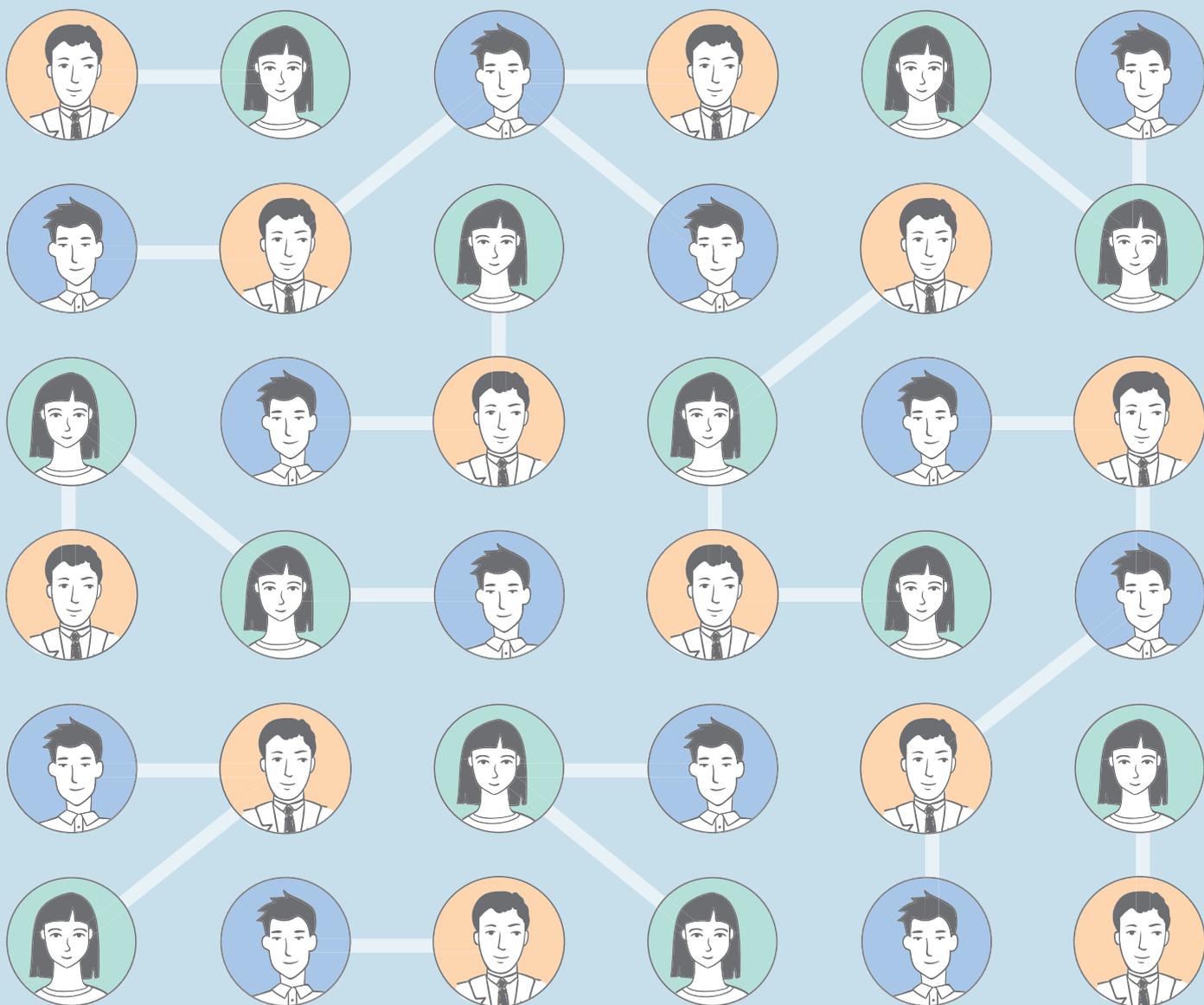


A Roadmap to the Future of Radiology Staff Resilience

Enhancing employee engagement of Millennials

Master thesis by Britta van Schaik



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Enjoy reading!

Britta van Schaik

Executive summary

With the introduction of the Quadruple Aim at Philips, healthcare staff experience is recognized as an important health system performance indicator. Engaged healthcare employees are related to retention, patient-centered care, high patient safety and improved quality of care provided. However, burnout seems to be a common phenomenon among healthcare personnel. Especially employees from radiology departments are prone to developing burnout symptoms. This does not only have negative consequences for the individual's well-being and the organizations' performance, but also negatively affects the quality of patient care.

As Millennials are the least engaged generation but will take up 75 per cent of the workforce in 2025, this thesis proposes solutions on how Philips might support Millennial healthcare employees within radiology departments to enhance engagement in 2030. This has been done by extensive research on how to create an employee experience that enhances engagement, how this looks like for Millennials at radiology in the future and exploring the opportunities for Philips to support this.

Field research revealed that technologists mainly value *involvement* in the workflow, department and hospital. This can be enhanced by giving them more responsibility based on interests, experiences and knowledge that they build up during their job. This means that in the future, technologists will have tailored roles (e.g. management-expert, patient care-expert and technology-expert) and could take over tasks of radiologists and residents.

Residents mainly value *staff equality* that creates an open and safe learning environment. This can be enhanced by structuring the supervision and assessment and by tailoring their learning pathway. This means that in the future, they will have personalized learning pathways which are tailored to their needs and learning preferences.

Radiologists mainly value being *result-driven* to define diagnoses as soon as possible. This can be enhanced by technology support in the workflow and in the interpretation of scans and images. This means that in the future, technology will take over simple tasks and will enable a more efficient workflow for radiologists who will have more time to focus on complex cases and collaboration with other physicians.

Based on these findings, five service propositions are designed on how Philips might support the Millennial employees at radiology in the future to enhance their engagement. Four service propositions are created during a creative workshop with Philips employees. As confidential information was used in this workshop, these four service propositions are considered confidential. One service proposition is created based on an individual brainstorm and insights from the project and is applicable to all roles within radiology:

As the roles of radiology employees will change into becoming more visible and specialized based on preferences and technology support, it is necessary to have a clear overview of all employees to sustain the employee engagement within the employee, department and hospital workflow. This can be supported by “a **personalized planning** that helps radiology employees who want to define diagnoses as soon as possible, be involved in the workflow, department and hospital, and want to learn in an open and safe learning environment by allocating employees correctly based on their tailored tasks and managing the workflow efficiency.”

All findings of this thesis are presented in the format of a roadmap where the design innovation elements are visualized: the changing role of radiology in the future, the employee values, the future scenarios and the service propositions. These propositions will serve as inspiration for projects or research initiatives for Philips to continue with. However, the next steps for Philips are to validate these service propositions with radiology employees to explore the desirability. Besides, these service propositions need to be validated based on feasibility and viability within Philips and should be benchmarked to other health technology companies as well as companies that provide educational services within healthcare.



Reading guide

This reading guide shows an overview of the report to assist while reading. Each chapter starts with a small introduction to explain the topic and what to expect. At the end of every chapter, a conclusion is written that highlights the most important findings.

CONCLUSIONS

For the fast readers. The outlined text at the end of the chapter contains the most important decisions, insights and conclusions which contributed most to the final deliverable.

JD-R Model	Job Demands-Resources Model
DI	Diagnostic Imaging
PACS	Picture Archiving and Communication System
HIX	Healthcare Information X-change
AI	Artificial Intelligence

VALUE BASED HEALTHCARE

A method which is focused on maximizing the value of care for patients and reduce the costs of healthcare. In simple words: the patients are central.

VALUE BASED IMAGING

The first contribution of radiology (interpreting images and scans to establish the diagnoses for patients) to value based healthcare.

EMPLOYEE VALUES

A specific value of employees that fulfils an unmet need or solves a dilemma in the future. In this thesis: the radiologists, residents and technologists from the Millennial generation.

WORK ENVIRONMENT

The physical surrounding where and how people work (together). In this thesis: the hospital environment of radiology employees.

FUTURE VISION

An expression of a desired future where it provides a strategic reference point. In this thesis: a future vision based on the employee values and the future of radiology.

FUTURE SCENARIO

An alternative view on the future. In this thesis: the workflow of radiology employees.

VALUE PROPOSITION

An innovation, service, or feature intended to make a product or service attractive to customers. In this thesis: service propositions for radiology employees.

ROADMAP

A visual portray of design innovation elements plotted on a timeline.

Table of contents

1	Introduction	11
	About Royal Philips	12
	Problem statement	14
	Project approach	16
2	Understand	19
	Context exploration	20
	The radiology department	20
	Meet the Millennials	24
	Literature exploration	26
	Burnout	26
	Engagement	26
	Job Demands-Resources Model	26
	Research model	27
	Conclusion	28
3	Discover	31
	Exploratory research	32
	Employee values	32
	Future of radiology	38
	Future vision	42
	Conclusion	44
4	Imagine	47
	Work environment elements	48
	Evolution of the work environment elements	52
	Conclusion	55
5	Design	57
	Future scenarios	58
	Value propositions	64
	Service propositions	65
	Conclusion	68
6	Deliver	71
	Validation	72
	Roadmap to Radiology Staff Resilience	74
	Conclusion	82
7	Discussion	85
	Contribution master thesis	86
	Conclusion	87
	Recommendations	89
	Personal reflection	90
	References	91



1 Introduction

This chapter provides an introduction on the relevance of this graduation project. First of all, Royal Philips as a company and the Research department will be introduced. Philips Research, specifically Health Services & Solutions, initiated this graduation project. The problem statement will be explained and an outline of the graduation project will be provided.

1.1 About Royal Philips

Royal Philips is a global leader in health technology and headquartered in Amsterdam, The Netherlands. They focus on improving people's lives and achieving better healthcare outcomes throughout the health continuum, from healthy living and prevention to diagnostics, treatment and home care, see figure 1. Philips makes use of advanced technologies and deep insights in clinical applications and the needs of customers to develop integrated solutions. They are market leader in the area of diagnostic imaging, image-driven treatments, medical IT applications, patient monitoring, home care systems and consumer health applications (Philips, 2019a). They have a multinational workforce of approximately 77,000 employees, globally present with sales and services in more than 100 countries worldwide with a sales of €18.1 billion in 2018 (Philips, 2019a).

PHILIPS RESEARCH

Philips Research is one of the departments within Philips that helps improve the quality of lives by developing meaningful and often breakthrough solutions based on people's needs. They are operating at the front end of the innovation process, which means that their expertise covers areas ranging from identifying and interpreting trends to ideation, technology and concept development and – if required – first-of-a-kind product development.

One division within Philips Research is Health Services & Solutions, see figure 2. This department creates data-driven innovation services and solutions that enable healthcare

providers to deliver improved outcomes at lower cost with improved patient and employee satisfaction. At the moment, this division is also focusing on educational services for radiology departments. The educational service project concentrates on using data to trigger, create and measure (the impact of) educational services.

QUADRUPLE AIM

In order for Philips to be the global leader in health technology, innovations need to meet the requirements of the Quadruple Aim framework, formerly known as the Triple Aim.

The Triple Aim is a framework that has been developed by the 'Institute for Healthcare Improvement' that describes an approach to optimize health system performance (Berwick, Nolan, & Whittington, 2008). Its main pillars are 1) improved patient experience of care, 2) improving population health, and 3) reducing costs. Yet, research showed that the stressful work life of physicians and healthcare staff impacts their ability to achieve these three aims (Bodenheimer & Sinsky, 2014). Two of the main consequences of the stressful work life are burnouts and general staff dissatisfaction. The increase of burnouts and dissatisfaction within the healthcare workforce have in turn been associated with lower patient satisfaction, reduced health outcomes, and increased costs. Therefore, in the Quadruple Aim, see figure 3, the healthcare staff experience has been included, with the aim to improve the work life of health care providers.

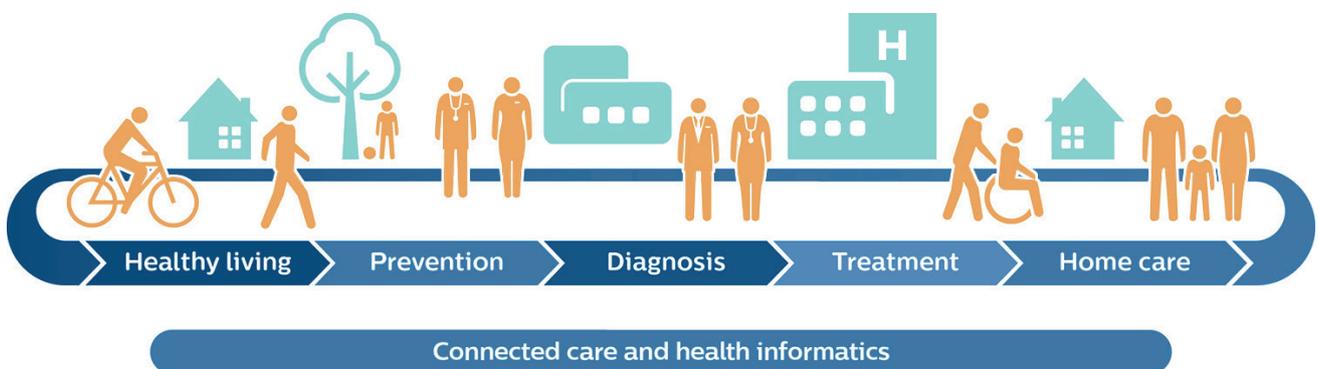


Figure 1: Focus of Philips on the health continuum of people (Philips, 2019a)

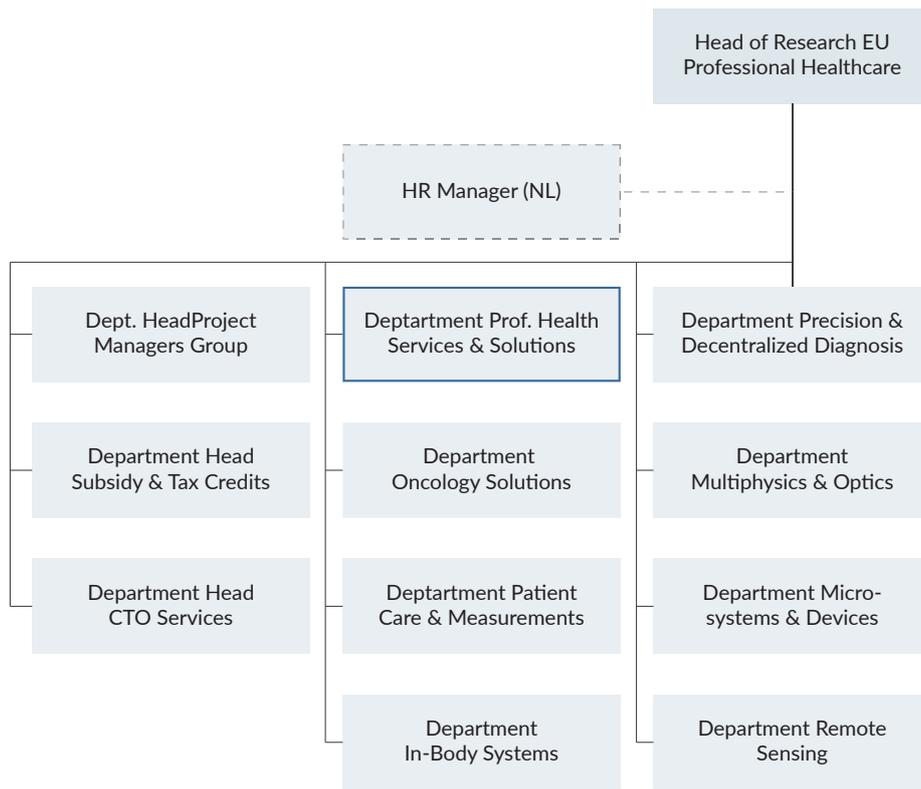


Figure 2: Organizational structure Research department Philips Eindhoven (Philips, 2019a)



Figure 3: Quadruple Aim

1.2 Problem statement

Starting from the Quadruple Aim and its critical outcomes, employee experience is an important topic to focus on. Engaged employees have a significant positive effect on organizational commitment (Geldenhuis, Laba, & Venter, 2014), invest more in their work and are likely to go beyond their required and expected amount of work tasks (Lockwood, 2007). Besides, engagement among healthcare employees is also related to retention, patient-centered care, higher patient safety and improved quality of care provided (Lowe, 2012).

In contrast, disengaged employees have negative consequences for businesses and organizations. Disengaged employees can be apathetic, robotic, depersonalized, estranged, and withdrawn from their job (Salanova, Agut, & Peiró, 2005). Their negative mindset can be contagious and affect how they treat and serve customers, or patients. One of the most well-known and critical consequences of dissatisfaction and disengagement among employees is burnout.

Burnouts are a severe condition and recently the World Health Organization (WHO) classified work “burnout” as an occupational phenomenon (World Health Organization, 2019). This means that it is not classified as a medical condition, however, it is defined as “a syndrome conceptualized as resulting from chronic workplace stress that has not been successfully managed”.

Burnout seems to be a common phenomenon among healthcare personnel (Glasberg, Eriksson, & Norberg, 2007; Prins et al., 2007; Prins et al., 2010; Thomas, 2004). Especially employees from radiology departments are prone to developing burnout symptoms (Philips, 2019b). According to research, there has been a downward trend in job satisfaction and an upward trend in burnout among radiologists (Peckham, 2015; Shanafelt, Boone, Tan, & al, 2012) with about half of them reporting feeling burned out, and only 25 per cent indicating that they were happy at work (Medscape, 2019). The consequences of burnout among healthcare employees does not only have consequences for the individual’s well-being (Salvagioni et al., 2017) and the organizations’ performance (Demerouti, Bakker, Nachreiner, & Schaufeli, 2001), but also negatively affects the quality of patient care (Prins et al., 2010; Wood & Killion, 2007).

There is another group of employees, the Millennials (also known as generation Y), that also report high levels of work-related stress and burnout complaints in the Netherlands, see figure 4 (25 to 34 yrs). Additionally, this generation also seems to be the least engaged generation with only 29 per cent being actively engaged (Gallup, 2016), see figure 5. From a business perspective, it is necessary to have a well understanding of the employee values of Millennials at radiology to be able to facilitate employee engagement to achieve the benefits of engaged employees across different generations.

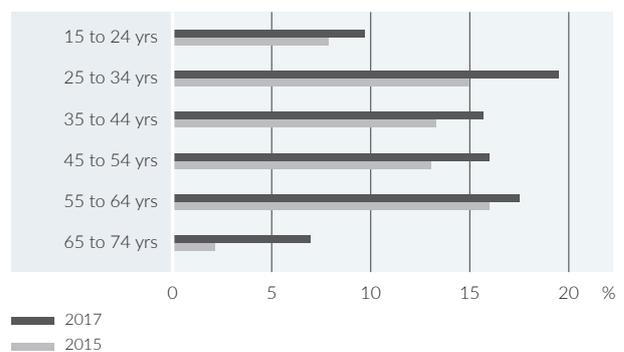


Figure 4: Work-related mental fatigue (CBS, 2018)

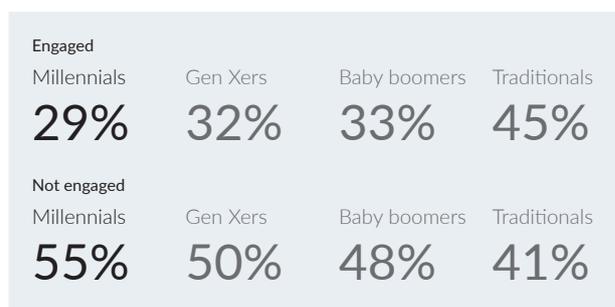


Figure 5: Millennials least engaged generation at work (Gallup, 2016)

RESEARCH QUESTION

With an eye on the future, where Millennials will take up 75 per cent of the workforce in 2025 (Forbes, 2018) and with the introduction of the Quadruple Aim, there is an opportunity for Philips to support the Millennial healthcare employees within radiology departments in their daily activities to achieve a better employee experience that enhances the engagement.

Based on the problem statement the following research question will be answered:

“How might Philips support radiology departments to create an employee experience that enhances engagement among Millennials?”

To be able to answer this research question, the following sub-questions are set up:

- How to create an employee experience that enhances engagement?
- How does the employee experience look like that enhances the engagement among Millennials at radiology
- How will the employee experience of engagement evolve over time?



1.3 Project approach

The aim of this graduation project is to explore the future of radiology where the employee engagement among Millennials is enhanced and how Philips might support this new way of working.

The approach of this graduation project is inspired by the Double Diamond (Design Council, 2005), which is one of the main approaches used at the faculty of Industrial Design Engineering at the University of Technology in Delft. This approach illustrates an iterative design process of diverging and converging based on the four phases: discover, define, develop, and deliver. The first two phases focus on finding the right purpose to design for, whereas the last two phases focus on developing, testing and refining ideas.

