up. So, the goal was to make it simple to use"

Purpose & Meaning: The motivation that was integrated into the VR in the design phase was helping and supporting colleagues

- **Helping colleagues**

"I liked it (working in this project) mostly because I guess the easy answer is that I expect that it will help people, so that's nice that you can work on something that helps people."

- **Empathy:**

"So, I also try to imagine being a person with a problematic shoulder and I tried the VR and then I wonder if I would push myself a little bit further if this was my moment to

show that I am further than I should be? Just because I want to and because I don't really feel the weight. So, would I dig my own grave basically?

Mental Wellbeing:

- **Trauma overexposure measures:**

  "So normally you would take a photo like a nice picture that shows to what chapter you're gonna be. But we had to take into consideration that we're exposing them (users) to pictures on things that they might not be ready for yet. And what I said a little bit before that the app should not trigger stuff accidentally. So, there was quite some time in testing that you didn't press (next) twice accidentally, which sounds very normal for any app that you use in your daily life but the ones that do sometimes make stuff, they know that it can happen very easily. "

- **Stress treatment focus:**

  It is focusing on people with other stress related issues but not the same kind of diagnosis where I searched out of interest, how is MDR for example used in the burnout. So now basically what this project is doing is extending that to both seeing whether the exposure in itself, is indeed there."

Physical Impact:

- **Physical pain distraction**

  "VR is also used a lot in distraction for pain which is in this case interesting, Are you focusing someone on their limitation or are you distracting them because you still put them in the plane and that is the probably overwhelming. I don't know what side that is going to flip to. This is sometimes an advantage, sometimes not. Not when you want to evaluate if someone is pain-free."

C.6 Virtual Reality analysis

The user testing sessions revealed two main categories of themes that are important to differentiate. Virtual Reality Impacts resemble concepts that emerged during the interviews with all the stakeholders because they relate to human values. As the name of the category indicates, it shows the impact that a VR intervention can have on the users. On the other hand, VR Characteristics are the technical characteristics of the technology, and they resemble values related to technical system design.

VR Impact

Mental Wellbeing

- **Self-awareness development:**

- **Mental reintegration stage:** Interviewees reported that through the use of VR they can pinpoint their mental progress in regard to returning to work.

  CC2: **"***After this, I think I'm ready to go back. It sounds like it".* / CC3**: "***At this moment, I didn't know that before going into this interview that it would give me this reaction or that I would get this reaction or when I go to a hotel for work, I never thought about it like it's now happening [..]. So, I have learned something today, it gave me insight in my own reintegration."* / CC5: *"I'm not there yet, but I think the more I get towards that day, the more emotions will come and probably there will be a step within VR that you know will make me feel that I don't want to go into the airplane."* / CC8: *"Because if you think you're OK and you think you are fine, I can go whenever (at work), and you do this and then suddenly your body gives you a signal or your brain that this is still a thing [..] I think this just can really help with this."*

- **Career clarity**: Insights on personal preferences regarding their return to cabin crew position.

  CC4: *"You know that the gap between flying, and my personal feelings is getting more and more wide. After this VR experience, it feels like I am confirming myself."* / CC2: *"Yeah, it's ok (being in the briefing room) it feels comfortable because uh, it's a small group and it's better for me to start with this instead of 12 people and going on a flight."*

- **Self-reflection development:** Participants mentioned that the VR initiated an introspection process of their current mental state.

  CC3**:** *Yeah, I'm surprised that that now these feelings are coming back again. So, I think it's very helpful to know it in advance or even just to go home in this afternoon and just think about it. It's different than if you haven't experienced it yet, and you have to deal with it in your (redacted) room, you are like surprised. But now I'm not surprised anymore, now I know if I'm OK, maybe I get sad if I go back to work, or maybe not. I think this is very helpful. Just to be this step to be an option. Yeah, maybe it's something to think about when I go home as well. So, when & if you do this like a standard thing in a real integration process, I think it's helpful that people can think about the things that are going to happen in the journey because sometimes you don't know until you experience it"*

- **Mental recovery**

CC1*: "And this gives me the feeling that I was, uh, expecting. So for me that means that this is a good. Uh, already a good test. But it helps. So crazy. This is also the feeling it's generating"* / CC6*: "And I think this (VR) is like therapy for going back (at work)."* / CC8*: "Yeah, I think this just can really help. I think specifically for people who have burnouts [..]."*

Safety & Control: People in the VR environment mentioned that they perceived a feeling of safety in the environment and control over their own reintegration process.

- **Avoid real-life consequences:**

CC1: *"It just shows also my concern and exactly how I thought I would feel when I entered the BMC for the first time. But now I can do it at home instead of being there in my uniform, more safely […] And in this situation with VR again you copy that situation without all the consequences. If it doesn't work, it's alright (no harm done)"*

CC1: "*In a way, I felt I was in control. And of course, on your own feelings, no. but like I said before, this takes out the step of feeling obliged to take your uniform and start going. And with this, you're much more in control"*

- **Familiar environment:**

CC3: *The (virtual) environment is nice. Its cozy. Most of the times it's crowdy here (BMC), people coming and going. But you know, I like the atmosphere as it is.*

CC9: It feels comfortable though. Still not very busy here though. For me it feels good (experiencing the BMC), but I like being here. I don't mind the crowds.

Workplace Connection: People reported that they were reconnected to their regular workplace after the VR session.

CC8: But *there's nothing here that you can prepare for like you can already start intervening with KLM anymore. So, I thought VR is really nice. You can do that here too, there are many empty rooms. You can start by doing this (the VR) slowly or I don't know right now, what's on the on the thing on the VR, but still be here and I think that's nice.*

CC9: "*I think it's excellent because I think the hardest thing when you go back to your work and your normal position that you have to do the whole package again. So, I can imagine that (this VR can do that)"*

- **Physical sensations**: some interviewees thought of smelling the coffee in the plane, felt the plane smell & temperature

CC3: *"but when I stand here, yeah. Uh, now feeling something in my stomach."*

CC5: *"I can feel the smell of the airplane again!!!! (surprised). I can smell it. It's funny, isn't it? The coffee too! Wow!"*

CC7: "I felt the plane a bit. And the temperature of the plane. Of course, it depends where you are, if they've got the heating already or not, but especially the sounds and the feel'

- **Work tasks recollection**: participants got acclimated with pre-flight preparation, team briefing, security process, flight safety

CC3: " *What kind of plane is this? Its small, so I'm flying in Europe, flight safety check. This is like a routine for me, like ok, I have to do the flight safety check. OK, putting my stuff away, probably. I might think like, "OK, I'm standing in the front today. What are my tasks today? I'm viewing the people. what kind of people are these? It's usual, viewing, scanning the people who are on these flights, seeing if I can help somebody."*

CC7: "*Like I said before, to open your my flight and to scroll through your flight and then see what's on. [..]. I mean, she should have been asking if we are ready to board. Often, they don't do, which is very annoying, yeah. Yeah, because you're still doing your checks and then the purser is being stressed by the ground crew, "we need to board, we need to board". And suddenly the passengers are here, and they even started just walking into the plane."*

CC8**:** *"I remember I have to do the flight safety again. [..] The funny thing is, I said that before, being here makes that you're sort of completely cut off with the work you do. But now when I am looking at it, I'm back in an instant, checking if everything is done according to order."*

- **Back-at-work feelings**: the reintegrating employees mentioned that they experienced feelings (e.g. stress, excitement, curiosity, pressure) that they usually used to have when at working.

CC1: *"I think this shows that it's really working. It just shows also my concern and exactly how I thought I would feel when I entered the BMC for the first time after my reintegration"*

CC3: *"This is also realistic because this reminds me always like, let's get some briefing cards just in case. Because I don't always have them with me and it's always nice to have them. So, this is like always like. Ohh yeah, let's take some. And then I go straight forward. But before I go and leave my suitcase to drop it, I always look for the senior purser and the purser in this room *points at the introduction room* and if they are there, then I go and introduce myself and have a little chit chat"*

CC5: *"The endless problem of storage with the bags. It's all coming back to me, like screaming and stressing for all these stuff! Oh yeah and you have to check everything."*

CC6: *"It was it like back home, like riding a bike. It's usual stuff, great. No stress at all."*

CC7: *"This brings up for me more emotions because it doesn't really trigger me, but it's like brings up more memories from the BMC because this is really work. This is where you where you solve your problems and. This is like important. Does it work? Have I got all this stuff I need on board, and does it fit, luggage? And then what type of passengers but that's like the biggest surprise of all. Ah yeah, I also see the colleagues now. This is exactly how it is.*

CC8: "*I think I get a good picture of what it would feel if I started back at the job."*

CC9: "I am away for some time, and even though I didn't fly the Boeing -737 for two years now, I remember it. OK, the passengers are coming too early. I'm a little bit surprised but umm on the intercontinental flights it happens a lot."

Thus, VR could be used to bridge this perceived gap of within the process before moving from the current reintegration process in a nursing home, towards the airport.