In this graduation project, the Double Diamond approach will be combined with the Design Roadmapping method (Simons, 2017), as the focus is on future innovation(s) for Philips. This method is used to visualize an organization's future innovations where user values, product-service solutions, market insights and technology innovations are linked and plotted on a timeline. This method consists of three phases: value mapping, idea mapping, and pathway mapping.

Combining the Double Diamond method with the Design Roadmapping method will add value to this project as the future vision will explore the future based on the values of the Millennial employees at radiology instead of on certain problems in the present.

ADJUSTED APPROACH

By combining these two approaches and keeping in mind the research question, this graduation project will consist of two phases of the roadmapping method: value mapping and idea mapping. Pathway mapping is left out of scope, as the focus will be on exploring and designing the future of radiology where employee engagement of Millennials is enhanced. Yet, this project will provide possibilities on how Philips might support this way of working. However, these will act as inspiration and starting points for further research.

The value mapping phase will consist of two diamonds: understand and discover, see figure 6. In the understand chapter, the context of radiology and Millennials are explored and literature research has been performed on engagement and burnout. This chapter ends with a research model that will form the basis of this project. In the discover chapter, the employee values of Millennials at radiology and the future of radiology will be explored. This chapter ends in a future vision.

The idea mapping phase will consist of one diamond and one iterative process: imagine and design. In the imagine chapter, three strategic life cycles of the development of radiology will be defined and the work environment elements for engagement will be explored. This chapter ends in the evolution of the work environment at radiology to sustain engagement over time. In the design chapter, all insights from the previous chapters are used to design three future scenarios of the workflow at radiology and proposes value propositions on how Philips might support this new way of working.

In the last chapter, deliver, a roadmap is presented that visually portrays the innovation elements that enhance employee engagement among Millennials at radiology in the future and how Philips could support this.

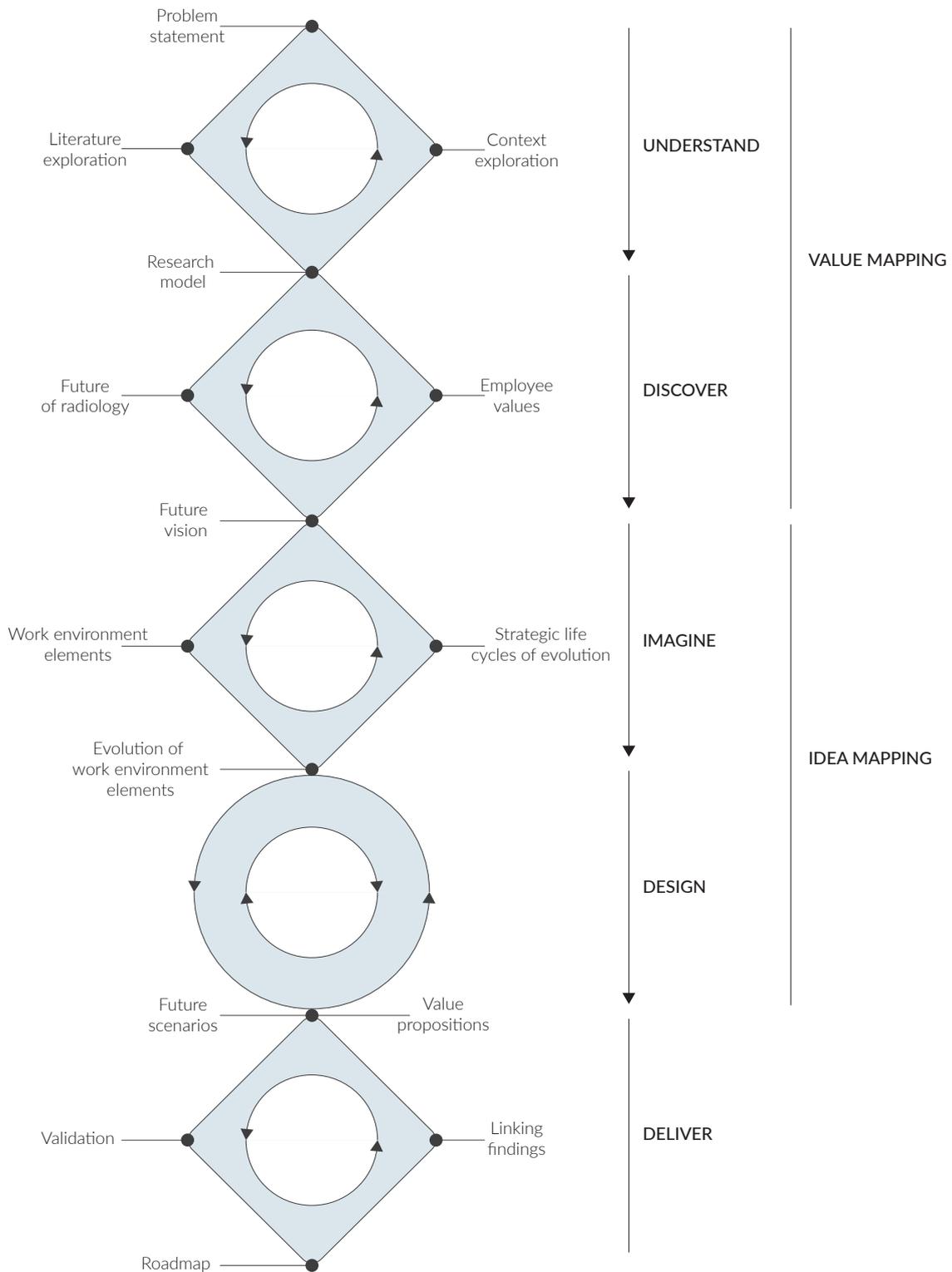


Figure 6: Project approach



2 Understand

In this chapter the current context of the problem statement is extensively explored. By means of desk research, the context of radiology is mapped out and the insights into who Millennials are have been laid out. Literature exploration has been performed to dive into the subjects of burnout and engagement and how these terms are linked to each other. At the end of this chapter, a research model is defined that forms the basis on how to create an employee experience of engagement.

2.1 Context exploration

THE RADIOLOGY DEPARTMENT

Radiology is the branch of medicine that uses imaging technologies to aid in the diagnosis of disease, illness and injury (Philips, 2018). It is one of the most important departments within the hospital as virtually all patients pass through the department of radiology (Aidoc, 2019).

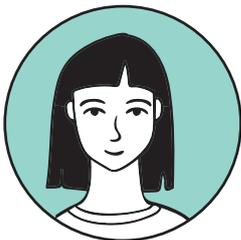
Diagnostic Imaging is used in almost every medical setting, including outpatient, inpatient, and emergency departments. It assists most clinical practices, including oncology, cardiology, neurology, and women's health.

Who works at radiology?

There are various stakeholders involved at radiology: technologists, residents, radiologists, the administration, and

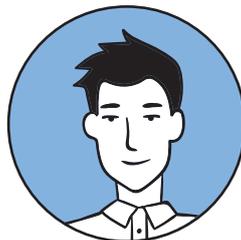
the patients (in, out, and trauma). The focus for this graduation project will be on the medical employees of radiology: technologists, residents and radiologist. Read below to get a better understanding of these stakeholders.

Referring physicians are not direct stakeholders within radiology, however, they do play a specific role and work closely with radiologists. Referring physicians send requests for scans or images of patients in order to treat them correctly. Some cases are more complex, and these will be discussed in multidisciplinary meetings together with radiologists, residents and other physicians if necessary.



Technologist

A technologist makes images and scans of patients to enable the radiologist to diagnose their illness. They will prepare the patient for the exam and must be able to soothe and calm the patient when they are nervous and anxious. Also for technologists there is a possibility to specialize in a certain modality. It depends on the hospital how many modalities technologists can have as a speciality.



Resident

A resident, not in all hospitals present, is on the way to become a doctor, in this case a radiologist. They have the same tasks as a radiologist, however, they are being supervised by a radiologist to make sure that the right diagnosis is made. The education of residents takes approximately 5 years, divided into two modalities: 1) common trunk phase, and 2) differentiation phase. During the common trunk phase, all residents follow the same education that consists of different internships of one month in each theme. During the differentiation phase, the residents deep dive into one or two themes and are working at general radiology.



Radiologist

A radiologist is a physician who interprets images and scans to diagnose a patient's illness, creates a report based on the findings and sends this to the referring physician. All radiologists specialise into a certain differentiation, such as cardio, abdominal, intervention, etc. For some exams, such as the ultrasound, the radiologists receive the patients themselves. The technologists make the images and scans for the other imaging modalities.

How do they work at radiology?

Based on a previous Philips project (Philips, 2018), an abstract version of the current workflow at radiology has been visualised, see figure 7.

During the morning, the day is opened by radiologists and residents to discuss the announcements of the day. The day schedule is reviewed and cases are discussed and prioritized. In the meantime, technologists are assigned to scanners, tasks, and patient preparations are arranged.

During the day, referring physicians send image requests via HIX, an integrated electronic patient file system that is used throughout the hospital. Radiologists view the requests in HIX and determine the scanning protocol per image request. When the patient arrives in the waiting room, the technologist opens the protocol of this patient from HIX in the software of the e.g. CT-scanner or MRI-scanner. Often, when the technologists review the protocol of the radiologist they have suggestions on how to optimize the protocol and propose this to radiologists.

After reviewing the protocol, scan time and possible scanner, the technologists make the scan or image of the patient and complete the exam information in the scanner system. The images or scans are stored in HIX and are automatically send to the Picture and Archiving Management System (PACS), a system that is used by radiologists and residents to interpret, review and report scans and images of patients. However, patient information cannot be opened in PACS. This means that the radiologists have multiple screens in front of them to see both patient information in HIX and the images or scans in PACS. The interpretations and findings of the radiologists and residents are stored in PACS and also automatically stored in HIX in order for the referring physician to be able to see the results.

Besides interpreting and reviewing the scans and images made by technologists, there is also time where radiologists supervise residents. During this supervision, residents can ask questions and radiologists give feedback and assessments.

Sometimes during the day, a peer-to-peer review is planned where radiologists review cases with peer radiologists and / or residents. Also, multidisciplinary meetings are planned with referring physicians, radiologists and residents to discuss the more complex cases.

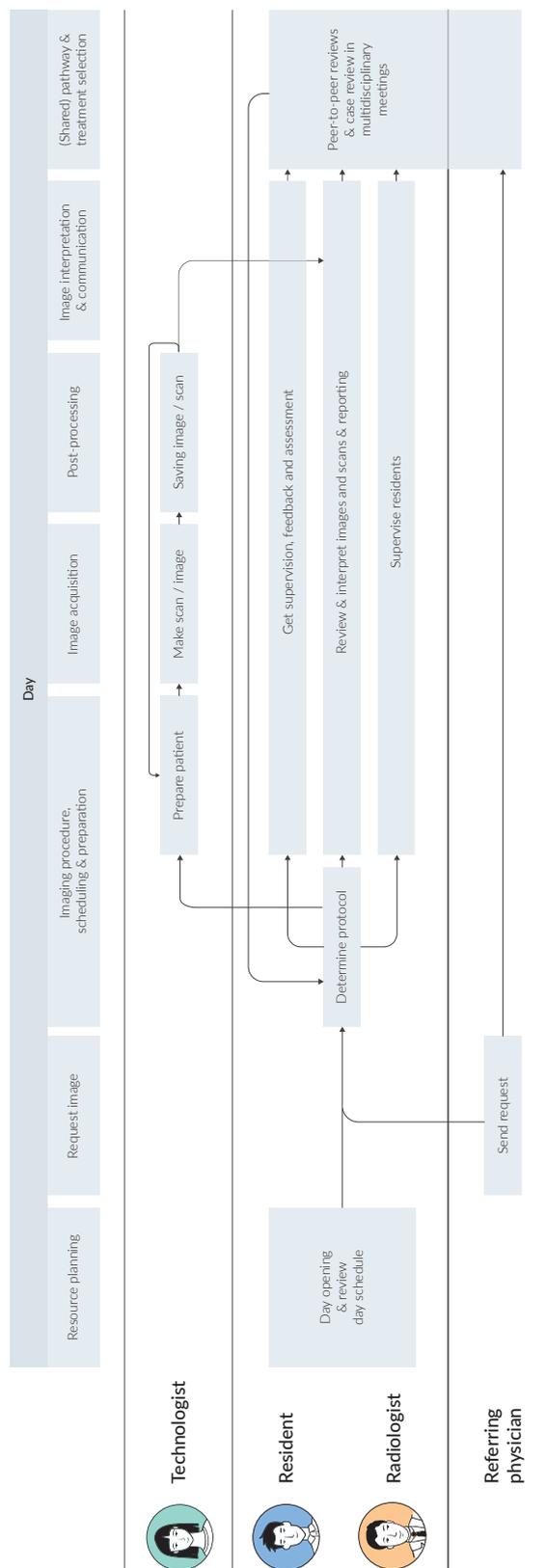


Figure 7: Current workflow at radiology

Imaging modalities

Over the years, different sorts of medical imaging techniques have been developed, each with their own advantages and disadvantages that make them useful for various conditions and patient anatomies. The imaging modalities are mainly used by technologist. Most used medical imaging modalities are:

- *DXR (Digital X-Ray)*

Digital X-ray works with a wavelength and frequency that the human eye cannot detect, but by transmission through a patient it can be converted into a two-dimensional image. It is typically used for evaluation of the lungs, heart and skeleton because of its wide availability, low cost, speed and comfort for the patient. However, there are risks associated with the use of radiation. Lately, radiology is also on the move, with wireless portable detectors and digital radiology rooms “on wheels” making x-ray systems more and easy-to-manoeuvre, with particular benefits for trauma, Intensive Care Unit and paediatric patients (Philips, 2018).

- *CT (Computed Tomography)*

CT uses X-rays in different angles to produce cross-sectional images of the patient’s body. To increase the contrast in the images, a contrast dye can be used to improve the visualizations. Compared to X-ray, CT images provide much more detail, however, they also produce a higher level of radiation. For this reason, pregnant women and patients allergic to the dye are encouraged to use an MRI scanner.

CT scans are used to diagnose muscle and bone disorders, locate tumours or infections, detect and monitor cancer, heart disease as well as guide procedures such as surgery, biopsy and radiation therapy (Philips, 2018).

- *MRI (Magnetic Resonance Imaging)*

MRI scanners do not use radiation, but apply a strong magnetic field and radio waves to generate cross-sectional images of the body. MRI scans provide greater contrast between different soft tissues of the body, making it especially suitable for imaging the brain, spine, muscles, joints, connection tissues, and the inside of the bones (Philips, 2018).

One important aspect is that MRI scans are not advisable for patients with pacemakers and / or other metallic hardware due to the powerful magnetic fields and radio signals. This can cause great accidents and danger for both patients and physicians present in the room.

- *US (Ultrasound)*

Ultrasound uses sound waves. High-frequency waves are transmitted into the body via the conducting gel, those waves bounce back when they ‘hit’ the different structures inside the body which is then used to create an image for diagnosis. Ultrasound is especially known for pregnant women and women’s health.



PHILIPS

MEET THE MILLENNIALS

Since the Millennials will be a large part of the workforce in 2025 and this generation is the least engaged generation within the workforce at the moment, an exploration is performed on who they are as a person, who they are as an employee and why they tend to be vulnerable to burnouts.

In 2018, there were 17.181.084 people living in the Netherlands (CBS, 2018a). This population consisted of different generations that all have different values, beliefs, and opinions regarding their life, also regarding their profession and professional engagement. These generations can be defined as the Silent generation, Baby boomers, Generation X, Pragmatic generation, Millennials, and Generation Z. From this total population, the Millennials covered 24,6%. See table 1 for an overview of the main characteristics of the generations.

Millennials as people

Millennials are a notably large and diverse group. Yet, it is important that they cannot be seen as one person with the same characteristics. However, there are some common characteristics of this generation that give an understanding of their behaviours and attitudes in general (Gallup, 2016):

- Millennials are **unattached**

Millennials generally do not feel strongly connected to their jobs or the stores where they buy products. They are less likely than other generations to feel pride in or identify with particular communities or institutions. This does not imply that they do not want to attach themselves or find groups with which they can relate, however, it does suggest that

Millennials view certain institutions differently than previous generations. This shapes their decisions to engage – or not to engage.

- Millennials are **connected**

Although Millennials are generally not attached to communities or brands, they are highly connected to the world around them. They have grown up in a digital world and know how to deal with this. Internet, laptops, Wi-Fi, and smartphones have enabled Millennials to instantly and constantly access information and entertainment, friends and strangers and anything they want. This helped them get a unique global perspective and transformed the way they interact, consumer, content and live.

- Millennials are **unconstrained**

Millennials want to have impact, push for a change in the world. They do not just accept “that’s the way it has always been done” as an answer. For example, they strive for gender equality, and fight climate change and social divides. In the daily world, they want businesses to approach them differently and adjust their customer experience to meet their needs and values.

- Millennials are **idealistic**

Millennials are highly optimistic and believe life and work should be worthwhile and have meaning. They want to grow, learn and understand how to fit in with their jobs, friends and companies. They look for work that matches their sense of purpose and makes them feel important and noticed. They want more out of life than only work and they believe they can obtain it.

Table 1: Generations in the Netherlands (CBS, 2018a; Launspach, 2019)

Generation	Born between	Current age (2019)	Current life phase	Number in Netherlands (2018)
Silent generation	1925 - 1940	79 - 93 yrs	Old age	778.914
Baby boomers	1940 - 1955	64 - 79 yrs	Senior	2.460.202
Generation X	1955 - 1970	49 - 64 yrs	Mid / late adult	5.878.229
Pragmatic generation	1970 - 1980	39 - 64 yrs	Mid adulthood	
Millennials	1980 - 2000	19 - 39 yrs	Young adults	4.253.083
Generation Z	2000 - now	0 - 19 yrs	Adolescence	3.810.656

Millennials as employees

Looking at the generations present within the workforce, four of the generations from Table 1 can be identified: the Baby boomers, Generation X, the Pragmatic generation, and the Millennials, who represented 42% of the workforce in 2018.

In the working environment, Millennials tend to want intellectual challenge, need to succeed, seek those who will further their professional development, strive to make a difference, and measure their own success (Eisner, 2005; Wong, Gardiner, Lang, & Coulon, 2008). Due to this they show confidence and voice their opinions in order to be heard. They value work-life balance and therefore they highly emphasize the value of leisure (Twenge, Campbell, Hoffman, & Lance, 2010). However, they also have higher expectations about promotions, pay raises, instant feedback, and praise from their workplace than earlier generations (Gursoy, Maier, & Chi, 2008).

As mentioned before, Millennials have grown up in a digital world. Continually online, plugged in, and connected to digitally and fast streaming information, entertainment, and people. This is also reflected in the workplace, as Millennials desire immediate feedback, favour an inclusive style of management, and dislike slowness (Francis-Smith, 2004). However, besides this interesting new generation within the workforce, research showed that 55 per cent of the Millennials are not engaged at work and that even 60 per cent say that they are open to a different job opportunity (Gallup, 2016).

Millennials and burnout levels

The fact that Millennials are not engaged at work and that in the Netherlands they reported the highest relative level of burnout complaints (CBS, 2018b) resulted in identifying the potential cause(s) for this. Thijs Launspach is a Dutch psychologist and expert on stress management, one of his specialty areas being Millennials and burnouts in the Netherlands. He explained the main reason why Millennials are more vulnerable to burnouts than other generations (Launspach, 2019).

“Millennials tend to be more vulnerable to burnouts than other generations, mainly because of the high and mostly unrealistic expectations they have of themselves. Especially in times of stress, Millennials tend to push themselves even harder. They create the highest expectations of themselves, which they can never actually meet. The idea, however, of not living up to these expectations is unbearable.”

These unrealistic expectations are mainly created by comparing themselves to others. Due to having grown up in a digital era where social media is accessible anywhere anytime, it is even easier to compare one selves to other people. In addition, (most) people tend to only post positive things and aspects about themselves on their social media. This shows an unrealistic image and causes Millennials to get an even more unrealistic expectation pattern of themselves.

2.2 Literature exploration

BURNOUT

Over the last decade, the prevalence of the stress-related syndrome such as burnout has increased significantly in the Western world (Glasberg et al., 2007). The most often used definition of burnout is ‘... a state of exhaustion in which one is cynical about the value of one’s occupation and doubtful of one’s capacity to perform’ (Maslach, Jackson, & Leiter, 1996). To be more specific, exhaustion refers to serious and continual fatigue and feeling emotionally drained, and cynicism includes loss of interest and enthusiasm and doubts about the significance and meaning of one’s job. A third dimension, lack of professional efficacy, refers to feelings of incompetence and ineffectiveness at work. In other words, a burnout is a phenomenon that includes a stress reaction (exhaustion), a mental distancing response (cynicism), and a negative belief (lack of professional efficacy). However, other research revealed that professional efficacy is not significantly related to burnout, whereas exhaustion and cynicism are (Schaufeli, 2018).

ENGAGEMENT

A high level of employee engagement is a strategic goal for a growing number of organizations in many industries, including healthcare (Lowe, 2012). Engaged employees are committed to their employer, satisfied with their work and willing to take the extra mile to achieve the organization’s goals. Besides, engagement has a positive influence on employees’ performance, the financial flow and stability, and also the achievement of organizational success (Bates, 2004; Harter, Schmidt, & Hayes, 2002; Richman, 2006).

Engagement can be defined as ‘... a positive, fulfilling, work-related state of mind characterized by vigour, dedication, and absorption’ (Schaufeli, Salanova, González-Romá, & Bakker, 2002). Vigour refers to high levels of mental energy, dedication to strong involvement and feelings of pride and absorption to being fully concentrated and deeply absorbed in one’s job. Although satisfaction and organizational commitment are related to performance, engagement appears overall to be a better predictor of employee performance (West & Dawson, 2012).

JOB DEMANDS-RESOURCES MODEL

The Job Demands-Resources model (JD-R) was introduced to understand both burnout and engagement and how they are linked. It shows both the health impairment process that happens at the base of the burnout process, and the motivational process that underpins the work engagement process, see figure 8 (Demerouti et al., 2001; Schaufeli & Bakker, 2004; Schaufeli & Taris, 2013). The two main work aspects that influence these processes are job demands and job resources.

Job demands can be defined as “the aspects of the job that require sustained physical or mental effort and are therefore associated with certain physiological and psychological costs” (Schaufeli & Taris, 2014). In other words, job demands are the ‘bad things’ at work that drain energy, such as work overload, conflicts with others, and future job insecurity (Schaufeli, 2017).

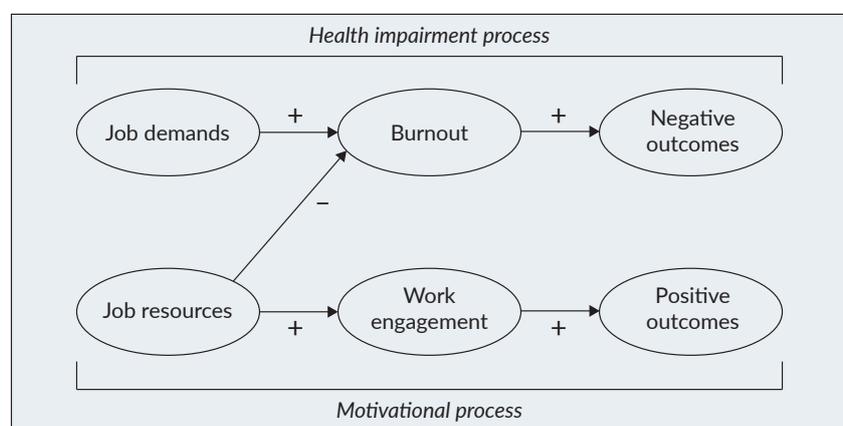


Figure 8: Job Demands-Resources model (Schaufeli, 2017)

In contrast, job resources are the 'good things' at work that can be defined as *"the aspects of the job that may do any of the following: (a) be functional in achieving work goals; (b) reduce job demands and the associated physiological and psychological costs; (c) stimulate personal growth and development"* (Schaufeli & Taris, 2014). Examples are support from others, job control, and performance feedback (Schaufeli, 2017).

Additionally, job resources can be divided into two categories: intrinsic resources and extrinsic resources (Schaufeli & Taris, 2014). Intrinsic resources can be described as the aspects that people value in their jobs, the things that satisfy human needs, whereas extrinsic resources can be described as work and organizational resources, or in other words: the work environment.

As can be seen from the model in figure 8, high job demands and poor job resources may contribute to burnout, whereas only abundant job resources contribute to work engagement. Increasing job resources will therefore be beneficial for both preventing burnout and fostering work engagement. In contrast, reducing job demands would only affect burnout and not work engagement (Schaufeli, 2017; Schaufeli & Taris, 2013).

Besides job resources and job demands, the role of personal resources can also act as an independent component of the JD-R model as personal resources can have a positive effect on engagement and can have a negative influence on burnout (Salanova, Bakker, & Llorens, 2006; Schaufeli, 2017; Schaufeli & Taris, 2013). These personal resources are defined as *"the psychological characteristics or aspects of the self that are generally associated with resilience and that refer to the ability to control and impact one's environment successfully"* (Schaufeli & Taris, 2014). It is likely to assume that personal resources play a role in the JD-R model, however, which place they should take is yet unclear (Schaufeli & Taris, 2014). Therefore, the personal resources are left out of scope in this graduation project.

RESEARCH MODEL

The JD-R model is used as an inspiration for creating a research model for this graduation project. As increasing job resources will be beneficial for both preventing burnout and fostering engagement, the focus will be on job resources rather than job demands. This way it should take care of two problems at once.

Both intrinsic job resources (employee values) and extrinsic job resources (work environment) are taken into account as they both influence employee experience (work engagement). These two elements need to be in balance in order to create the employee experience that enhances engagement among Millennials at radiology. Figure 9 shows the final conceptual research model.

In order to design an employee experience of engagement, the assumption is made that the employee values will stay the same over time as human needs and wants are fundamental and universal drivers of behaviour (Trend Watching, 2019). However, the work environment will change over time due to trends and environmental changes. Thus, in order for employee engagement to be sustained over time, the work environment needs to be adapted to a changing context based on trends while being in balance with the employee values.

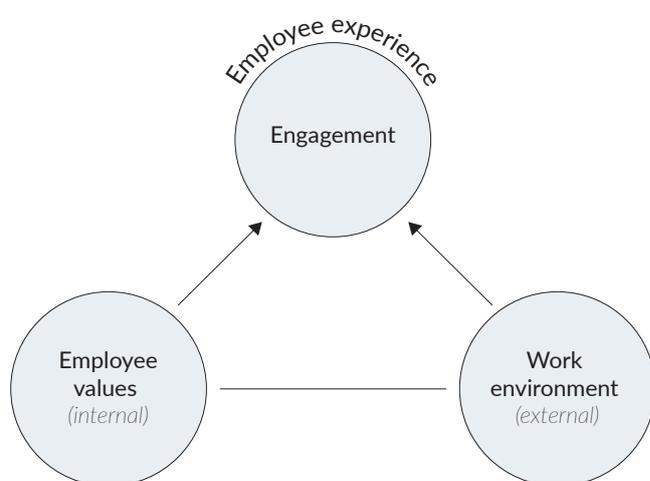


Figure 9: Conceptual research model

2.3 Conclusion

The context exploration within the radiology department showed that there were three main medical roles that are most interesting to focus on within this graduation project: technologists, residents and radiologists. Although not every hospital educates residents, this role will be taken into account to get a full overview.

The exploration on the Millennials showed that they are the biggest generation at the moment and have remarkably different characteristics than previous generations. They are unattached which influences whether they engage or not with certain institutions. They are digitally connected which makes it easier to create an unrealistic expectation pattern of themselves and therefore the chance of developing burnout is higher. They are unconstrained and do not accept “that’s the way it has always been done” which indicates that the world needs to change. And lastly, they are idealistic and are therefore looking for jobs that match their sense of purpose. These characteristics imply that also their values might be different than other generations which affect their feelings toward organizations and thus their engagement.

Literature exploration revealed how burnout and engagement are linked to each other by means of two main work aspects: job demands and job resources. The focus for this graduation project will lay on the job resources (intrinsic and extrinsic), as this will both have influence on preventing burnout as well as on fostering engagement.

Based on this, a research model has been created that will form the basis of designing an employee experience of engagement. In this model, the intrinsic job resources (employee values) and extrinsic job resources (work environment) are both taken into account. However, the employee values will stay the same over time as these are fundamental and universal drivers of behaviour, while the work environment will change due to trends. Thus, for employee engagement to be sustained over time, the work environment needs to be adapted to a changing context while being in balance with the employee values.

In the next chapter, the employee values of Millennials at radiology will be explored and the changing role of radiology in the future will be defined. Based on this, a future vision will be created that envisions the changing role of radiology in the future, while enhancing the employee values of engagement.



PHILIPS



3 Discover

This chapter will dive into the employee values of Millennials at radiology and how the future of radiology will look like based the future expectations of radiology employees and trend research. Based on these results, a future vision is designed that envisions the changing role of radiology within the future of healthcare while enhancing the employee values of engagement.

3.1 Exploratory research

EMPLOYEE VALUES

To have insights in the employee values, desk research has been performed to find relevant employee values for Millennials, values for healthcare employees, and values for people in general. Appendix A shows a list of all values found in literature and an interactive workshop (Eisner, 2005; Lowe, 2012; Pacmed, 2019; Stum, 2001; Vansteenkiste, Neyrinck, Niemiec, Soenens, & De Witte, 2007). As this graduation project focuses on Millennials working at radiology, it is important to identify the values they consider most important within their job. As this could not be found in literature, all the values that were found were clustered into eight final values, see figure 10a and 10b.

To explore and discover the employee values of Millennials working at radiology, interviews were held with three radiologists, two residents and four technologists working in academic and peripheral hospitals, see table 2. During these interviews, the participants were asked to first describe their role at radiology and what they want to achieve within their job. The values that were defined and clustered, were used as a communication tool to discover the participants' values

in their job. See appendix B for the interview guide, method, materials, data analysis and the results based on the roles and values in more detail.

Roles

All participants described their role as diverse due to the different modalities (technologists) and diversity of pathologies (residents and radiologists). They enjoy working with technology to aid people who need care. They like solving problems and making sure the patients get the right diagnosis to help them the best.

All participants also mentioned that the reality of their tasks is conform the expectations they had before starting the job. This is mainly due to the 'learning by doing' during their education as they practice in the field with supervision. The only difference is that the workload is higher than they expected. Participant #4 even said that each year there are 1.6 million requests for scans and images. This number increases with 20 per cent annually.

Autonomy

"Freedom, flexibility and being able to make your own choices in your work"

- Autonomie *Pacmed
- Make improvements *Lowe
- Autonomy *Vansteenkiste
- Flexibility *Eisner
- Decide how to work *Lowe

Equality

"Transparent, honest and personal contact with respect for colleagues"

- Transparantie *Pacmed
- Fair treatment *Lowe
- Respect *Lowe
- Respect *Eisner
- Less respect for rank *Eisner
- Same goals as organisation *Lowe

Result driven

"Efficient actions and decisions that have an impact and make a difference"

- Competence *Vansteenkiste
- Bekwaamheid *Pacmed
- Need success *Eisner
- Efficiëntie *Pacmed
- Strive to make a difference *Eisner

Self-development

"Be challenged to learn and grow"

- Growth *Stum
- Innovatief *Pacmed
- Professional development *Eisner
- Use skills *Lowe
- Training/education *Lowe
- Career advancement *Lowe
- Intellectual challenge *Eisner
- Opportunity to grow *Eisner

Figure 10a: Eight value clusters

Involvement

"Feeling that you are part of a team with colleagues and organization"

Communication *Lowe	Support *Lowe	Team work *Lowe
Relatedness *Vansteenkiste	Affiliation *Stum	Aandacht *Pacmed
Inclusive management *Eisner	Communicatie *Pacmed	

Recognition

"Feeling that you are appreciated and heard in what you do and who you are"

Recognition *Lowe	Rewards (time off) *Eisner
Promotion *Lowe	Immediate feedback *Eisner
Rewards *Stum	

Trust

"Environment in which you feel safe and can trust others"

Trust *Lowe	Betrouwbaarheid *Pacmed
Safety/security *Stum	
Positive work environment *Eisner	

Work / life balance

"A good balance between effort and relaxation"

Balanced life *Eisner	Work/life balance *Stum
Workload *Lowe	
Balanced life *Lowe	

Figure 10b: Eight value clusters

Table 2: Sample of interview participants

Participant	Profession	Gender	Year born	Years employed	Type of hospital
1	Technologist	Male	1979	19	Peripheral
2	Technologist	Female	1989	10	Peripheral
3	Technologist	Female	1996	5	Peripheral
4	Resident	Male	1991	1,5	Academic
5	Resident	Male	1988	5	Academic
6	Radiologist	Male	1983	1,5	Peripheral
7	Radiologist	Male	1981	5	Academic
8	Radiologist	Male	1985	1 month	Academic
9	Technologist	Female	1993	5	Academic

Values

To explore the values, the participants were asked to put the eight values in order of importance. They all mentioned that all values are important to them within their job, however, in the end they were able to create a list of importance. To identify which value is most important to each role, these results were processed. As can be seen in figure 11, the value importance per role is shown. See appendix B for the initial results and calculations. For this graduation project, it is decided to focus on the most important value per role to reduce the complexity of the project.

- *Technologist | Involvement*

According to figure 11, involvement is the most important value within the job of technologists (59,4%). Technologists usually work together to make scans and images. However, as the team of technologists can be quite big, it sometimes happens that they do not know the person they have to work with. This influences the efficiency of their work which is not preferred as it increases the work pressure. Besides, they also value being involved in decision making at the management level, as this influences their working environment and workflow. They often feel the ‘underdog’ of the hospital as they experience

they are not heard. Teamwork among healthcare employees is also highlighted in literature as being an important aspect as it has been associated with higher level of job satisfaction, a higher quality of care, an increased in patient safety, greater patient satisfaction with their care, more productivity, and a decreased stress level (Lowe, 2012).

- *Resident | Equality*

Looking at figure 11, staff equality is something that residents value most in this stage of their ‘profession’ as this creates an open and safe learning environment (87,5%). In such environment residents have the feeling they can ask questions freely, be able to make mistakes and learn the most. Hierarchy does still exist within the radiology department, however, this is more a tradition from the older generations than something the residents act on themselves. A big difference in hierarchy will have a negative influence on the learning environment as residents do not feel comfortable to admit mistakes. This can be linked to the values of Millennials found in literature (Eisner, 2005), as they do respect rank in hierarchy as there needs to be a person that makes the final decisions, but they do not prefer this in management.

- *Radiologist | Result-driven*

Shown in figure 11, being result-driven is the most valued aspect by radiologists, as they want the best results for their patients (75%). They want to contribute to value-based healthcare and emphasize that the work they do must be useful and valuable. They do notice that other physicians are also able to interpret scans themselves, however, radiologists felt they add value by having a more holistic view of the patient whereas other physicians may tend to have a focused vision on one specific anatomy or pathology. Being result-driven is also highlighted in literature as one of the values of Millennials as they want to create an impact with the work they do (Eisner, 2005).

Based on all the insights from the interviews, profiles are created that summarize all findings, see pages 35, 36 and 37.

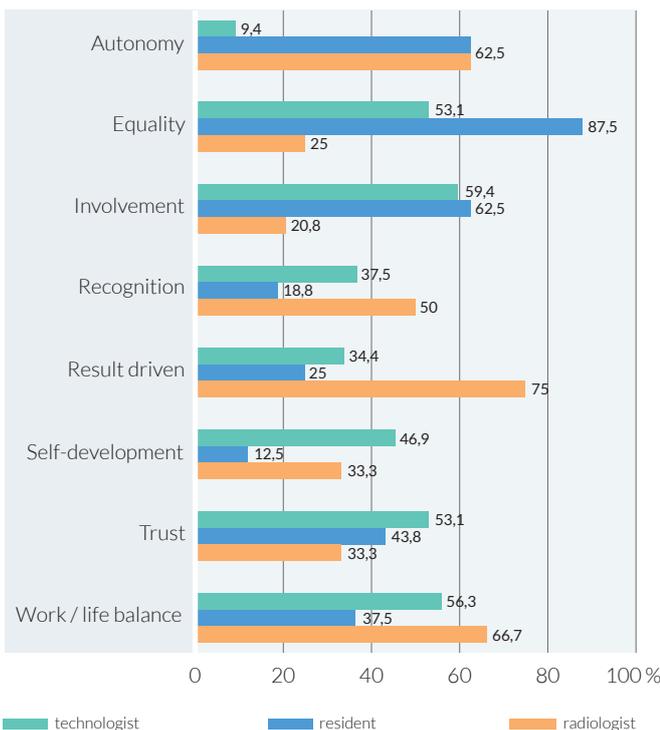


Figure 11: Value importance per role

Technologist

“Sometimes they [patients] almost give you a hug when the test succeeded!”

Role

A technologist will help the patient prepare for the test and must be able to soothe and calm patients in distress. Within their job they must accurately **interpret** the physician's orders and **produce the quality images** needed. To produce the images, the technologists physically place the patient in the correct position. They describe their role as **diverse** due to the various modalities, such as MRI, CT, and ultrasound. They are interested in **technology** as well as **helping people** that are in need of care.

Characteristics

Interest in technology and patient care

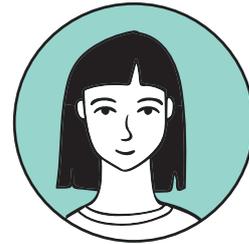
Working with the latest technology to help patients.

Limited patient contact

Due to the workload, the time per patient is often very limited.

Empathic and social

Being able to soothe and comfort patients when they are nervous for the test or have claustrophobia. Recognition of patients motivates technologists in their job.



Value

Involvement is highly valued by technologists as the most important aspect of their job. **Teamwork and colleagues** make it fun to go to work, however, since the team of technologists can be quite big, it sometimes happens that they do not know the person they have to work with. This influences the way they work by being less efficient, which is not preferred. Technologists also value to be involved in decision-making and to have the feeling that they are heard and not feel the 'underdog' of the hospital. Support from the department and hospital is crucial for them to be able to work in an environment that fit their tasks, values, obligations and responsibilities, especially since the hospital expects technologists to work efficiently and adequately.

Future Expectations

Technologists expect that their role will not change significantly as a consequence of technical developments. There will be a **shift** in tasks, such as less administrative tasks and more scanning. However, **personal contact** with the patients is the most important aspect that ensures their role will still exist in the future. Their role will be more independent and they will get more responsibility. However, the workload is increasing due to more requested scans and images and faster scanning techniques.

Resident

“Admitting your mistakes is less likely if you do not have an equal ratio with your colleagues.”

Role

Residents at a radiology department are being **trained** to become a radiologist after they finish their medical studies. Their role is comparable to the one of a radiologist, however, they are still **supervised** by radiologists. Residents are interested in **solving complex problems** by interpreting the images and data of patients made by technologists. They create a report and send it to the referring physician for further treatment. They describe their role as **diverse**, due to the variation in diseases. They work individually, are interested in technology and want to help people.

Characteristics

Working individually

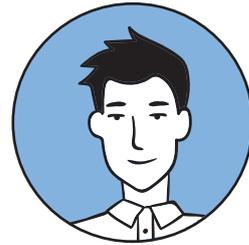
Working individually 80% of the time, which they prefer. They are being supervised by radiologists.

Limited patient contact

Prefer lower patient numbers to be able to focus on solving complex puzzles.

Heavy workload

Each year, 1.2 million exams are requested. This number increases with 20% annually.



Value

Staff equality is something that residents value most in this stage of their 'profession' as this creates an open and safe learning environment. It is important that all people involved in the department of radiology are satisfied and engaged since this will be beneficial for interacting with and diagnosing patients. Hierarchy still exists within the department, however, this is more a tradition from the older generations than something the residents act on themselves. A big difference in hierarchy will have a negative influence on the learning environment as you "do not feel comfortable to admit mistakes", besides: "whether hierarchy in the work environment is useful for patient safety or prioritizes treatment, I do not know. I doubt that".

Future Expectations

In the future, residents will become radiologists. They expect that they will have to **'super specialise'** into a specific anatomical area because patient complexity is increasing. They believe that the relation between technology and healthcare is getting more important and they see technology as a tool that can **help interpreting** images and scans for standard cases. They expect a new role: **technical radiologist** that knows both 'languages' of technology and healthcare. This role will focus on supervising or maintaining automatic image recognition.

Radiologist

“How can I make sure that my work adds value to patients in order to make him/her feel better or have a better surviving chance?”

Role

A radiologist is a physician who receives patient referrals from other physicians. Their main task is to diagnose patients with their illness or disease using a variety of advanced imaging tools. They describe their role as **solving complex problems** independently and individually. They are interested in the diagnostics of **complex cases** and the **technology** that supports this. The radiologist interprets the images that are made by technologists, creates a report and sends his report to the referring physician, who then follows up with the patient to discuss the outcome.

Characteristics

Working individually

Radiologists work 80% of the time individually and they prefer working like this.