Mental impact:

- **Trauma Exposure:** It was observed that people in the VR were exposed to traumatic experiences that triggered some kind of emotional response.

  CC1: *"Can I take the headset off for a minute? *gets emotional*, I just don't understand whats happening to me. *cries and takes some time* [..] It's uh funny, that's exactly how I imagined that if I would see an empty plane or empty BMC, I would be OK with it. But now (in the VR) as soon as I see the people coming in or feel the start of the flight and it makes me nervous. [..]" /* CC3: *"I don't have anxiety when I am in here (in the VR hotel), but I feel a little bit sad *starts getting*

emotional. Sorry, I'm in the process. I'm just a little bit sad" /* CC6: *"being back in there (in the VR plane) is good but emotional"*

- **Fear of falling:** People mentioned that in the environment they felt scared in regards with when standing up.

  CC4: *"I cannot stand up because I feel I am going to fall." (stands up after a while)*

  CC5: "*I get that if I stand up, I'm not gonna fall. I realize that I'm in the room, but I cannot see my feet."*

Physical impact:

- **Cybersickness**: Some participants had a motion sickness-like experience in VR, which is visually induced instead of the actual movement.

  CC2: *greets the virtual passengers coming in the plane* I feel like I'm getting a little sick - dizzy.

  CC8: "*No, I just had one moment when we were entering the plane. Because at some point I turned too fast I think, and for a moment I felt like dizzy."*

- **Pain distraction:** During the session, the users seemed to conduct movements unconsciously, that triggered their physical pain.

  CC9: *"(tries to look around in the 360o environment and stops) It is a little bit difficult for me to do this while sitting due to my (condition). "*

VR Characteristics

Entertainment: During the VR experience, users expressed views that showed that they found the environment funny and enjoyable.

CC5: **Starts laughing hysterically* This is really funny. Nobody really wants to admit they do it, but we all do it. Like, (when the crew asks you) "-what did you do? - No, I was just studying, you know? - I played the violin" and then you just die-hard binge-watching everything 24/7 so I think this is very real!*

CC8: *"But I am really happy, I enjoyed it. It was fun, it was so fun!"*

- **Immersivity:** The users felt the sensation that they were deeply involved within the virtual world to the point of detachment from reality.

  CC1*: "Well, the look of it feels real and it's obviously not my house, but yeah, you're like, it's in your heart"* / CC6: *"Still it's really great that you have really impression to be there. Like the technology is good"* / CC7: *"I really enjoyed it. It is very realistic.*

It really takes me there, even that we are just chit chatting in between and I know I'm not there. I completely forgot this space. I'm completely gone that was very funny." / CC8: *"It makes you feel that you're there."*

Accessibility

- **Eye-glasses accessibility:** Participants with vision conditions (myopia) used the VR wearing their glasses.

  CC7: *"Does it work with glasses or I need to remove them? (Yes, it works)"*

- **Seated usage:** Participants used the VR software while sitting on a chair, without the necessity to walk around in the physical environment

  CC4: *"It feels more safe to be sitting"* / CC2: *"Yeah. Can I sit down? It feels better*

- **Ambidextrous usage:** It was observed that that people could navigate through the menu and use the VR either with left or right hand.

Customization: During the user testing sessions, it was observed that people experienced some technical shortcomings that referred to more personalized features that fit their experience and their needs:

- **Content concerns**
  - Lack of long-haul flight journey scenarios - CC5*: "What aircraft is this? (737) Yeah, I don't really fly that anymore… Sort of strange. I only international so the feeling is not as real. So, it's more like a visit for me. I don't really feel triggered."*
  - Lack of a busier work-environments when the full scenario is chosen – CC8 *"This is really empty. Especially since I chose full. However, it is never this quiet maybe very late at night. Yeah, well, for me, personal, this is not realistic"*
  - Lack of acoustic stimuli on the surrounding environment – CC9: *"It's very quiet now like if you're flying alone."*
  - Lack of in-flight related content – CC3*: "Uh, so where is the flight? Where is the flight? Short flight? Very short flight"*
  - Lack of additional content during the transition from the plane towards the hotel room – CC5: "*Oh, I am at the hotel room already? That's a big step. That's funny that's really, really fast. No bus, no check-out! […] I can just imagine for other colleagues this would be a big gap."*
- **Lack of interaction**
  - Preference for self-navigating through the environment (BMC, plane, gate) – CC2: *"Can't I go there? *Points to go to a certain position in the building**"*

    - Lack of interacting with the flight schedule tablet – CC3: *"Oh yeah, can I grab it (the tablet)?"*
    - Lack of interacting with in-flight objects (ovens, catering trolleys, luggage cabinets) – CC6: *"I would also like to do the physical part, opening stuff."*
    - Lack of interaction with passengers – CC6: *"Yeah, to be walking towards the passengers and five different people asking you things at one time. These are maybe the things that you have to get used to it."*
- **Usability difficulties**
    - Another step for passengers coming in – CC8: *"Yes, I would like that because I thought that the next step was the passengers coming in, that's why I pushed the next button."*
    - Empty-full option difficulty -CC8: *"Overall it was easy to use, except in the beginning the full and empty option. I could not get that right"*
    - Tutorial necessity for VR (360o degrees, gestures, standing up) – During the session, the researcher had to explain to every participant the environment, the gestures to navigate around the environment and when the users should stand up or sit down depending on the scene.
- **Lack of accessibility**
    - Lack of a lower point of view – CC2: "*Oh my god!!! This is funny! It's a little, scary, it scares me! Because I think so high. I know I'm here (in a room sitting), but it feels like I'm a on top of there (the couch inside the VR)."*
    - Inability to use the VR with any other finger than the pointer – During the sessions, it was observed that users were trying to navigate in the VR using their middle finger but the system wouldn't respond to it.
- **Lack of engagement**
    - Preference for less steps & faster content - CC2: *'Yeah, this takes a little too long for me. All the small steps to the briefing. I'm like, OK, I look around and then I like to continue, be there. It's takes too long. Should I stay for the whole briefing?"*

Concluding, the following mindmap was created to show the links and connections between the themes. Again, the colors show conceptual connections between the themes and relate to the concepts of *Figure 3: Reintegration process mindmap & Figure 4: Return to workplace mindmap.* The gray-colored concepts refer to the VR Characteristics, while the rest refer to the VR Impacts and relate with the concepts derived from the rest of the interviews with the Cabin Crew.

C.7 Definitions of the emerged work values

- **Organizational Support** as a work value refers to the commitment of an organization to prioritize the wellbeing and sustainable growth of its employees

through providing a safe work environment, being empathetic to their needs and providing necessary resources to foster a culture of genuine communication and inclusivity.

- **Work-Life Balance** as a work value refers to the importance of employees being able to manage their professional responsibilities and live a fulfilling personal life, through a supportive work culture that understands that these natures may be not always be in an equilibrium.
- **Autonomy & Safety** as a work value refers to the importance of empowering employees to have control over their work while taking ownership of their own wellbeing.
- **Physical Wellbeing** as a work value refers to the importance of the employees being able to conduct their work that corresponds to their physical capabilities, while not impacting their vitality.
- **Mental Wellbeing** as a work value refers to the importance of the employees being able to conduct their work in an environment that supports emotional stability, reduces stress, and provides resources for mental health care.
- **Purpose & Meaning** as a work value refers to the importance of employees finding a sense of contributing and making a positive impact to the wider society through their work.
- **Workplace Connection** is a value that specifically focuses on the context of reintegrating employees back to work. This value references the importance of employees being able to refamiliarize themselves with their work duties and environment before returning there after their absenteeism.

C.8 Definitions of the emerged VR values

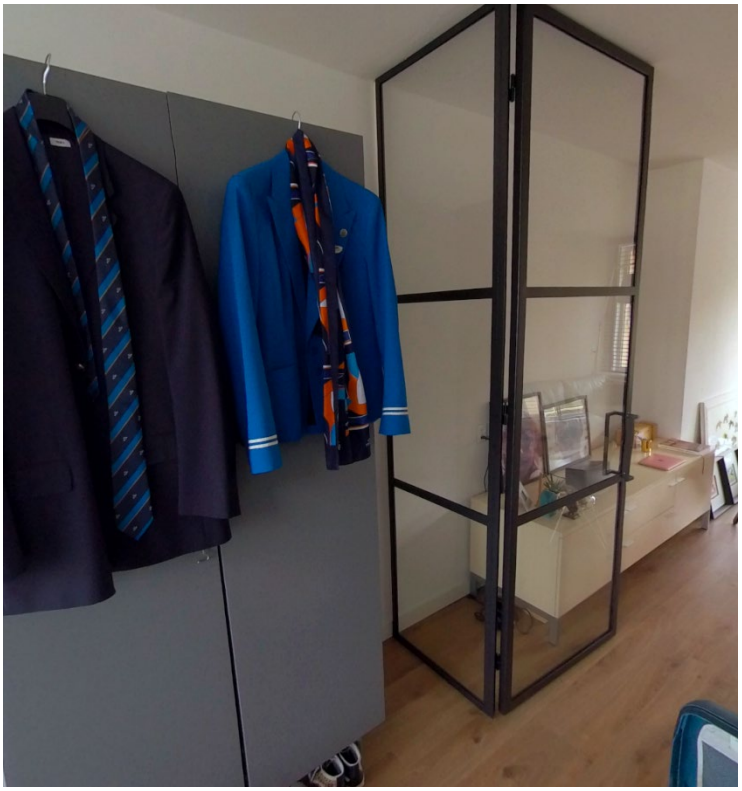
This section will showcase the values that emerged through the design process of Virtual Reality. These are the values that were "baked" into the technology while designing it or values that the stakeholders found important to be designed into the technology through discerning their absence.