Limited patient contact

Radiologists prefer short patient contact as they are more interested diagnosing.

Heavy workload

Workload is high. Approximately 1000 exams a day, of which a big part is 'bulk' (simple cases).



Value

Result driven is the most valued aspect by radiologists. “I do not feel like doing things or tasks that are not important”. The work of the radiologists needs to lead to **value-based healthcare** to achieve the best results for the patient. At the moment there are also other physicians who interpret scans and images themselves, however, radiologists do not see this as a threat. They see that they have an added value “and that most specialists are also quite busy with other things”. Besides, radiologists have a more **holistic perspective** than other physicians who are prone to a tunnel vision within their specialty.

Future Expectations

In the future, **patient complexity** is increasing. Simple tasks will be taken over by **technology** (e.g. AI software), which means that the radiologists will shift focus to **complex cases**. Their role will shift towards being superspecialized in a disease area, managing the data and acting as a consultant. Due to this, **multidisciplinary meetings** will be more important and the contact between physicians will increase.

FUTURE OF RADIOLOGY

Healthcare organizations today find themselves operating in a highly-volatile, changing, complex environment. Ongoing technological advancements and new business delivery models bring many challenges as well as opportunities (Philips, 2016). In order to properly understand the dynamics of change, a deeper analysis on healthcare and radiology has been performed in two ways: the future expectations of radiology employees themselves and trend research.

Future expectations

Besides exploring the main values of Millennials at radiology, their perspective on their role in the future was explored as well in order to define the future of healthcare and radiology. Interestingly was that all nine participants described similar aspects of the future for radiology.

- *Patient complexity*

Patient complexity will increase, which means more pathologies to take into account for diagnosing patients. Due to the population growth and that people are getting older, the pathologies of patients can become more complex, likely showing more co-morbidity (i.e. illnesses occurring at the same time within one patient). The result could be that radiology employees need to 'super specialize' into complex subjects or aspects of the anatomy of patients and technology innovations to diagnose patients correctly.

- *Shift in tasks*

The shift in tasks can be explained in two ways: a human shift and a technology shift. As radiology employees will become more specialized due to the increasing patient complexity, the tasks of some roles will shift. Technologist already have the opportunity to become a physician assistant and this shift will become more important. Simple tasks of radiologists and residents could be taken over by technologists, with or without the support of technology.

However, the role of technology will also increase and will aid in or even take over administrative tasks and simple cases. This might lead to employees focusing on the complex cases and therefore the interaction with referring physicians will increase. However, all participants mentioned that they do not see technology taking over happening within 20 years

as the technology is far from outperforming the human interpretation. Besides, the opinions on the ethical aspect of technology diagnosing patients is divided.

- *Organizational structure*

Another relevant insight stemming from the interviews concentrated on organizational structure of hospitals and healthcare in general. Nowadays, there are various departments based in the hospital. The traditional departments can be defined as cardiology, orthopaedics, gynaecology, radiology, etc. However, this structure is on the move.

As the hospitals are transforming towards value-based healthcare where the patient is the center of care, the organizational structure of departments is transforming as well. This can already be seen in at the Karolinska University Hospital in Sweden (Karolinska University Hospital, 2016). They have built a completely new organization based on the patient's journey through the healthcare system, transitioning away from the current departmental structure based on specialist expertise. The hospital is now structured around 'themes' such as Children's and Women's Health, Heart & Vascular, and Trauma and Reparative Medicine. Within these themes, corresponding specialists are present as well as radiologists. Radiology will therefore act as a central function within each theme.

The intention behind this transformation is to create comprehensive responsibility for the patient's illness and treatment. Within the current organizational structure, the patient has to visit several departments that do not always cooperate and communicate well. This is also due to the patient information exchange between different departments within the digital systems.

Besides this organizational change from departments towards themes, another organizational structure is changing as well. Normally, patients are referred by their general practitioners to specialists in hospitals, such as a cardiologist. The specialists refer their patients to the radiology department for images and scans to define the right diagnosis and after, the patient goes back to the specialist for treatment. However, at the breast clinic at the Albert Schweitzer hospital in Dordrecht, women

directly go to the radiologist for images and scans of their breasts to determine diagnoses (Albert Schweitzer ziekenhuis, 2008). If it turns out that there is something suspicious, the women are referred to the specialist. If nothing can be diagnosed, the women can go home.

This change in healthcare structure does not only affect the workflow of the hospital employees, also the patient journey and the patients' perception will be different as they can be diagnosed and treated sooner. However, the way of working within healthcare cannot just simply be changed. Healthcare insurances and the Dutch government also have their protocols and purposes and should therefore not be forgotten.

Trend research

Trend research within healthcare and radiology has been performed using the Demographic Economical Political Ecological Social Technology method (Van Boeijen, Daalhuizen, van der Schoor, & Zijlstra, 2014) to validate or elaborate on the future expectations mentioned by the participants of the interviews. Figure 12 shows a visualization of the trends.

- *Healthcare landscape*

The **ageing population** (World Health Organization, 2018), **increasing patient complexity** (McGinnis, Stuckhardt, Saunders, & Smith, 2013) and **shortage of employees** (Ligtvoet, 2019; Studelta, 2019) are threatening the Dutch healthcare system and spin **healthcare costs** (NOS, 2019) out of control. **Value-based healthcare** is a new way of approaching healthcare to deliver better quality of care for patients, over costs. By restructuring health care systems to achieve value for patients, health care delivery needs to be organized around the medical conditions of patients, accurately measure the outcomes that matter to the patients and to incorporate the costs (Porter & Teisberg, 2006).

For radiology this means a correct, timely, and useful diagnosis. At the moment, the results of radiology, the diagnoses, are considered a cost rather than an outcome (European Society of Radiology (ESR), 2017). However, radiology plays a fundamental and critical role in establishing the diagnoses for patients, which can be defined as **value-based imaging**. This step is the very first towards value-based healthcare.

- *Technology*

At the same time, the healthcare sector is an important area of innovation where the use of new technologies creates new opportunities and challenges. The use of (integrated) **cloud services** (Packt, 2019), **telehealth** (Forbes, 2016), and **virtual reality** (Popular Science, 2016) are growing to support a **collaborative mindset and approach** (Relias Media, 2019) to reinforce the shift from volume- to value-based healthcare.

In radiology this means that healthcare professionals get the opportunity to become **super specialized** (Triggle, 2015) in complex patient pathologies and anatomies and share or discuss this with other (external) healthcare professionals in **multidisciplinary meetings** (Health Europe, 2019) to decide the care pathway of a patient.

- *Privacy*

Nonetheless, care is also becoming more **personalized** (Karolinksa University Hospital, 2016). As every patient represents a unique dataset that demands a unique solution, **big data** and **artificial intelligence** (Forbes, 2015) give radiology the opportunity to identify the patterns amongst millions of patients' symptoms, diagnoses, and treatment plans. However, archiving these personal patient data will represent one of the largest areas of **privacy risk** (Gartner, 2019). There is no solution yet to the ethical question of leaving the decision power to technology, however, the data is there. Now it is time find a way to unlock its potential to change to value-based healthcare.

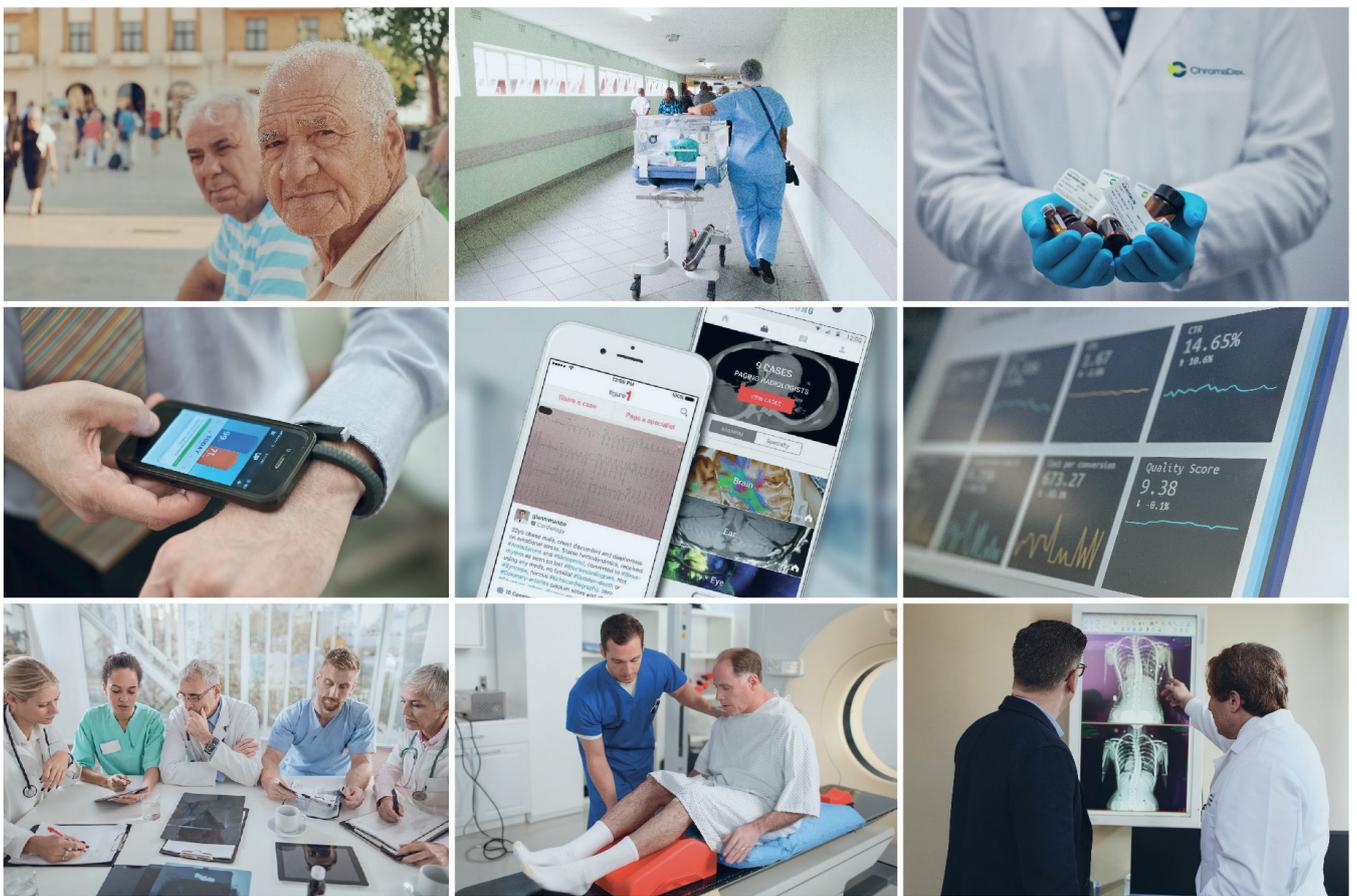


Figure 12: Visualization of trends (Philips image library, Unsplash (Stephan Dawson, Anna Auza, Hush Naidoo, Kendall))

3.2 Future vision

The employee values of engagement of Millennials at radiology have been defined as well as the role of radiology in the future. These insights will be combined to create a future vision where Millennials at radiology are engaged.

A future vision is an expression of a desired future where it provides a strategic reference point (Simonse, 2017). Beyond this desired future end state, a vision has four distinguished properties (Simonse, 2017):

- **Clarity** – the vision expression enables immediate understanding of what it would be like to experience the future innovation in the explicitly expressed desired end state;
- **Value** – drivers capture the compelling benefits of value wishes: wherein the specific value fulfils an unmet need or solves a dilemma of a user target group in the future;
- **Magnetism** – involves the desirability and attractiveness of the vision – ‘the thing’ the vision creators are truly passionate about in such a way that it potentially energizes others to direct their actions towards it;
- **Artefact** – materialise the imagined value wishes with images in 2D or 3D-dimensions.

This means that the future vision of radiology in this graduation project will give clarity about the role of radiology in the future, contains the value drivers of radiology employees to enhance engagement and will contribute to the quadruple aim of Philips to make it desirable and attractive to direct their actions towards it. Figure 13 will show the 2D artefact of the future vision.

In the future, the *entire healthcare workflow* will be enhanced by being more structured, integrated and efficient and where collaboration with physicians as well as with technology is crucial. The organizational structure of hospitals will change disruptively as it will be structured around ‘themes’ instead of departments. As the role of the radiology employees will change into becoming more visible and specialized and will be the driving force of collaboration between disciplines with the support of technology, radiology will be the central function within the themes.

To be more specific, patients are referred by their general practitioner to a radiologist of a specific theme and, after making and interpreting images and scans, the patient is referred to the right specialist within the theme for further treatment. An example:

A patient with chest pain is referred by his general practitioner to the Heart & Vascular theme within a hospital. The technologist makes scans and images from the patient's chest and the radiologist and / or resident interprets these. It turns out that the chest pain is caused by a malfunction of the heart and therefore, the patient is referred to the cardiologist of the Heart & Vascular theme for further treatment.

This structural change in the healthcare workflow also means that healthcare insurances and the Dutch government need to be involved as well, as the total healthcare structure in the Netherlands is way more complex than only the hospitals. However, for this graduation project, the healthcare insurances and government are left out of scope as it will focus on the future of radiology.

To enhance the engagement among Millennials in this new central role of radiology, the employee values will be incorporated. Technologists will be involved in the workflow and work together with technology and physicians. Staff equality will make sure that residents can learn in an open and safe learning environment and that the workflow will contribute to value based imaging where the patient is placed in the center of care.

The following future vision of radiology is created by combining the changing healthcare workflow and the employee values that enhance engagement:

“The role of radiology shifts towards being **the center of solving patient pathologies together** with referring physicians as well as with the support of system technology. A structured, integrated and efficient workflow **supports staff equality to create an open and safe learning environment** and will **contribute to value-based imaging** in order to achieve the best diagnoses for patients.”

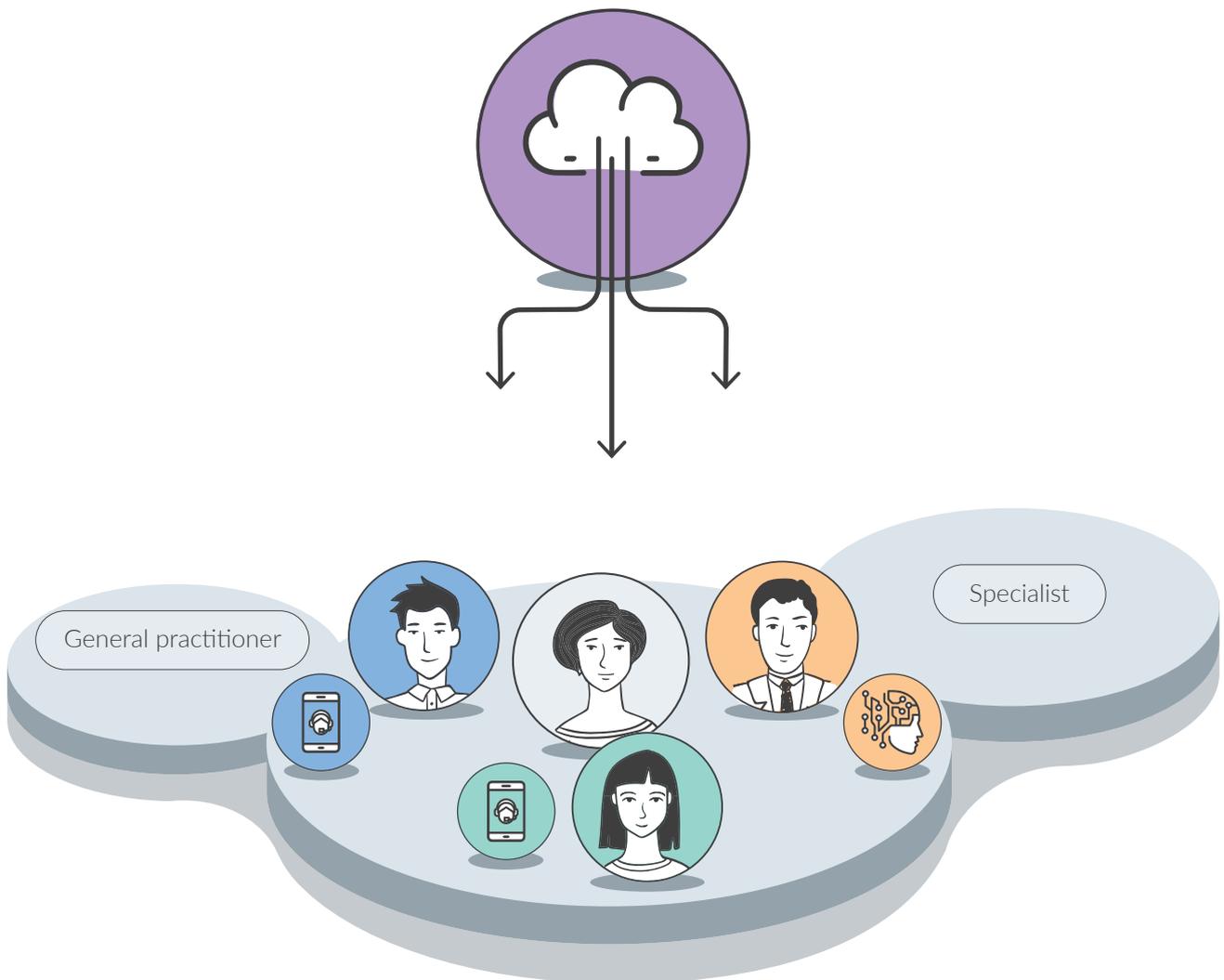


Figure 13: Artefact of future vision

3.3 Conclusion

In this chapter, the employee values of Millennials at radiology have been identified by means of interviews. This revealed that technologists value involvement in the workflow, department and hospital the most as they now sometimes feel the 'underdog'. Residents value staff equality most as this will create an open and safe learning environment which is most important to them in this phase of their education. Radiologists value being result-driven the most, as they want the best results for their patients and contribute to value-based healthcare. For them this means defining the diagnoses as soon as possible.

This chapter also explored the future of healthcare and radiology based on the future expectations from the participants in the interviews as well as on trend research based on the DEPEST method. Three main directions were found:

- Increase of patient complexity which creates possibilities for super specialization;
- Shift in tasks which can be defined as human shifts as well as technology shifts;
- Organizational structure change. As value-based healthcare becomes more important, the traditional structure of departments within hospitals is on the move. Department will become themes where radiology will get a central function. This central and visible role of radiology will even be more emphasized as patients will be referred to radiology first for consultation instead of to a specialist.

Based on the employee values of Millennials at radiology and the changing role of radiology in the future, a future vision is designed. This future vision envisions an enhanced healthcare workflow and points towards the desired future where the employee engagement of Millennials is enhanced.

“The role of radiology shifts towards being the center of solving patient pathologies together with referring physicians as well as with the support of system technology. A structured, integrated and efficient workflow supports staff equality to create an open and safe learning environment and will contribute to value-based imaging in order to achieve the best diagnoses for patients.”

In the next chapter, the extrinsic aspect of the research model, the work environment, will be explored and translated into the changing context to define its evolution and sustain employee engagement.



4 Imagine

This chapter will dive into the exploration of the work environment elements that represent the employee values of the future vision by means of various creative sessions. However, as the future vision elaborates on the far future, it is necessary to define the steps towards this. This chapter will explore these steps based on three strategic life cycles, each with their own vision. Next, the explored work environment elements are mapped within the three strategic life cycles to explore the evolution in order to sustain employee engagement over time.

4.1 Work environment elements

Looking at the research model defined in chapter 2, the extrinsic aspect of employee engagement is the work environment. To be able to design a future employee experience where engagement is enhanced, the extrinsic aspect needs to be in balance with the intrinsic aspect, the employee values. During an individual brainstorm session, a three-hour creative session with six Millennials and five one-on-one brainstorm sessions with radiology employees, many ideas for the work environment were created. The sample of participants of the creative session with Millennials can be found in table 3. All Millennials had a medical focus in their education or job and

were experienced in participating in creative sessions. Figures 14-17 show an impression of the creative session with the Millennials. The sample of participants of the one-on-one brainstorm sessions can be found in table 4. Figures 18-22 shows an impression of the ideation results with radiology employees which was based on creating mind maps as the participants were not experienced in participating in creative sessions. Appendix C shows the approaches, rough ideation materials and original ideas and insights of the creative sessions and brainstorm sessions.