- **Privacy,** as a VR design value, refers to the right of an individual to use the system without having any data collected about themself while using the Virtual Reality system.
- **Customization,** as a VR design value, refers to striving for a system that caters to each individual's needs and capabilities. Customization encapsulates concepts such as inclusivity & accessibility.
- **Usability,** as a VR design value refers, to making all people successful users of the system through intuitive and efficient motions.
- **Human Wellbeing,** as a VR design value, highlights the importance of maintaining or improving people's physical and psychological welfare while using the system.

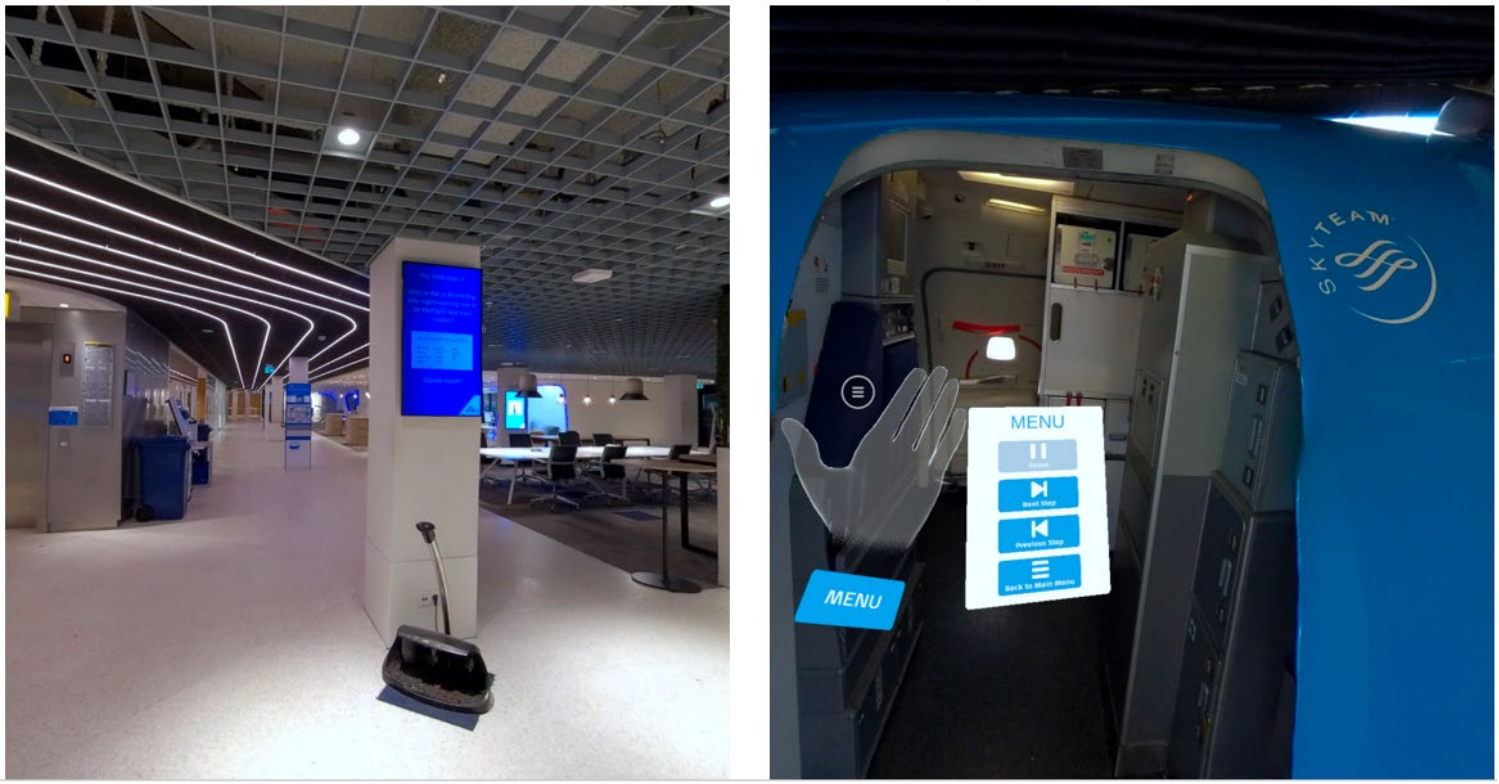
- **Autonomy,** as a VR design value, refers to people's ability to act in ways that they believe will help them to achieve their goals while using VR systems.

Appendix D: KLM Virtual Vitality

Appendix Figure 3: VR Hardware used - Meta Quest 3



Appendix Figure 4: Virtual Vitality environment - Main Menu & at home preparing for work:



Appendix Figure 5: Virtual Vitality environment- the BMC & entering a Boeing-737

Appendix Figure 6:Virtual Vitality environment - Performing flight safety procedure & entering the hotel room

Appendix E: Interview guide

Investigating the values in the workforce reintegration process of KLM Cabin Crew using Virtual Reality: contributions for empirical research in Value Sensitive Design

Management of Technology

Topalli Pavlo, Faculty of Technology, Policy & Management, Technical University of Delft

Jenny Lieu, Faculty of Technology, Policy & Management, Technical University of Delft

Werker Claudia, Faculty of Technology, Policy & Management, Technical University of Delft

Maloney Jae, XR Center of Excellence, Air France -KLM Royal Dutch Airlines

Corresponding author: Topalli Pavlo, MSc, Faculty of Technology, Policy and Management, Technical University of Delft, P.O. 2628 CD, Mekelweg 5, Delft, the Netherlands.

Interview Guide

Introduction of the researcher

Pavlo Topalli, a MSc Student in TU Delft, and I come from Greece! I am currently doing my research thesis on Management of Technology. I am interested to know about your perspective and experience on the reintegration process. I want to understand what is important for you, what do you value during this process. With your answers, I hope to showcase your perspective regarding this process and to improve it, if you think it needs improvement. There are no right or wrong answers, its all about you, and what do you think and feel like. Additionally, always feel free to interrupt or correct me.

At some point in this research, I have some Virtual Reality glasses that you could try on, and tell me your opinion on them. I will guide you through each step, if you would be open to try them on.

Before we begin, I would like to ensure the information you provide is going to be treated anonymously and that all the collected data is going to be handled confidentially. You can always withdraw from the interview at any point.

A: Value-oriented semi-structured interview guidelines

A1. Cabin Crew under reintegration

Ice breaking questions

1. What is your role within KLM?
2. How has it been for you, being away from the air for some time now?

Interview guide before using VR

3. Is there something that you enjoy during this reintegration process?
4. Do you feel that your needs are considered by the company doctors / your manager during this process?
5. What is important for you, during this reintegration process?
6. Is there something you would need to make your return-to-work process better?
7. Is there something concerning you in regards with returning to work?
8. What is your perception of using technology in the reintegration process? (If they would want to use technology in this phase)

Interview guide while & after using VR

9. How did you find the content of VR? Did it feel real/ immersive?
10. How was VR for you in terms of usability?
11. How was VR for you in terms of comfort?
12. Did something concern you in the VR?
13. What would you change in this VR experience?
14. Would you change anything in the reintegration process as a whole?
15. Would you want to use VR in the future as a tool for the reintegration process?

Would you like to add anything before we close this interview? It can be on anything, the reintegration process, the VR, or even the interview itself?

A2. Company Doctor

Interview guide before using VR

1. What is important for you as a doctor, in relation to the patient during the reintegration process?
2. Is there something concerning you in regards with the returning-to-work process?
3. Is there something you would suggest to make the return-to-work process better?

Interview guide while using VR

4. How did you find the content of VR?
5. Did you find anything that concerns you in the VR usage?
6. What do you think is important to ensure in this VR experience?
7. What would you change in this VR experience?
8. Would you change anything in the reintegration process as a whole?