Table 3: Sample of participants creative session (Millennials)

Participant	Gender	Year born	Educational background
1	Female	1995	Strategic product design
2	Female	1996	Technical medicine
3	Female	1995	Strategic product design
4	Female	1993	Industrial product design
5	Female	1995	Strategic product design
6	Male	1994	Biomedical engineering

Table 4: Sample of participants brainstorm sessions (radiology employees)

Participant	Profession	Gender	Type of hospital
1	Radiologist	Male	Academic
2	Technologist	Female	Academic
3	Technologist	Male	Academic
4	Resident	Male	Academic
5	Resident	Male	Academic



Figures 14 - 17: Impression creative session (Millennials)

As can be seen in figure 23, a total of 172 ideas was generated for all three employee values together. Of this, 66 ideas were based on improving the involvement of technologists, 52 ideas were based on creating an open and safe learning environment based on staff equality for residents and 54 ideas were based on being result-driven to determine diagnoses for patients as soon as possible for radiologists. These results were analysed and idea clusters per value were created. The number behind each idea cluster represents in how many creative sessions (from a total of 7) the idea was mentioned.

The ideas for involvement and equality were mainly based on the way of working, whereas the ideas for being result-driven were mainly based on technology innovations. These idea clusters were clustered again to define one concrete work environment element for each employee value, see figure 23. Appendix D and E show how the ideas were clustered and how the work environment elements were defined based on these idea clusters.

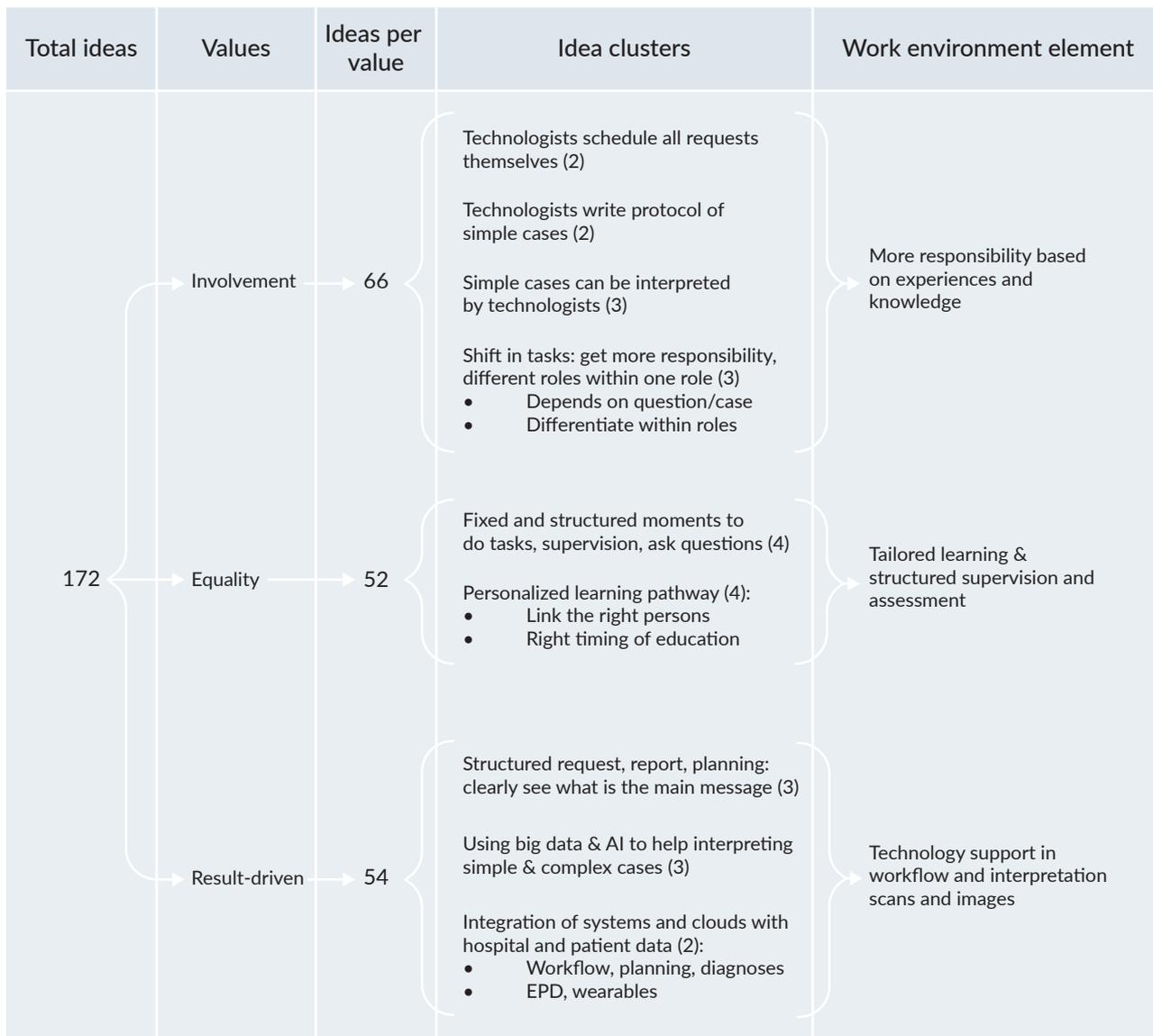


Figure 23: Ideas towards work environment elements

Involvement

The involvement of technologists, and thus their engagement, can be enhanced by giving them more responsibility based on their personal interests and experiences and knowledge that they build up during their job. This means that in the future, technologists will have tailored roles based on a personal fit. They can, for example, be an expert in patient care (preparing and comforting the patient before, during and after the exam), be an expert in management (scheduling requests and writing protocols of simple cases with the support of technology), or be a technology expert (making scans and images and do interpretation of simple cases with the support of technology).

Allowing the technologists to become an expert in a specific field based on their interests, experiences and knowledge would not only increase their involvement within the workflow of radiology, also the patient will benefit as some tasks of radiologist will be taken over by technologists and therefore results might be delivered sooner.

Equality

The staff equality to create an open and safe learning environment for residents, and thus their engagement, can be enhanced by structuring the supervision and assessment and tailoring the learning to their preferences. As the supervisors, the radiologists, are educated to become physicians and not teachers, they do not all have the right core qualities to supervise the residents adequately. Likewise, not enough attention is given to the assessment which creates confusion among residents whether they performed their tasks well enough to work independently.

By structuring the supervision and assessment and tailoring the learning to their preferences, residents get the opportunity to connect with the right people, get the right supervision and acquire the right knowledge.

Result-driven

Being result-driven to deliver the right diagnoses as soon as possible, and thus the engagement of radiologists, can be enhanced by the support of technology. Artificial intelligence at radiology is one of the main technological innovations nowadays. Although the support of artificial intelligence is not profitable at the moment yet, tests that are being performed look very promising and the prospect is that it will support the radiologists soon.

This technology support can benefit the radiologists (and residents) in the workflow by prioritizing cases as well as in interpreting images and scans made by technologist. This will allow the radiologists to work more efficiently and reduce the redundant scans and images due to the inability to correct interpretation.

4.2 Evolution of work environment elements

STRATEGIC LIFE CYCLES OF EVOLUTION

In order to reach the future vision of engagement at radiology where the entire healthcare workflow is enhanced based on the employee values and work environment elements, it is necessary to explore the steps towards this. The development and evolution are based upon three different life cycles of strategic business innovation (Simonse, 2017) that work towards the enhanced healthcare workflow. These strategic life cycles overlap to create continuous innovation on the long term, see figure 24.

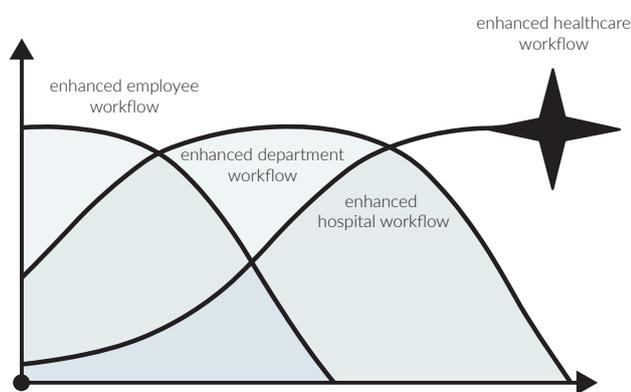


Figure 24: Strategic Life Cycles model of Three Horizons (Simonse, 2017)

The first cycle concentrates on innovation in a business that will mature over time, in this case focusing on enhancing the individual radiology employee's workflow. The second cycle envisions an enhanced department workflow, where there will be a focus on the interaction between the different roles within radiology. This follows into the third cycle of enhancing the hospital workflow, where roles and departments outside

of radiology will also be taken into account, such as referring physicians and multidisciplinary meetings.

The three concrete work environment elements that each represent one of the employee values of the future vision are mapped within the three strategic life cycles to define how the work environment will evolve over time. Figure 25 shows this evolution of the work environment elements. See appendix F for the initial mapping of the work environment elements within the three strategic life cycles.

TECHNOLOGIST

In the first life cycle, the work environment element that enhances the involvement of technologists will start with identifying and defining the interests, experiences and knowledge to divide the tasks among them more efficiently. Also, it will be possible for technologists to schedule the requests coming from the referring physicians themselves. In some hospitals the referring physicians schedule their requests in the planning of technologists which causes inefficient use of the resources due to lack of experience and knowledge of performing scans and images. Giving the technologists the control to schedule these requests themselves will increase the involvement in the workflow. By identifying the interests, experiences and knowledge and giving the technologists the control of their own planning will enhance the employee workflow as the individual task division will be optimized.

	Enhanced employee workflow	Enhanced department workflow	Enhanced hospital workflow	Enhanced healthcare workflow
 Technologist	Identifying and defining interests, experiences and knowledge to divide tasks more efficiently Schedule all requests	Coach and guide technologists to become experts within their interests, experiences and knowledge Check requests simple cases	Tailored role based on interests, experiences and knowledge Interpret images and scans of simple cases	More responsibility based on interests, experiences and knowledge
 Resident	Moments for structured supervision & assessment and ask questions to right and available people	Residents are linked to supervisors with the right core qualities to get better suited supervision	Personalized learning: moments to work, learn and get feedback. Paced to needs, time, preferences and specific interests of residents	Tailored learning & structured supervision and assessment
 Radiologist	Structured request via referring physician and technology supports in prioritizing cases and suggests type of scan in protocol	Technology supports in interpreting simple cases by giving likelihood of diagnosis	Technology supports in interpreting complex cases by giving likelihood of diagnosis	Technology support in workflow and in interpretation images

Figure 25: Evolution of work environment elements

In the second life cycle, the technologists will be coached and guided to become an expert within their interests and where they could use their experiences and knowledge that they gained during their job. Also, it will be possible for the technologist to check the requests of simple cases (e.g. an x-ray request to see if a bone is broken) from referring physicians and write the protocol for this request. This is normally a task that is done by radiologists and residents. However, with the support of technology, technologists will be able to do this themselves. This creates a new 'expert' field in which they can be coached and guided. This will enhance the department workflow as technologists can take over the simple tasks of the radiologists and residents and at the same time perform tasks based on more responsibility.

In the third life cycle, the technologists will have obtained their tailored role as an expert within their interests based on experiences and knowledge. Also, it will be possible for technologists to interpret scans and images of simple cases (e.g. an x-ray request to see if a bone is broken) with the support of technology. This also is normally a task that is done by radiologists and residents, however, in this life cycle it will be possible for technologists to perform this task. This will enhance the hospital workflow as there will be more time for radiologists and residents to focus on other tasks, such as complex cases, in collaboration with other departments and physicians, while technologists can perform their tasks efficiently.

RESIDENT

In the first life cycle, the residents will have moments for structured supervision and assessment and the possibility to ask questions to the right and available people. This will enhance the employee workflow of residents as they know what they can expect from the supervision and have the possibility to learn adequately from other people.

In the second life cycle, the residents will be linked to the supervisors with the right core qualities to get better suited supervision. Directly meaning that they will be linked to the right radiologists with the right core qualities and within their medical interest. Besides, as the employees of radiology will become more specialized, residents could also have the opportunity to specialize in the technical part of the job, e.g.

(new) imaging modalities. This would mean that residents could be linked with other radiology employees who are experts on imaging modalities rather than radiologists. This will enhance the department workflow as the collaboration between the residents and (potential) supervisors will be reinforced.

In the third life cycle, the residents will have a personalized learning pathway in which their moments to work, learn and get supervision are paced to needs, time, preferences and their specific interests. This means that they will be linked to radiologists and other employees within the hospital to get the right supervision that suits them. This will enhance the hospital workflow as residents can be linked to experts outside of the field of radiology as well.

RADIOLOGIST

In the first life cycle, the work environment element that enhances engagement of radiologists will start with a structured request from the referring physicians, support in the workflow by prioritized cases and support in writing the protocols of requests. This will enhance the employee workflow of radiologists as technology, such as artificial intelligence, will help them to work more efficiently in order to have time for other tasks that require more attention.

In the second life cycle, the radiologists get support in the interpretation of simple cases by giving the likelihood of the diagnosis. Besides, as the technologists can take over the task of writing the protocol of simple cases in this life cycle, there will be more time left for radiologists to focus on the complex cases. This will enhance the department workflow as the human and technology shift in tasks will create an efficient workflow for all radiology employees.

In the third life cycle, the radiologists get support in the interpretation of complex cases. Also, in this life cycle the technologists will take over the interpretation of simple cases. This means that radiologists will have even more time to spend on the complex cases and to work together with other physicians in multidisciplinary meetings. The support of technology in the interpretation of complex cases will therefore enhance the hospital workflow as the collaboration with other physicians will get supported as well.

EMPLOYEE EXPERIENCE OF ENGAGEMENT AMONG MILLENNIALS AT RADIOLOGY

The employee engagement of Millennial employees at radiology is reached in the third life cycle. In this life cycle, the roles of technologists are tailored, the residents have personalized learning pathways and the radiologists get technology support in the workflow and interpretation of scans and images. This corresponds with the work environment elements that have been identified to enhance the engagement in the future vision based on the employee values.

However, the difference between the *'enhanced hospital workflow'* and *'enhanced healthcare workflow'* is that the organizational structure of hospitals and healthcare will change: themes instead of departments and patients are referred via the general practitioner to a radiologist within a specific theme. Though, the way of working of the radiology employees will not change.

4.3 Conclusion

This chapter explored the extrinsic aspect of the research model, the work environment, that represent the employee values in the future vision. This was done by an individual brainstorm, a creative session with six Millennials and five one-on-one brainstorm discussions with radiology employees. This resulted in a total of 172 ideas for the work environment, where 66 ideas were based on the involvement of technologists, 52 ideas were based on staff equality for residents and 54 ideas were based on being result-driven for radiologists.

These ideas were clustered and work environment elements were identified. The involvement of technologists, and thus their engagement, can be enhanced by giving them more responsibility based on interests, experiences and knowledge that they build up during their job. This means that in the future, technologists will have a tailored role. This can vary from being a management-expert, technology-expert or patient-expert.

The staff equality for residents to create an open and safe learning environment, and thus their engagement, can be enhanced by structuring the supervision and assessment and by tailoring their learning. This means that in the future, they will have personalized learning pathways that is tailored to their learning preferences.

Being result-driven for radiologists to define diagnosis as soon as possible, and thus their engagement, can be enhanced by technology support in workflow and interpretation of scans and images. This means that in the future, technology support will enable a more efficient workflow.

In order to reach the future vision of engagement at radiology where the entire healthcare workflow is enhanced based on the employee values and work environment elements, it necessary to explore the steps towards this. The development and evolution are based upon three different life cycles of strategic business innovation, each with their own vision: *enhanced employee workflow*, *enhanced department workflow*, and *enhanced hospital workflow*.

Based on this, the work environment elements are mapped within the three strategic life cycles to explore the evolution of the work environment in order to sustain employee engagement over time. This evolution of the work environment elements will be used in the next phase to design future scenarios. These future scenarios will give a detailed overview of the way of working at radiology within each strategic life cycle.



PHILIPS | Directory | Review | Analysis | Simulation | Plan | Report | Help

BRAIN RESTORED | V010 | EPS | F

Beam

- LT LATERAL
- RT LATERAL

Properties

Name: LT LATERAL
Field ID:
Isocenter: WHOLE BRAIN
Color: red

2D Display: Yes No
3D Display: Yes No

Machine: Varian 2300
Version: 2013-06-19 16:03:28
Energy: 6MV
Modality: Protons

SSD: 92.17 cm | SAD: 100.0 cm

Geometry

Modifiers

1 Brain
Beam's Eye View 295 for RT LATERAL

2 Brain
Beam's Eye View 000 for LT LATERAL

3 Slice 2.1 x -0.55 cm 1. Brain

4 Slice 2.05 x 1.94 cm 1. Brain

5 Lat Coll 1.5
SSD: 92.17
6 LR: 92.5
7 LR: 92.5
8 Opp: 92.5
9 Y: 5.5

6 Lat Coll 1.5
SSD: 92.17
7 LR: 92.5
8 Opp: 92.5
9 Y: 5.5

5 Design

Based on the evolution of the work environment elements, future scenarios are designed. One future scenario for each strategic life cycle which shows a detailed view of the workflow of radiology employees and referring physicians. Based on these future scenarios, value propositions are created on how to support this new way of working. Besides, based on an individual brainstorm, a creative session with Philips employees and insights from previous creative sessions, concrete ideas are defined to support the radiology employees.

5.1 Future scenarios

FUTURE SCENARIO 1

The referring physician creates a structured imaging request that is saved in HIX. This request is structured in such a way that a clear overview is generated according to the patient's symptoms and the purpose of the request. Technology, such as artificial intelligence and big data, checks the request and, based on the symptoms and purpose, suggests what scan suits best. The radiologist and resident check the request and suggested scan, adjust this if necessary and release the protocol in order for the technologist to be able to schedule the scan based on available resources.

As the tasks of technologists can be divided more efficiently based on interests, experiences and knowledge, another technologist prepares and comforts the patient while the second technologist makes the scan and saves this in the imaging system. The results are automatically stored in the electronic PACS, in order for the radiologists, residents and referring physician(s) to be able to view and interpret the images or scans.

In the meantime, both residents and radiologists have fixed moments during the day to interpret the scans made by the technologists based on prioritization. However, there are also moments for structured supervision, feedback and assessment and residents have the time to ask questions to the right and available people.

Additionally, there are moments planned where peer-to-peer or multidisciplinary meetings are organized to discuss complex cases and decide on a pathway and treatment for the patient. For simple cases, the referring physician can view the interpretations of the radiologist or resident in HIX to define the patient's pathway and treatment.

Besides this workflow of the individual roles of radiology, there are team meetings planned every now and then. These meetings are important as it will create room to adjust the way of working in specific situations.

This scenario shows a structured and efficient way of working where the employee's workflow is enhanced. This is visualized in figure 26.

Time pacing scenario 1

Giving technologists the control of scheduling the requests and prioritization of cases were already done in some hospitals and sometimes already feasible. Besides, moments for supervising residents are mostly already scheduled during the day or week, however, organizing that these are moments are structured and that there is a possibility to ask questions to the right and available people might need some time to implement. Therefore, this future scenario would be feasible in 2021.