A3. Cabin Crew Manager

Interview guide before using VR

1. What is your opinion regarding the KLM working culture and daily conditions of your employees?
2. (What kind of development & education plans are set for cabin crew members?)
3. What are your responsibilities and tasks in regards with reintegration?
4. What is the role of UWV in the reintegration process?
5. What is the role of your senior within this process?
6. What is important for you as manager for this reintegration process?
    a. Needs & priorities (open for now)
7. Is there something concerning you in regards with this reintegration process?
8. Do you feel that you consider the needs of the crew during this process?
9. How did the idea of implementing VR in the reintegration process emerged?
10. Have you used VR before?
11. What are your expectations regarding the use of VR?

A5. VR Manager

Interview guide before using VR

1. How did you come up with this concept of using VR in the reintegration process?
2. How was this VR scenario prototype created?
3. What is important for you, while designing the VR for the reintegration context?
4. What are your expectations regarding the use of VR in this context?

A6. VR Designer

Interview guide before using VR

1. How did you come up with this concept of using VR in the reintegration process?
2. How was this VR scenario prototype created?
    a. Did you consult with the end-users before creating the prototype?
3. What do you think is important while designing VR for the reintegration context?
4. What are your expectations regarding the use of VR in this context?

Appendix F: Ethical approval & Informed consent

F.1. Ethical approval

Date 25-Apr-2024
Correspondence hrec@tudelft.nl

Human Research Ethics
Committee TU Delft
(http://hrec.tudelft.nl)

Visiting address
Jaffalaan 5 (building 31)
2628 BX Delft

Postal address
P.O. Box 5015 2600 GA Delft
The Netherlands

Ethics Approval Application: Investigating Virtual Reality for workforce reintegration – A Value Sensitive Design approach through a KLM Case study
Applicant: Topalli, Pavlo

Dear Pavlo Topalli,

It is a pleasure to inform you that your application mentioned above has been approved.

Thanks very much for your submission to the HREC which has been approved.

In addition to any specific conditions or notes, the HREC provides the following standard advice to all applicants:
• In light of recent tax changes, we advise that you confirm any proposed remuneration of research subjects with your faculty contract manager before going ahead.
• Please make sure when you carry out your research that you confirm contemporary covid protocols with your faculty HSE advisor, and that ongoing covid risks and precautions are flagged in the informed consent - with particular attention to this where there are physically vulnerable (eg: elderly or with underlying conditions) participants involved.
• Our default advice is not to publish transcripts or transcript summaries, but to retain these privately for specific purposes/checking; and if they are to be made public then only if fully anonymised and the transcript/summary itself approved by participants for specific purpose.
• Where there are collaborating (including funding) partners, appropriate formal agreements including clarity on responsibilities, including data ownership, responsibilities and access, should be in place and that relevant aspects of such agreements (such as access to raw or other data) are clear in the Informed Consent.

Good luck with your research!

Sincerely,

Dr. Ir. U. Pesch
Chair HREC
Faculty of Technology, Policy and Management

F.2. Informed consent

/ /2024

Dear participant,

You are being invited to participate in a research study titled "***Investigating Virtual Reality for workforce reintegration – A Value Sensitive Design approach through a KLM Case study***". This study is being conducted by a MSc Student from the TU Delft, Pavlo Topalli (p.topalli@student.tudelft.nl) , and supervised by:

- Dr. J. (Jenny) Lieu from the Technology, Policy & Management Department of TU Delft.
- J. (Jae) Maloney from XRCOE Department of AF/KLM Group

Research purpose

The purpose of this research study is to gather data regarding the experience of KLM employees in the reintegration process and their perception on the usage of Virtual Reality technologies in the reintegration process. You will be asked initial questions, then you will explore a VR scenario mock-up, if you want. The questions that you should expect during this session will ask to share your experience and view on the current reintegration process, your concerns and needs during this period and your own views around using Virtual Reality for this purpose. The data collected will be used to identify themes and patterns that emerge from your responses. The study's findings will be presented in a clear and concise manner with appropriate citations and references to support the study's conclusions. This will help to improve the current reintegration process and identify the cabin crew's perception. The data will be used for the master's thesis and the thesis will be published at the TU Delft Educational repository. The expected duration is 1 hour per session.

Withdrawal from the study

Your participation in this study is entirely voluntary and you can withdraw at any time. You are free to omit any questions. If requested, the (partially) collected data regarding you will be destroyed.

Risks of participating

In case of having a history of having pre-existing binocular vision abnormalities please do not participate in the VR session or contact the company doctor before taking part in the experiment.

Interview: During the interview some personal identifiable information will be requested for the research such as age group , gender and job category for the purpose of demographics and delivering focused results.

User-testing session: The subject has the chance to dive into a virtual world to explore the KLM environment.