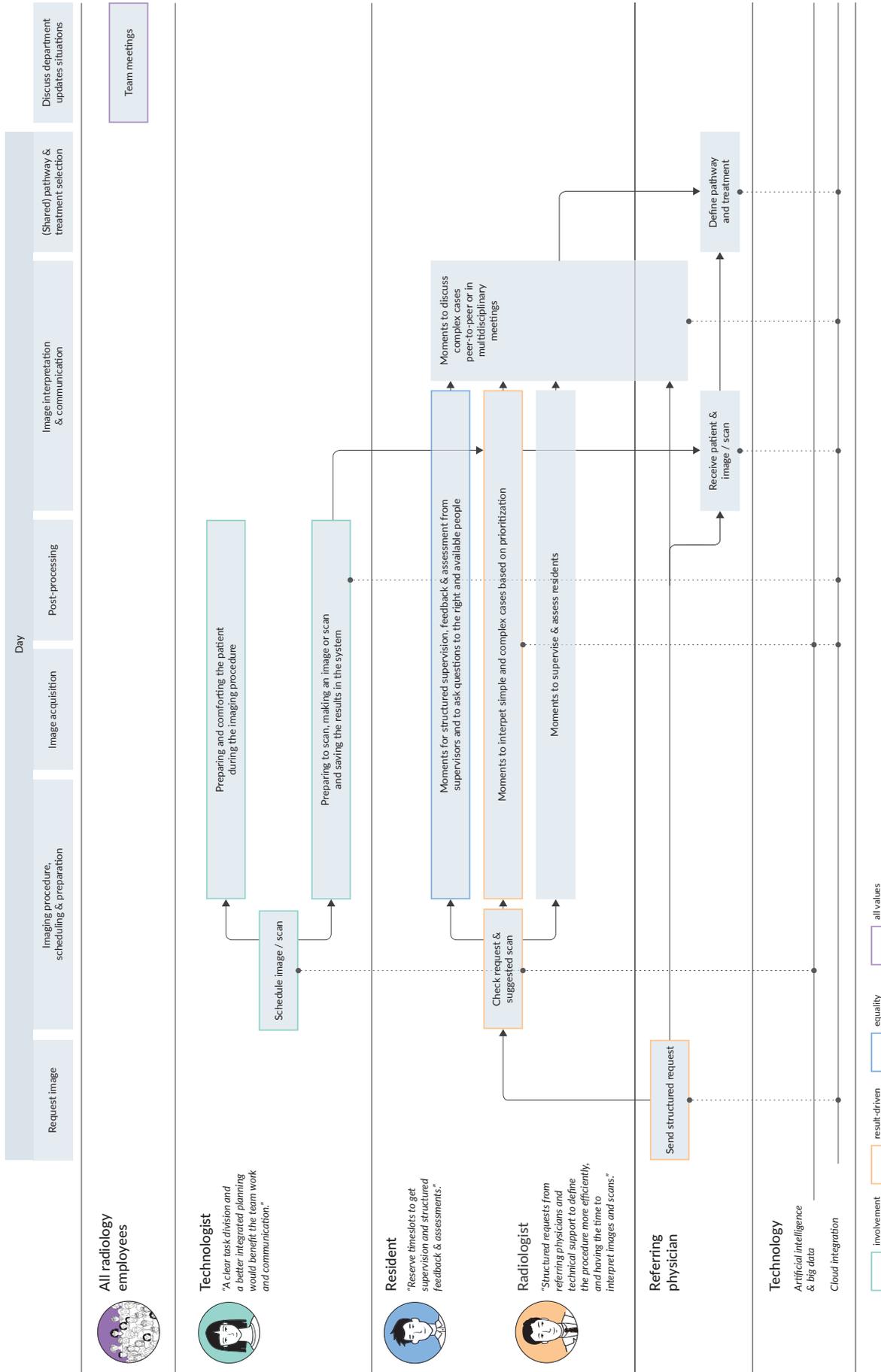


Figure 26: Future scenario 1 - enhanced employee workflow

FUTURE SCENARIO 2

Starting the future scenario of the enhanced department workflow, again the referring physician creates a structured imaging request that is saved in HIX. Technology, such as artificial intelligence and big data, checks the request and, based on the patients' symptoms and purpose of the scan, suggests what type of scan suits best.

Depending on the imaging request, it can be defined as simple or complex. The requests of the simple cases and suggested scans are checked by experienced and trained technologists and with the support of technology, the protocol can, if necessary, be adjusted and be released to be scheduled and performed by technologists. The requests and suggested scans of the complex cases, however, are checked by the residents and radiologists and also here, with the support of technology, the protocol can, if necessary, be adjusted and be released to be scheduled and performed by technologists.

After the technologists prepared and comforted the patient and performed the scanning, the results are saved and stored in the imaging system, HIX and PACS, in order for the radiologists, residents and referring physician(s) to be able to interpret and view the images or scans.

In the meantime, both residents and radiologists have time to interpret prioritized cases. The interpretation of the simple cases can be done with the support of technology. This support will help the radiologists and residents to uncover potential disease characteristics that fail to be seen by the naked eye. Besides, there will be moments during the day for structured supervision, feedback and assessment where the residents are linked to the supervisors with the right core qualities.

Additionally, there are again moments where peer-to-peer or multidisciplinary meetings are organized to discuss the care pathway and treatment for complex cases. For simple cases, the referring physician can view the interpretations of the radiologist or resident in the electronic patient file to define the patient's pathway and treatment. Also, there are radiology team meetings planned every now and then as this will create room to discuss specific updates and to create flexibility to adjust the way of working if necessary.

This way of working with the support of technology and a shift in responsibilities will enhance the workflow of the department of radiology which is visualized in figure 27.

Time pacing scenario 2

The technology support in the interpretation of simple cases of this future scenario would be feasible to implement within 1 year, according to the radiologist of the brainstorm session. Besides, the technologists mentioned that they already give tips and advice on the protocols of simple requests. However, to take over the task of writing protocols for simple requests needs some training and trust from radiologists. Also finding out the core qualities of each supervisor and resident to match them accordingly would take some time. Therefore, this future scenario would be feasible in 2023.

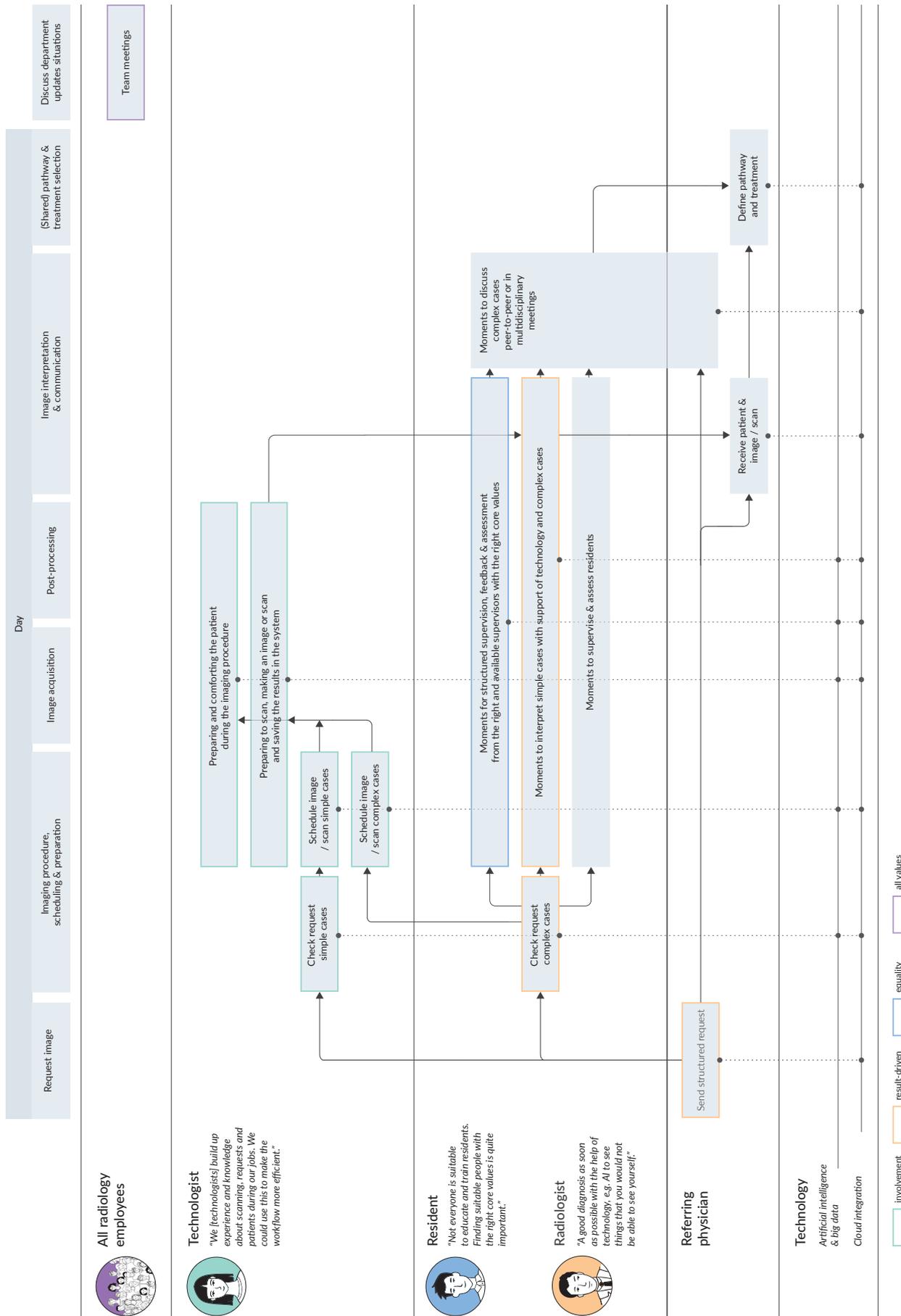


Figure 27: Future scenario 2 - enhanced department workflow

FUTURE SCENARIO 3

In this future scenario, the technologists have obtained their tailored role based on their interests, experiences and knowledge. Management-expert technologists can schedule requests and write protocols of simple cases with the support of technology, technology-expert technologists make scans and images and can do interpretation of simple cases with the support of technology, and patient-expert technologists prepare and comfort the patients.

The beginning of this future scenario is comparable to the second future scenario where a structured request is saved in HIX and with the support of technology, it is defined as simple or complex. Simple requests are referred to a management-expert technologist to write a protocol and complex requests are referred to residents and radiologists to write a protocol. Both, simple and complex requests, are scheduled and by the management-expert technologist and the results are saved in order to be interpreted.

Patient-expert technologists prepare and comfort the patients before, during and after the scanning and the technology-expert technologists makes the scans and images. In case of a simple request, e.g. a simple fracture in a bone, the technology-expert technologists interpret these images with the support of artificial intelligence. A threshold value is for example set to make sure that the interpretations can be made safely. The results of the simple cases are saved in HIX and can be viewed by the referring physician who decides on the treatment and care pathway for the patient.

In case of a complex case, e.g. an MRI scan, there are moments during the day where radiologists and residents can interpret these based on priority with the support of artificial intelligence. The results are saved in the electronic patient file and can be viewed by the referring physician for further treatment and care pathway selection. However, in the more complex cases where multiple perspectives are needed, moments are planned to discuss these cases with other radiologists, residents and physicians.

Besides having moments to interpret complex cases, residents have personalized moments to work, learn, and get structured feedback from the right supervisors based on their learning needs, tailored to learning preferences and to specific interests.

This way of working with the support of technology will enhance the hospital workflow, which is visualized in figure 28.

Time pacing scenario 3

Support of technology in complex cases in this scenario would be feasible in around 5 years, according to the radiologist of the brainstorm session. Besides, if the technology can support the radiologist in the interpretation of simple cases in 2023, this technology could also support the technologists in interpreting the simple cases. However, they need to be trained on how to do this and gain trust of radiologists. Also creating personalized moments for residents to work, learn and get supervision in a structured way would take some time to organize this. Therefore, this future scenario will be feasible in 2025.

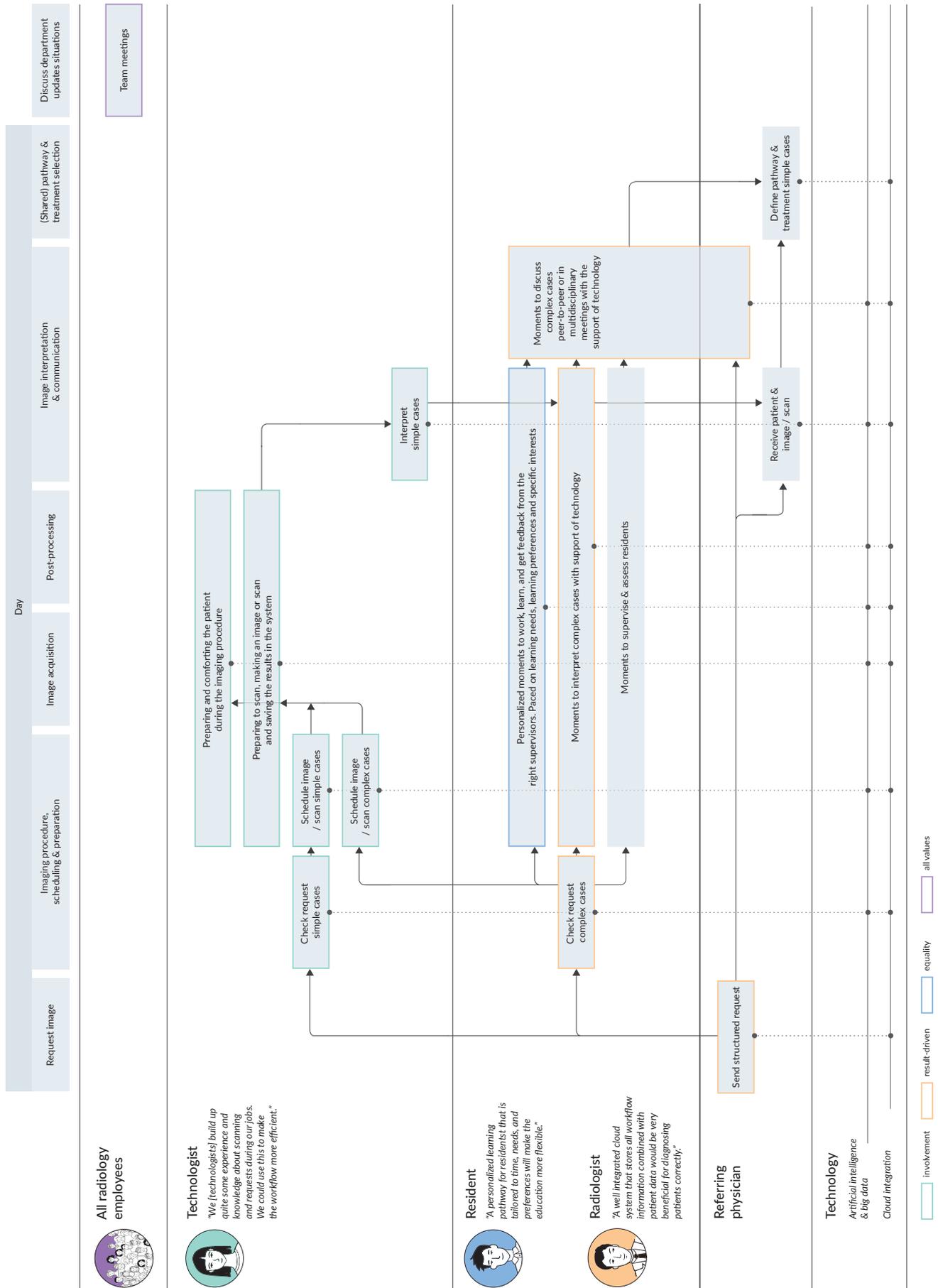


Figure 28: Future scenario 3 - enhanced hospital workflow

5.2 Value propositions

Now that the three future scenarios on how radiology employees will work while enhancing engagement are defined, value propositions for Philips on how to support this new way of working can be explored. First, general value propositions have been designed that give the direction or opportunity area. After that, service propositions have been designed. These service propositions are more concrete and based on specific ideas and will serve as inspiration and project or research initiatives for Philips to continue with.

Value proposition 1

The first future scenario shows that the tasks of technologists are divided more efficiently based on a personal fit, the supervision of residents is structured and they are given the possibility to ask questions and the cases for interpretation are prioritized for radiologists. Besides, the radiologists get support in writing protocols and receive structured requests. The value proposition can be defined as follows:

“Enhancing the employee workflow through boosting task efficiency and facilitating knowledge acquisition.”

Where boosting task efficiency refers to the task division of technologists, the prioritization of cases for radiologists and the support in writing protocols. The knowledge acquisition refers to the way residents get supervision and the facilitation to ask questions.

Value proposition 2

The second future scenario focusses on guiding the technologists in becoming experts within their interests based on experiences and knowledge, matching the residents to the right supervisors and giving support in interpretation of simple cases for radiologists. Therefore, the value proposition of this scenario can be defined as:

“Enhancing the department workflow through facilitating collaboration and guidance in personalized responsibilities.”

Where facilitating collaboration refers to matching the residents to the right supervisors and the collaboration between the radiologists and the technology support in interpretation. The guidance in personalized responsibilities refers to guiding the technologists in becoming experts.

Value proposition 3

The third future scenario elaborates on technology support for radiologist in the interpretation of complex cases, tailored roles of technologists and personalized learning pathways for residents. Therefore, the value proposition of this scenario can be defined as:

“Enhancing the hospital workflow through support in interpretation complexity and providing guidance in personalized pathways.”

Where support in interpretation complexity refers to the way the radiologists interpret images and scans on their own as well as in multidisciplinary meetings, and guidance in personalized pathways refers to the tailored roles of technologists and personalized learning for residents.

5.3 Service propositions

Based on the future scenarios and general value propositions, an individual brainstorm and a creative session with employees of Philips were performed to explore how Philips might support this new way of working of radiology employees. The participants in the creative session had a background in research, design and innovation management. Due to the diversity of participants' background, various perspectives were combined to define desirable, viable and feasible ideas. Figures 29 and 30 show an impression of the creative session with Philips employees. The approach and rough ideation materials can be found in appendix G.

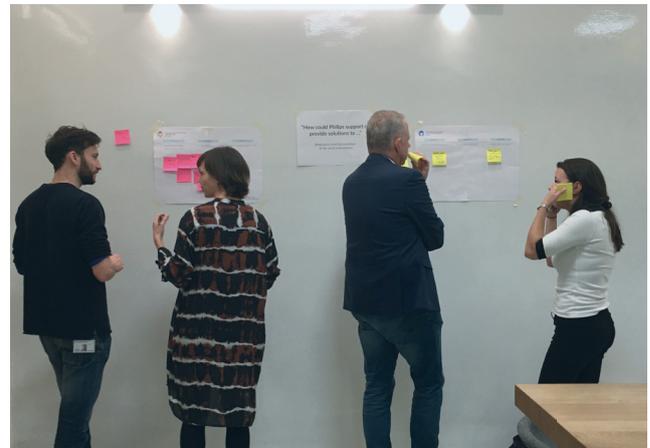
The ideas of the creative session with Philips employees were used to define relevant and concrete service propositions for each role. Together with the inspiration of the Value Proposition Canvas (Strategyzer, 2019) the "fit" between the radiology employee values and the ideas from the session was explored. Yet, for strategic business innovation it is important to have a continuous flow of innovation. This means that the service propositions need to be applicable within each future scenario. These service propositions will serve as inspiration and as starting points for future projects and research initiatives for the research, design or business department.

The service propositions based on the creative session with Philips are redacted as confidential information was used to create ideas. Therefore, the results can be found in appendix H.

One service proposition has been designed based on an individual brainstorm and insights from previous research of this project. This service proposition is applicable to all roles within radiology and is explained on the next page.



Figures 29: Impression of creative session Philips employees



Figures 30: Impression of creative session Philips employees

All roles

Finally, a fifth service proposition was designed which is applicable to all roles. Due to the changing role of radiology, the tailored and specialized roles of radiology employees and technology support, it is necessary to have a clear overview of the employees to sustain the employee engagement within the employee, department and hospital workflow. This can be supported by *“a personalized planning helps radiology employees who want to define diagnoses as soon as possible, be involved in the workflow, department and hospital, and want to learn in an open and safe learning environment by allocating employees correctly based on their tailored tasks and managing the workflow efficiency.”*

Where in the first future scenario the personalized planning enhances the individual employee workflow. In the second future scenario, it will support the entire radiology department workflow and in the third future scenario it will enhance the hospital workflow. This also means that the personalized planning will support the referring physicians and other specialists, see figure 31.



Figure 31: Personalized planning for employees

5.4 Conclusion

Based on the evolution of the work environment elements, this chapter showed the designs of the future scenarios: one for each strategic life cycle. They showed a detailed overview of the workflow of radiology employees and referring physicians.

In the first future scenarios, in 2021, the tasks of technologists are divided more efficiently based on their interests, experiences and knowledge. There will also be an opportunity for them to schedule all requests themselves as they have the overview of available resources. The residents will get structured feedback and the possibility to ask questions to the right and available people. The radiologists will get technology support in the workflow as this will filter the cases based on priority.

In the second future scenario, in 2023, technologists get even more responsibility with the support of technology. In this scenario they are able to write protocols of simple cases. There will be moments during the day for structured supervision, feedback and assessment where the residents are linked to the supervisors with the right core qualities. Additionally, the radiologists will get support of technology in the interpretation of simple cases.

The third future scenario, in 2025, technologists will have obtained their tailored role based on interests, experiences and knowledge. Besides, the technology-expert technologists are also able to interpret the images of simple cases with the support of technology. The learning pathway of residents is personalized based on learning preferences and the radiologist get technology support in the interpretation of complex cases.

Based on these three future scenarios, value propositions have been created on how to support this new way of working. In the first future scenario this value proposition can be defined as: *“Enhanced employee workflow through boosting task efficiency and facilitating knowledge acquisition.”* The value proposition of the second future scenario can be defined as: *“Enhanced department workflow through facilitating collaboration and guidance in personalized responsibilities.”* And the final value proposition for the third future scenario can be defined as: *“Enhanced hospital workflow through supporting in interpretation complexity and providing guidance in personalized pathways.”*

To get more specific ideas on how Philips might support the radiology employees in the future scenarios, service propositions have been designed. This was done based on an individual brainstorm, a creative workshop with Philips employees and all insights from the previous creative sessions. This resulted in five service propositions, where four are based on individual roles of radiology and one that is applicable to all employees. The four service propositions that are based on individual roles are considered confidential as these are created with confidential back ground

information of Philips. The fifth service proposition which is applicable to all roles is defined as: a personalized planning helps radiology employees by allocating them correctly based on their tailored tasks and managing the workflow efficiency.



6 Deliver

This chapter elaborates on a validation session that has been conducted with radiology employees in order to define the desirability of the future scenarios. And last but not least, the roadmap of employee engagement at radiology in 2030, which includes all findings and results of this graduation project, is presented. It includes the changing healthcare and radiology landscape, the employee values that enhance engagement, the three strategic life cycles, the future scenarios based on the work environment elements, the value propositions and the service propositions for Philips.

6.1 Validation

The various work environment elements from the future scenarios have been laid out to two technologists, one resident and one radiologist for an anonymous validation based on desirability. They were asked to what extent these work environment elements enhance their engagement. Appendix I shows the original survey with responses from the participants.

INVOLVEMENT | MORE RESPONSIBILITY BASED ON EXPERIENCES AND KNOWLEDGE

According to the technologists, more responsibility based on experiences and knowledge will enhance the involvement and they gave it 4 out of 5 points. They argued that more responsibility will enhance involvement as *“it is more important to do your tasks. At the moment nobody really notices what you are doing.”* and it can *“absolutely benefit the involvement, however, it should not give too much pressure on some people.”*

- *Scheduling requests*

In the first future scenario, technologists will be able to schedule all requests as they have the knowledge and overview of available resources. This will enhance the involvement of technologists and it scored 4 out of 5 points. They argued that in this way they *“can better schedule appointments and it would be already feasible”*, however, *“research should be done into how this will be implemented as it could be an expensive administrative task.”*

- *Writing protocol of simple requests*

The second future scenario envisioned that technologists will be able to write protocols of simple requests. According to the validation with technologists, this will enhance the involvement and it scored 4,5 out of 5 points. They argued that in this way they *“get more responsibility and will be positively involved”* and it can *“increase the process efficiency”*. It would be feasible to implement this as *“quite a lot of technologists already know much about this and think along with radiologists”*. However, only *“experienced technologists will be able to do this”*.

- *Interpretation of simple cases*

In the third future scenario, it was envisioned that technologists will be able to interpret the scans and images of simple cases. This will enhance the engagement according to the validation, and it scored 4 out of 5 points. The technologists argued that in this way *“you are not only pressing the button, but also involved*

in the real diagnostic process”. As technologists already see a lot of images and scans, it would be feasible to implement this within 10 years. Besides *“data analyses can be faster with the use of algorithms and in this way radiologists can focus more on the complex cases”*.

EQUALITY | TAILORED LEARNING & STRUCTURED SUPERVISION AND ASSESSMENT

According to the resident, structured supervision will enhance the staff equality to create an open and safe learning environment as it *“will then be possible to always discuss uncertainties in certain cases”*. It was score 4 out of 5 points.

Possibility to ask questions to right and available people

In the first future scenario, the residents will have the possibility to ask questions about certain cases to the right and available people. This will contribute to an open and safe learning environment and scored 4 out of 5 points as it will *“broaden the knowledge, which is an essential part of education”*.

- *Matched to the right supervisors*

In the second future scenario, residents will be matched to supervisors with the right core qualities. According to the validation with the resident, this match making will enhance the engagement as *“not everyone possesses the right core qualities. You have to find out what core qualities someone has and put them in a position where they can use and explore those qualities”*. It was scored 5 out of 5 points.

- *Personalized learning pathway*

In the third future scenario, the residents will have a personalized learning pathway that is tailored to their needs and preferences. This work environment elements was scored 4 out of 5 points and will therefore contribute to an open and safe learning environment as there is *“clarity of who is doing which tasks and where you can ask for supervision”*.

RESULT-DRIVEN | TECHNOLOGY SUPPORT IN WORKFLOW AND INTERPRETATION IMAGES AND SCANS

According to the radiologist in this validation, technology support in workflow and interpretation will contribute to being result-driven and thus the engagement as *“adequate information with the support of technology will lead to quality and efficiency”*. It scored 4 out of 5 points.

- *Support in workflow by prioritizing cases*

In the first future scenario, the radiologists will get technology support in their workflow as it will prioritize cases for interpretation. This will enhance being result-driven to enhance engagement as it will *“contribute to the workflow efficiency”*. This scored 4 out of 5 points.

- *Support in interpretation of simple and complex cases*

In the second and third future scenario, technology will support radiologists in the interpretation of scans and images. In the second future scenario this will be for simple cases, and in the third future scenario this will be for complex cases. The support in interpretation of scans and images will contribute to being result-driven and the engagement as it *“enables better, faster and more precise diagnosis of disease”*. It scored 4 out of 5 points.

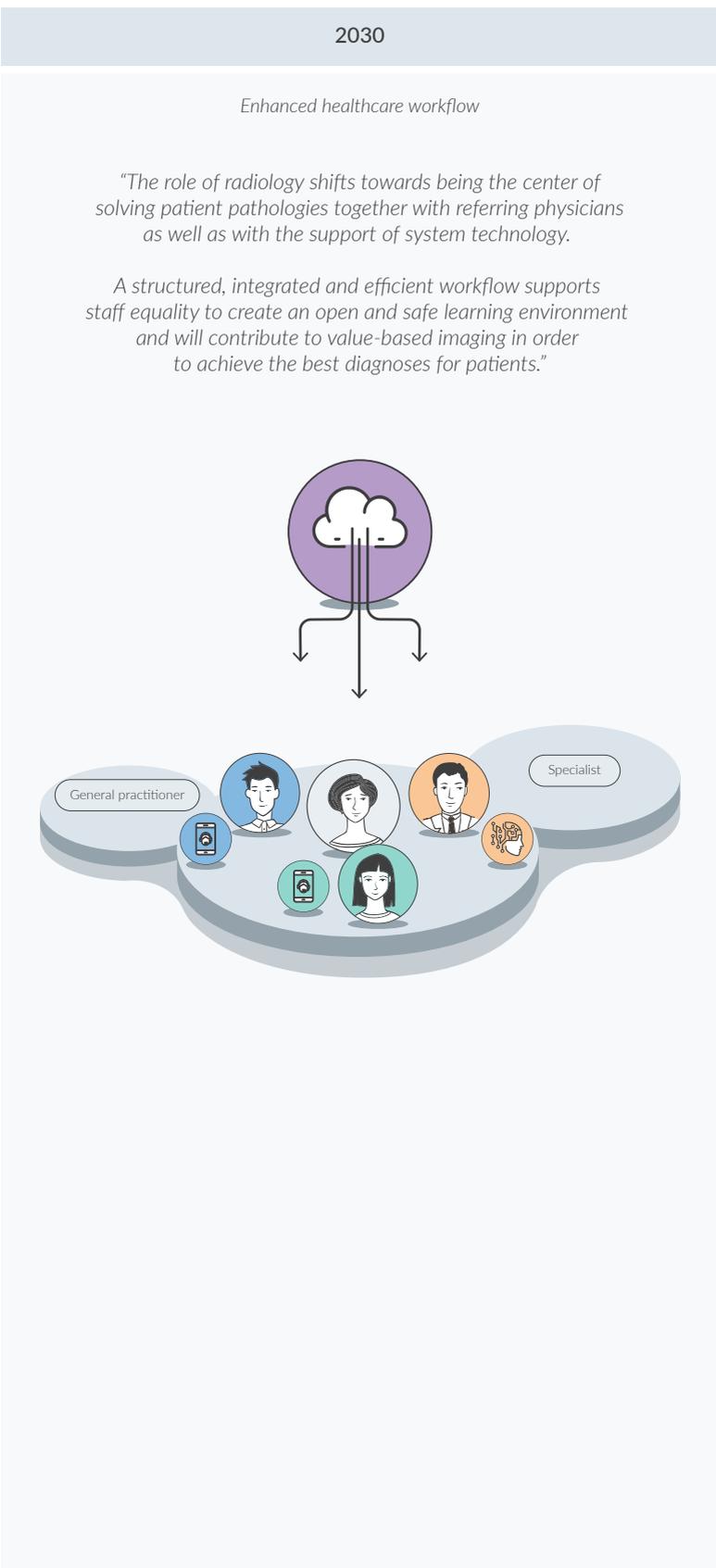
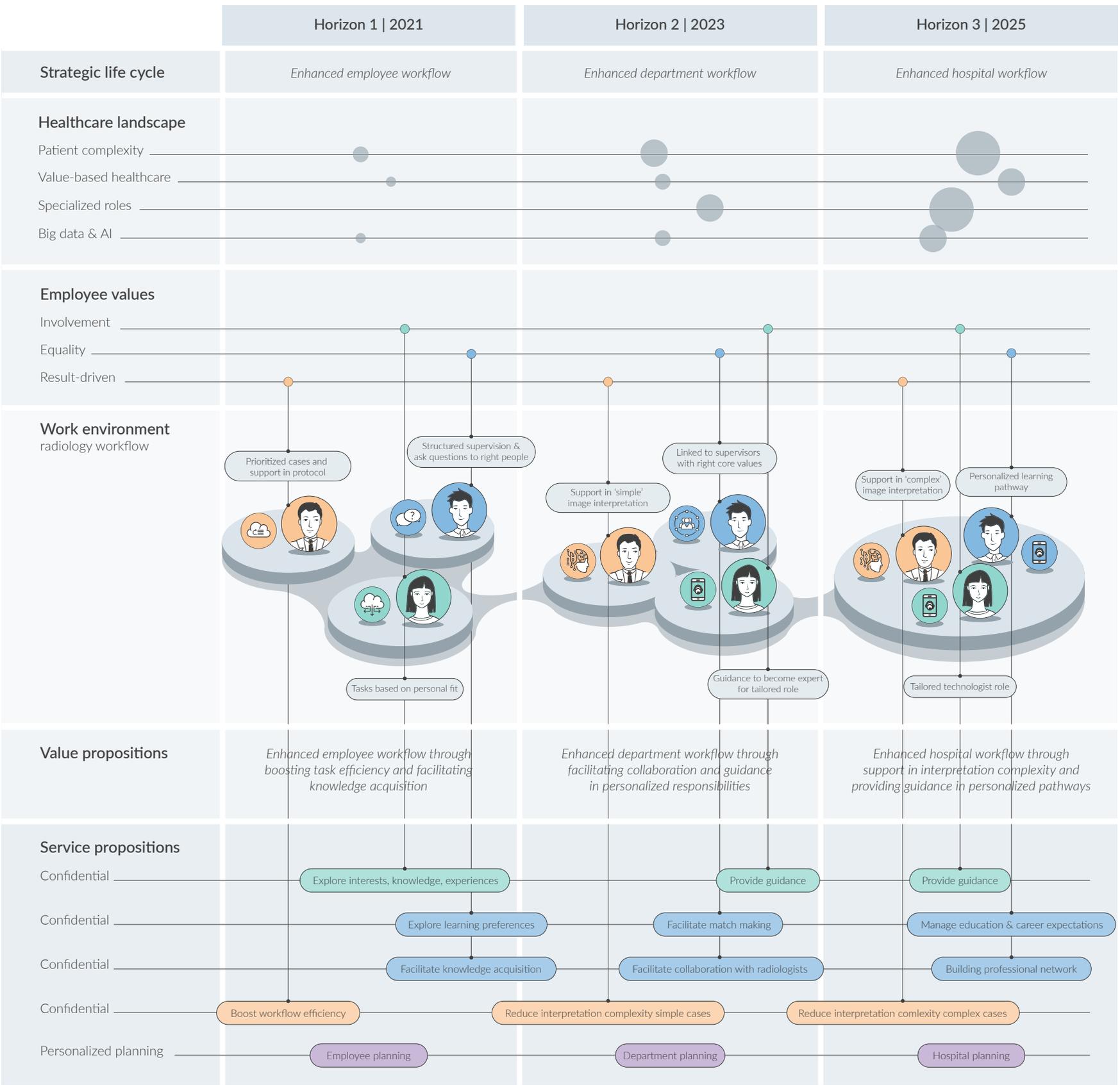
This validation with radiology employees showed that the identified and designed work environment elements within the future scenarios do enhance the employee engagement. This implies that the value propositions and service propositions are based on valid insights.

6.1 Roadmap to Radiology Staff Resilience

After all desk and literature research, field research and creative sessions, the main findings were used to build a roadmap towards employee engagement among Millennials at radiology. A roadmap is defined as: a visual portray of design innovation elements plotted on a timeline (Simonse, 2017). The roadmap of this graduation project shows the changing work environment elements of the radiology workflow per role based on the changing healthcare landscape and role of radiology and employee values. Besides, it shows the possible service propositions how Philips might support this new way of working. The final and complete roadmap is shown on the right.

The employee values of the technologists, residents and radiologists will stay the same during the three strategic life cycles, or in this roadmap: the three horizons. However, the work environment of the radiology workflow will change due to the changing healthcare landscape and role of radiology. As can be seen in the second row, the healthcare landscape shows the four main trends and expectations that will shape the future role of radiology. The importance of the trends in each horizon is indicated with circles. The bigger the circle, the more important this trend will be to the roles of radiology in this horizon.

Besides, the five service propositions on how Philips might support the new radiology workflow in the future are mentioned at the bottom. These main concepts of the service propositions will stay the same during the three horizons, however, how they will support the roles of radiology evolve over time based on the three life cycles.



HORIZON 1

In the first horizon, the employee workflow of all three roles will be enhanced through *boosting the task efficiency* and *facilitating knowledge acquisition*. Patient complexity will start to play an important role as it might increase the workload of radiology. However, the use of big data and AI provides opportunities to support. Figure 32 shows horizon 1.

Task efficiency refers to prioritized cases and support in writing the protocols for radiologists. This can be supported by boosting the radiologists' workflow efficiency by filtering the cases on priority and it will suggest the type of scan that might be needed for a request when writing the protocols.

The task efficiency also refers to divided tasks based on a personal fit for technologists. This can be supported by helping technologists to explore their interests, knowledge and experience to be able to divide the tasks more efficiently. This will boost the workflow as the technologists will perform tasks in which they are good at and they enjoy doing.

The knowledge acquisition refers to structured supervision and the possibility to ask questions to the right and available people for residents. This can be supported by exploring the residents' learning preferences for structured supervision. Another support for residents is to facilitate knowledge acquisition. Residents are able to search for information on specific cases or medical subjects and get in touch with experts to ask their questions.

Lastly, the **personalized planning** will support all roles of radiology. In this horizon, the planning will enhance the individual planning of each role by providing an overview of the tasks of that day.

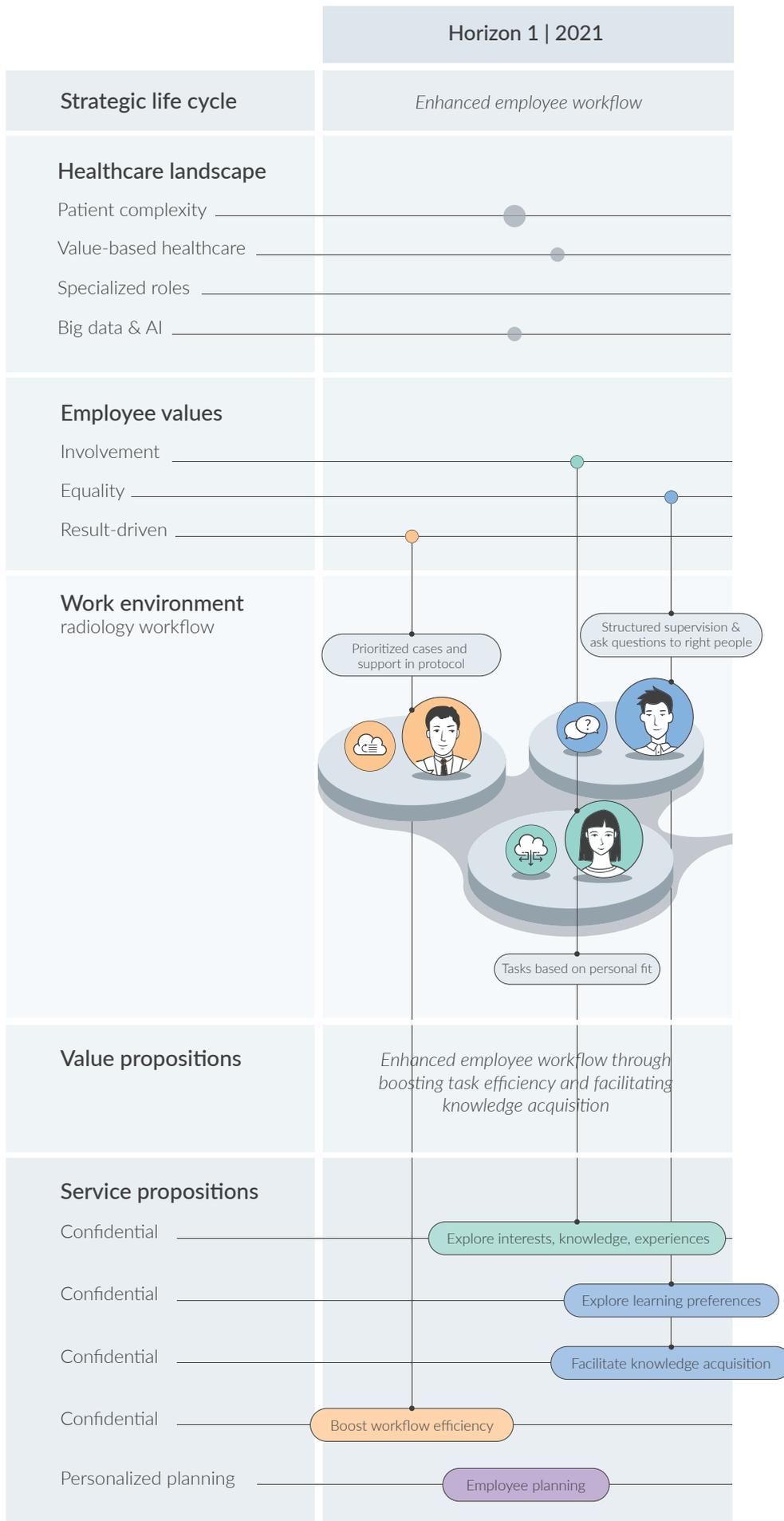


Figure 32: Horizon 1: enhanced employee workflow

HORIZON 2

In the second horizon, the department workflow will be enhanced through *facilitating collaboration* and *guidance in personalized responsibilities*. As the patient complexity will increase even more, super specialized roles within radiology will play an important role in this horizon. Value-based healthcare and big data and AI will provide opportunities to support in here. Figure 33 shows horizon 2.

Facilitating collaboration refers to the support in interpretation of simple images for radiologists by for example giving the likelihood of a disease. This will allow the radiologists to have more time for other cases that require more attention.

Facilitating collaboration also refers to being linked to supervisors with the right core qualities for residents. This can be supported by facilitating match making. Exploring the learning preferences of residents and the core qualities of supervisors and match them accordingly.

The guidance in personalized responsibilities refers to the guidance technologists get to become experts for their tailored roles. In this horizon, the technologists can already take over simple tasks of radiologists and residents, such as writing the protocol of simple requests with the support of technology. However, technologists are also able to have tailored roles in other directions, such as management or patient-care.

As in this horizon the roles of radiology will already get more specialized and tailored, the **personalized planning** gets a bigger role. It will support the radiology department by providing an overview of the tailored and specialized roles and a task division based on this.