- However, it cannot be excluded that some participants might experience cybersickness which includes nausea (discomfort, stomach awareness), disorientation (focusing, vertigo, dizziness), or oculomotor (fatigue, headache).
- The experience may cause anxiety.

Risk Mitigation

Interview:

To the best of our ability, your answers in this study will remain **confidential**. The following measures will be followed to minimize risks:

- The interview will be anonymous. The participant will be assigned an ID number and the connection between the two entities (ID & contact details/name) will be stored on a separate private file
- Personal data such as contact details, which are used solely for administrative purposes, will not be shared and will be securely deleted upon the completion of the research project.
- Personal identifiable information such as gender, age group, job category will be anonymized, separated and will be grouped into larger clusters that make the anonymization process stronger.
- If any physical/ psychological or any medical information mentioned by the participant, its identity will remain anonymous, and any information that could potentially reveal its identity will be kept deliberately vague.
- Anonymised data may be shared with others, as part of the thesis in the TU Delft Educational repository.
- Free text questions may be quoted or paraphrased as part of the resulting MSc thesis. The answers will be reviewed to ensure they do not contain personally identifiable information.
- All the data collected will be safely stored and backed-up only in TU Delft approved databases with access given only to the student, 1st and 2nd supervisor.

User testing session:

- In order to avoid possible negative side effects, the time spent in Virtual Reality environment is very limited.
- The user-testing will be conducted sitting on a chair to prevent injuries and the experience will be monitored on a laptop.
- The user-testing will be conducted under the supervision of a medical professional.
- The user may experience some slight oculomotor, nausea or disorientation.
- In any of the above-mentioned cases, the test will be stopped right away.

Anonymize, store, and access of the data

The collected data will be anonymized. We will record the subject's personal data on protected servers of TUDelft which can only be accessed by the authorized researchers (1st supervisor & student) in this project. No traceable personal data will be provided back to KLM. Incidental findings will be handled anonymously. This information will be stored until the completion of the MSc Thesis, together with interview answers, observation notes, and potential audio recordings. The personal data will be processed to demark the collected insights. The name will only be indicated on the consent form, each subject will only be identified by an ID number. The data will be stored in a secured university project drive which only can be accessed by the student and the supervisor. The

data is managed according to the data management plan (DMP) of this study. The data will not be shared and re-used by default.
For any questions regarding this research, the following researchers can be contacted: Pavlo Topalli - P.Topalli@student.tudelft.nl

Consent form

Virtual Reality Technologies in the Reintegration Process

Personal Information:	**ID:** _____
Job Title:	_____
Gender:	**Male**: ☐ **Female**: ☐ **Other**: ☐
Age Group	**18-27**: ☐ **28-43**: ☐
	44-59: ☐ **59+**: ☐

Please tick the appropriate boxes	**Agree**
1. I have read and understood the study information dated ___ / ___ /2024, or it has been read to me. I have been able to ask questions about the study and my questions have been answered to my satisfaction.	☐
2. I consent voluntarily to be a participant in this study and understand that I can refuse to answer questions and I can withdraw from the study at any time, without having to give a reason.	☐
3. I understand that taking part in the study involves: • Answering questions about my reintegration process experience and my perspective on Virtual Reality technologies. • Answering the questions with the knowledge of my expertise.	☐
4. I understand that the interview will last no more than 1 hour.	☐
5. I understand that the interview may be audio recorded and transcribed. The audio recording will be transcribed.	☐
6. I understand that I might experience some discomfort, oculomotor, or fatigue during using the Virtual Reality technology.	☐
7. I understand that the following steps will be taken to minimise the threat of a data breach, and protect my identity in the event of such a breach: • Secure data storage • Data anonymisation	☐
8. My name will **not be published** in the report.	☐
9. My job title **may be mentioned** in the report.	☐
10. I understand that the (identifiable) personal data I provide will be destroyed at the end of the MSc Thesis (end of August).	☐
11. I understand that after the research study, the de-identified information I provide will be used for an academic report.	☐
12. I agree that my responses, views, or other input can be quoted anonymously in research outputs.	☐
13. I understand that the personal data will not be shared and re-used by default.	☐

Signatures

_____	_____	_____
Name of the participant (printed)	Signature	Date

I, as a researcher, have accurately read out the information sheet to the potential participant and, to the best of my ability, ensured that the participant understands what they are freely consenting.

_____**Pavlo Topalli**_____	_____	_____
Name of the researcher (printed)	Signature	Date

Study contact details for further information:
Pavlo Topalli - P.Topalli@student.tudelft.nl

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