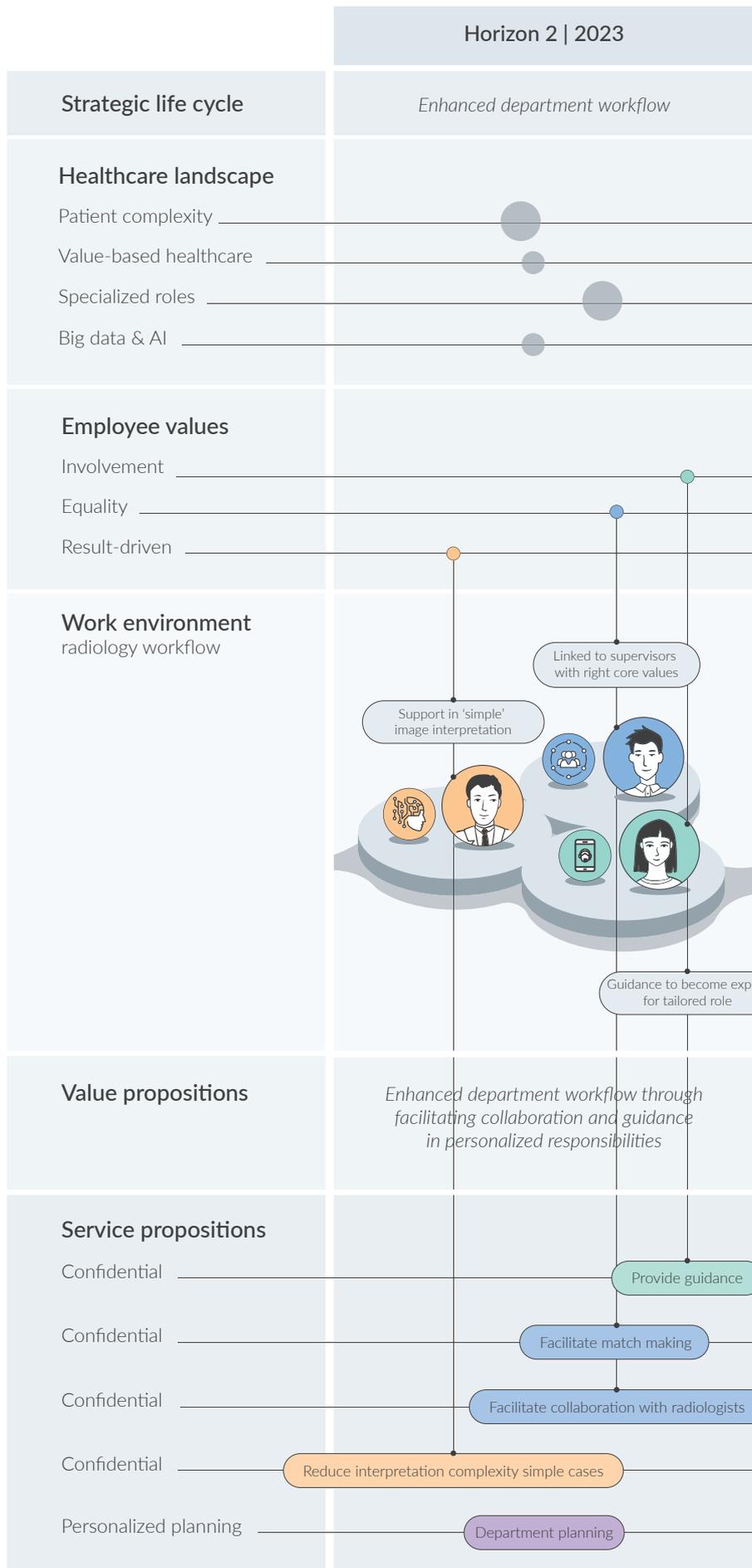


Figure 33: Horizon 2: enhanced employee workflow

HORIZON 3

In the third horizon, the hospital workflow will be enhanced through *support in interpretation complexity* and providing *guidance in personalized pathways*. Patient complexity will increase even more and therefore the super specialized roles become very important. Value-based healthcare will start to play a bigger role as well due to the specialized roles of healthcare employees. Big data & AI will provide more opportunities to support this complexity and workflow. Figure 34 shows horizon 3

The support in interpretation complexity refers to the support in interpretation of complex images and scans for radiologists. However, in this horizon the technologists will be able to do the interpretation of simple cases. Therefore, they will also get support in the interpretation, just as the radiologists. Again, it will give a likelihood of the disease that cannot be seen by the naked eye and provides support in multidisciplinary meetings as well.

The guidance in personalized pathways refers to the tailored roles of technologists. In this horizon, the technologists will have obtained their tailored role based on their interests, knowledge and experiences. This can vary within different directions. Providing guidance to technologists will be important as value-based healthcare will play a bigger role and therefore the innovations within healthcare and radiology will increase. It is important for technologists to stay up to date about this.

The guidance in personalized pathways also refers to the personalized learning pathways for in this horizon. Due to the increasing complexity in healthcare and radiology, the residents will get guidance to manage their education and career expectations.

In this horizon, the **personalized planning** will support all employees within the hospital. For the referring physicians it is also important to know which specific role the radiology employees have to be able to work together well and efficiently.

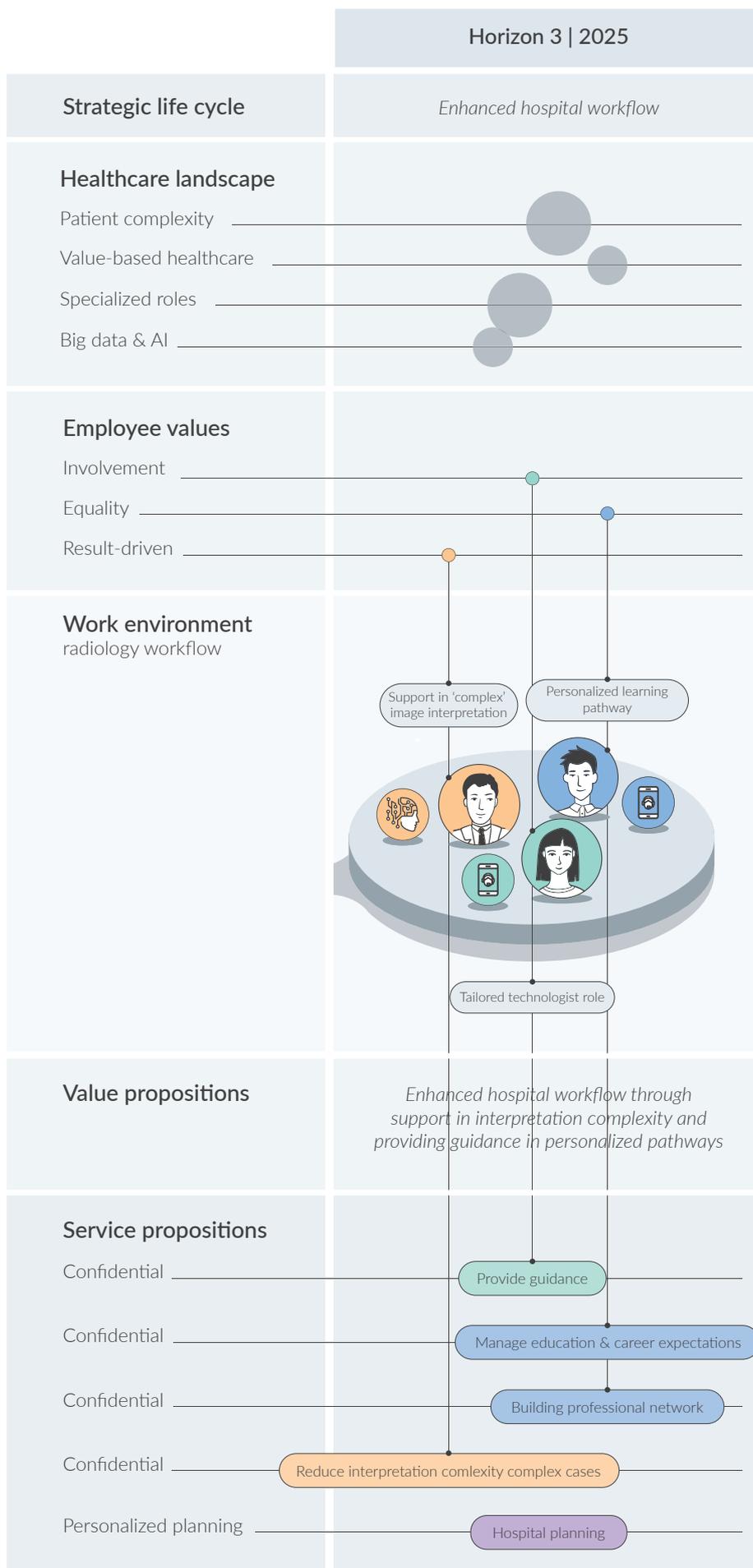


Figure 34: Horizon 3: enhanced employee workflow

6.3 Conclusion

Based on a validation session with two technologists, one resident and one radiologist, the desirability of the work environment elements within the three strategic life cycles was explored.

Having more responsibility based on experiences and knowledge does enhance the engagement of technologists as *“it is more important to do your tasks. At the moment nobody really notices what you are doing.”* and it can *“absolutely benefit the involvement, however, it should not give too much pressure on some people.”* Being more involved in the diagnostic process would benefit the engagement as *“you are not only pressing the button”*. This would be feasible according to the validation session. Especially with the support of technology, because *“data analyses can be faster with the use of algorithms and in this way radiologists can focus more on the complex cases”*.

Tailored learning & structured supervision and assessment enhances the engagement of residents, as it *“will then be possible to always discuss uncertainties in certain cases and broaden the knowledge”*. Besides, match making with the right supervisors is crucial. *“Not everyone possesses the right core qualities. You have to find out what core qualities someone has and put them in a position where they can use and explore those qualities.”* Combining this in a personalized learning pathway is a solution as there is *“clarity of who is doing which tasks and where you can ask for supervision”*.

Support from technology in the workflow and interpretation of scans and images enhances the engagement of radiologists. The technology support can filter information based on priority and give *“adequate information which will lead to quality and efficiency”*. Support in interpretation of scans and images will *“enable better, faster and more precise diagnosis of disease”*.

To conclude, all work environment elements enhance the engagement of the roles within radiology according to the validation session. This implies that the value propositions and service propositions are based on valid insights.

Based on all insights, findings and results within this project, a roadmap has been created. This roadmap is *“a visual portrayal of design innovation elements plotted on a timeline”* (Simonse, 2017). It shows the changing work environment elements of the radiology workflow per role based on the trends and employee values. Besides, the service propositions on how to support this new way of working is visualized.



7 Discussion

This last chapter contains a discussion of this graduation project. It summarizes the main results and answers the research question on *how Philips might support radiology departments to create an employee experience that enhances engagement among Millennials*. Besides, an elaboration on the recommendations will be given and a personal reflection is laid out.

7.1 Contribution master thesis

This master thesis adds value to stakeholders in the healthcare and radiology industry, to the Strategic Product Design field of study and to the problem owner Philips Research in particular. This thesis aims to contribute to the awareness of employee engagement among healthcare employees (and Millennials in particular) and aims to stress the importance why healthcare organizations and health technology companies should pay attention to this matter. The main take-aways are the insights on the two aspects of employee engagement and that the Millennial generation is different than other generations. The future scenarios and the five service propositions in this thesis serve as an inspiration source for both the healthcare and radiology industry as well as for Philips research by showing how a health technology company can support healthcare organizations. Besides, this thesis aspires to spark research at Strategic Product Design at the faculty of Industrial Design Engineering on how to create relevant and inspirational propositions for companies, while handling a customer centric approach.

Fundamentally, this thesis provides Philips Research with new service propositions that act as inspiration to benefit the employee experience pillar of the Quadruple Aim. Therefore, not only contributing to becoming the biggest health technology company, however, also showing that companies like Philips provide solutions based on market pull instead of only technology push.

7.2 Conclusion

The research question and its sub questions have been answered throughout the several chapters in this thesis. In this paragraph, the most important conclusions are drawn to explicitly answer the research question and sub questions.

1. How to create an employee experience that enhances engagement?

Literature exploration revealed how burnout and engagement are linked to each other by means of two main work aspects: job demands and job resources. The focus for this graduation project laid on the job resources (*intrinsic* and *extrinsic*), as this will both have influence on preventing burnout as well as on fostering engagement. The intrinsic job resources can be defined as the employee values, whereas the extrinsic job resources are described as the work environment.

However, the employee values will stay the same over time as these are fundamental and universal drivers of behaviour, while the work environment will change due to trends and developments within the field of healthcare. Thus, for employee engagement to be sustained over time, the work environment needs to be adapted to a changing context while being in balance with the employee values

2. How does the employee experience look like that enhances the engagement among Millennials at radiology?

An exploration to identify the employee values of Millennials at radiology showed that technologists value involvement, residents value staff equality that creates an open and safe learning environment and radiologists value being result-driven to define diagnoses as soon as possible. Besides, field and trend research revealed that the entire healthcare workflow will be enhanced in 2030. The organizational structure of hospitals will change from traditional departments into themes, where radiology will have a central role. This means that the role of radiology will become more central and visible and will drive the collaboration between other physicians with the support of technology. Based on the employee values and the future role of radiology, a future vision has been designed that describes the future of radiology where employee engagement among Millennials is enhanced:

“The role of radiology shifts towards being the center of solving patient pathologies together with referring physicians as well as with the support of system technology. A structured, integrated and efficient workflow supports staff equality to create an open and safe learning environment and will contribute to value-based imaging in order to achieve the best diagnoses for patients.”

Based on the employee values and changing role of radiology, the work environment of radiology has been explored by means of various creative sessions. This revealed that the involvement of technologists, and thus their engagement, can be enhanced by giving them more responsibility based on their interests, knowledge and experiences that they gain during their job. This means that in the future, technologists will have tailored roles which can vary from being a management-expert, patient care-expert and technology-expert. The staff equality to create an open and safe learning environment for residents, and thus their engagement, can be enhanced by tailoring their learning and structuring the supervision and assessment. This means that in the future, residents will all have a personalized learning pathway paced on their learning preferences. Being result-driven to define diagnoses as soon as possible for radiologists, and thus their engagement, can be enhanced by technology support in the workflow and interpretation of scans and images. This means that in the future, radiologists will get technology support and can therefore focus more on the complex cases and collaboration with other physicians.

3. How will the employee experience of engagement evolve over time?

As the future vision, and thus the entire healthcare workflow, will be enhanced in 2030, several steps need to be taken to arrive there. This evolution is based on the three strategic life cycles. The first step is to enhance the employee workflow, where innovations within each role of radiology will take place. This will follow into an enhanced department workflow, where the interaction and collaboration within radiology will be developed. The third life cycle is based on an enhanced hospital workflow, where also the roles of referring physicians will be taken into account.

Based on these three strategic life cycles, the work environment elements from the creative sessions are mapped out.

In order for technologists to obtain tailored roles, the first step is to explore interests, knowledge and experiences to divide the tasks more efficiently and on personal fit. In the second life cycle, they will be coached and guided to become real experts within their interests and in the third life cycle they will have obtained their tailored role. Besides, technology support will allow them to take over the simple tasks of radiologists, such as scheduling all requests, writing the protocol of simple cases and interpreting simple images (e.g. x-rays).

In order for residents to have personalized learning pathways, the first step is to have structured supervision and assessments and have the possibility to ask questions to the right and available people. In the second life cycle, they will be matched to supervisors with the right core qualities. In the third life cycle, they will have personalized learning pathways that are tailored to their learning preferences.

In order for radiologists to be able to focus on the complex cases, the first step is technology support in the workflow. This will be done by prioritizing cases and give support in writing protocols. In the second life cycle, technology will support in the interpretation of simple cases. This allows the radiologists to work more efficiently and have more time left for complex cases. In the third life cycle, the interpretation of simple cases can be done by technologists and technology will support radiologists in the interpretation of complex cases.

4. How might Philips support radiology departments to create an employee experience that enhances engagement among Millennials?

By means of an individual brainstorm, a creative session with employees of Philips and the insights from previous creative sessions and research, five service propositions have been designed. These service propositions show how Philips might support the radiology departments to sustain employee engagement among Millennials. Four service propositions are

based on the different roles. These are considered confidential and can be found in appendix H. One service proposition is applicable to all roles and can be defined as:

- A **personalized planning** will help radiology employees by allocating them correctly based on their tailored roles, personalized employee pathways and managing the workflow efficiency.

These five service propositions serve as inspiration and project or research initiatives for Philips research, design and business.

7.3 Recommendations

DESIRABILITY OF RADIOLOGY EMPLOYEES

The research on employee values in the discover phase was based on interviews with three radiologists, two residents and four technologists, mainly from the same academic hospital. This does not give a representative result for all Millennial employees at radiology throughout the Netherlands. However, it does give an indication of possible outcomes and serves as inspiration to build on. Also, during the one-on-one brainstorm sessions with radiology employees, these values were proposed and validated. Based on this validation, the employee values were considered as valid results and used for the rest of the project. However, to fully understand the employee values of radiology employees, an extensive qualitative and quantitative study is needed.

The work environment elements are validated with radiology employees, however, this validation was based on four participants. To fully understand whether these work environment elements and their evolution suit the radiology employees and their values to enhance engagement, further research should be conducted.

Lastly, the service propositions that were explored and designed in the final phase of this thesis are not elaborated upon extensively. Also, these are not validated with radiology employees to explore if this sparks the desirability. It is recommended to Philips to further explore these service propositions and explore the desirability of these based on the radiology employees' values and perspectives.

Unfortunately, a more extensive research and validation with radiology employees could not be realised within this project's time frame.

FEASIBILITY AND VIABILITY FOR PHILIPS

In this thesis, the main focus was to explore how to create an employee experience that enhances engagement among Millennials and how this would look like in the future. After this was researched, explored and designed, attention has been given on how Philips might support this new way of

working at radiology. However, these five service propositions have not been elaborated upon extensively and should be considered as initiatives for further research. The required research into the feasibility (*"to what extent are these service propositions feasible?"*) and *"does Philips have the resources to invest in these service propositions?"*) and viability (*"to what extent are these service propositions aligned with the current vision, strategy and goals of Philips?"* and *"to what extent does Philips want to invest in these service propositions?"*) were not feasible to explore within this project's time frame.

This means that the next step for Philips is to validate these service propositions based on feasibility and viability and explore whether it is profitable and realistic to set up research projects based on these. Therefore, it is suggested to benchmark these service propositions to other health technology companies such as Siemens, GE and start-ups as well as to companies that deliver educational services to healthcare organizations and / or employees. Besides, these service propositions are focused on one aspect of the Quadruple Aim: staff experience. In the future, it would be best if Philips, after validation, dived into the service propositions deeper based on the other three aspects of the Quadruple Aim. This way, the service propositions would be more impactful, not only for the healthcare employees but also for patients and other stakeholders.

7.4 Personal reflection

When looking back at this graduation project, I believe I can say that I reached my learning goals and that I have grown in a personal and professional way. I was able to use the skills and knowledge that I gained during the past six years of studying at the faculty of Industrial Design Engineering to create a result of which I am proud.

LEARNING GOALS

As I described in the learning goals of my project brief at the beginning of this thesis, I wanted to gain in-depth knowledge on strategic design for healthcare within corporates. I am thankful for the opportunity that Philips gave me to develop this knowledge and experience, for my supervisors for guiding me in this (strategic) process and for all professionals that contributed to make it possible for me to learn. This really expanded my knowledge in this field of study and in the corporate world.

PROCESS AND METHODS

Reflecting on my process in this project, I am very proud of how I developed myself. In my project brief I defined a planning and project approach, however, it turned out that I needed to be flexible to be able to reach the result I was aiming for. This was sometimes confusing as I lost grip on my project. However, I was able to get back on track with a new plan on how to approach it.

Yet, the topic of this thesis is fairly psychological and broad. Therefore, I found it quite hard to get grip on. Although I was sometimes very critical towards myself, I lost confidence to make decisions to proceed. However, this critical attitude made the quality of my work even better. Besides, the supervision from the TU Delft and Philips helped me with this as well as it gave me back the confidence to make decisions and move on.

PROJECT RESULT

As I am fairly critical towards myself and the results of my decisions and actions, it was hard for me to define where my project would end. I struggled with being able to make mistakes and learn from it on one side, while on the other side the results had to be valuable for Philips as well. This caused me to put pressure on myself to deliver the best results without having the room to make mistakes and learn.

However, in the end I believe that the project result I designed both gave me the opportunity to make mistakes and learn as well as delivering something valuable for Philips. Although I was not able to perform all validation steps in the end, I am proud of the result of this project.

I also learned on deciding which aspects of my research were relevant for the next steps within the project and which could be considered as background information. In the end I feel I managed well to find a structure that makes my project and report relevant and logic. Also I am very glad that I had the opportunity to do field research and interviews with employees at radiology. It was hard to find participants, however, I am very grateful for my network that helped me connect with the right people. This really made the project come to life and contributed to the result.

COMMUNICATION

In my opinion, I made big steps in my communication skills. On academic level as well as on connecting with stakeholders. I mostly learned how to cooperate and communicate with multiple stakeholders who all have their own purpose in this project. In the beginning I found this quite difficult, especially finding my way within this complex project environment. However, after a few months I started to feel comfortable and found my working environment.

PROJECT MANAGEMENT AND PLANNING

I am quite impressed how I dealt with the project management of this graduation project. However, I noticed that I wanted to involve all feedback and insights I gained and please all stakeholders. This increased the complexity of the project, which made it harder to manage and plan. Next time, I will focus on expectations management of all stakeholders and prioritize them based on relevance to the project to relieve myself from lots of work and stress.

I sincerely hope that I have sparked Philips' curiosity within employee engagement among Millennials at radiology departments and that they can use my approach and project results as inspiration for further research and projects.

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