EXPANDING THE QUANTIFIED-SELF

To optimize performance of knowledge workers and to minimize burnout risk

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Expanding the Quantified-Self
To optimize performance of knowledge workers and to minimize burnout risk

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EXECUTIVE SUMMARY

Burnouts are a severe, negative consequence of lacking performance management within firms and a result of a disbalance between energy input (e.g: sleep, social activities, physical activity) and output (e.g: workload, anxiety on the job, caring for a kid) Burnouts lead to employment challenges for firms, resulting in a potential threat for the strategic competitive advantage for the firm. Moreover, on an individual level, high risks of burnout lead to severe consequences for the individual health of knowledge workers (e.g: cardiac diseases, impact on personal life, autoimmune-diseases) and major costs for both the society and firms itself. Dutch Journalists of the NRC concluded that an average burnout accounts for €60.000,- per burnout, while the total societal burden account for €1.8 billion each year as a result of direct and indirect effects of burnouts. Despite the competitive significance of vital employees for firms, we see an increasing number of burn-out related cases within the Netherlands. In 2019, 14,6 people per thousand inhabitants were officially diagnosed with neurasthenia/surmenage (=burnout) by their general practitioner. Moreover, in 2018, Approximately 16,4% of the male employees and 18,1% of the female employees experienced “multiple times or more” burn-out related symptoms during the month. Generally, this is 1 out of 6 employees of the Dutch workforce. This account for a 41% increase of burn-out related symptoms with men and an increase of 66% of burn-out related symptoms with women.

The Quantified-Self (QS) philosophy prescribes the approach of the human being as a machine and, following the QS fanatics, has the potential to optimize performance. For example, the QS-approach is widely adopted within athletes sporters to optimize performance based on oxygen-levels and heartrate measurements. However, measuring different elements of the human body (such as nutrition, sleep or physical activity) has not yet been able to decrease the development of burn-out related symptoms. This research addresses the question on how the quantified-self and life-logging can contribute to the optimization of energy management within firms, and thus decrease the risk on burn-out related amongst knowledge workers and implicated side effects as stated above. First, an integrative, holistic framework is presented (the Vitality Map) which incorporates all relevant determinants (21 in total) influencing the knowledge worker battery, and thus, determine sustainable performance of knowledge workers. These determinants are categorized on four levels, which consist of two levels of non-adjustable determinants and two levels of adjustable determinants.

An extensive literature is conducted, integrating five theoretical domains which lay around the solution, including health & vitality, artificial intelligence, knowledge workers, performance management and human resource management systems. Based on the literature research, societal and competitive challenges are analyzed and translated into 9 Design Objectives. The Design Objectives are generic objectives which human resource management systems should incorporate in order to facilitate optimal performance management of individual knowledge workers within firms. The following Design Objectives are formulated:

Thirdly, the Performance Management System (PFMS) Framework is developed, which builds forward on the Vitality Map and which presents how the data collection, aggregation, analysis and presentation should be implemented within firms. The PFMS is presented in Figure 2. This framework provides a fundamental description of the performance delivery process (energy charge to performance) and shows how the data can contribute to informed consent in performance management and policy developments, which leads to better strategic decision making in firms in relation to the human resources available within the organization and preventive interventions which decrease the costs which are associated by curation of burnouts. Moreover, the PFMS Framework suggests how the positing and collaboration of health, vitality and performance consultants and internal stakeholders within the firm can cooperate in order to optimize human resources within the company.

At last, the research contributes to the scientific development of cross-disciplinary approaches in human resource practices. Five theoretical domains are integrated and incorporated in a single artefact which is supported by the interviewees. Further research is suggested to explore the practical implementation of the artefact prototype as developed in this This Thesis Research. However, human resource managers and IT managers within firms can adopt the practical tools as provided in this Research Paper.
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1. PROBLEM IDENTIFICATION
This chapter elaborates on the identified problem for this thesis research. First, the Research Objective is presented. Second, the background of the problem is elaborated. In the third subchapter, the scientific knowledge gap is delineated. Last, based on the problem statement, scientific knowledge gaps and the research objective, the research questions are formulated.

1.1 Research Objective
Burnouts are a severe, negative consequence of lacking performance management within firms. Burnouts lead to employment challenges and thus risks for the strategic competitive advantage for the firm, high risks on the individual health of knowledge workers and major costs for both the society and firms itself. Arboned claims that every burnout costs averagely €60,000,- and that the total costs for the Dutch society account for €1.8 billion each year as a result of direct and indirect effects of burnouts. (ArboNed, 2017) Despite the competitive importance of vital employees for firms, we see an increasing number of burn-out related cases within the Netherlands. In 2019, 14,6 people per thousand inhabitants were officially diagnosed with neurasthenia/surmenage by their general practitioner. Moreover, in 2018, Approximately 16,4% of the male employees and 18,1% of the female employees experienced “multiple times or more” burn-out related symptoms during the month. Generally, this is 1 out of 6 employees of the Dutch workforce. Since 2007, there has been in increase of 41% of burn-out related symptoms with men and an increase of 66% of burn-out related symptoms with women. (RIVM, 2021). Human Resource Managers are burdened with the responsibility to maintain business output while simultaneously breaking this alarming trend.

The objective of thesis research is to determine the potential value of the Quantified Self in strategic human resource management by increasing performance and decreasing negative effects of disbalance between input and output of human resources. Contributing to increased energy management within has major societal value, since it decreases the risks on burnouts, burnout-related symptoms and associated health risks. Moreover, the Thesis Research contributes to the decrease of societal costs of the consequences of burnouts. The objective of the research is to extend existing research of the Quantified Self and Human Resource Management, through connecting the two research fields and validate the connection. As part of this Thesis Research, the root of the burnout problem is analyzed, the potential of Human Resource Management Systems to contribute to the reduction of this problem is researched and a concrete methodological approach for Human Resource Managers for adoption of human resource management systems is presented. This Thesis Research explores the potential of digital technologies to support strategic human resource management. Inherently, this Thesis Research is conducted at the interface of technology, management and policy development, which is defined as the domain of the Management of Technology-track.

1.2 Problem Background

1.2.1 The managerial challenges in managing knowledge workers
Strategic human resource management is defined as “a strategic and coherent approach to the management of an organization’s most valued assets - the people working there, who individually and collectively contribute to the achievement of its objectives.” (Armstrong, 2008). The Michigan School, building on the framework of The Harvard Framework, distinguished four general human resource processes that appear in all organizations, namely: (Fombrun, Tichy, & Devanna, 1984) (Beer, 1984)

1) Selection - Matching available human resources to jobs
2) Appraisal - Performance management
3) Rewards - To motivate and stimulate employees to deliver
4) Development - Developing high quality employees

From this perspective, researchers generally agree that vital employees have a positive effect on employee productivity. (Ryan and Bernstein, 2004). Vitality has been defined as “the subjective feeling of being alive and alert” (Ryan and Frederick, 1997) Research found that different aspects
are correlated with the vitality of employees. For example, researchers found that sleep has a positive effect on the employee vitality. Moreover, other physical aspects positively influence job vitality, such as body exercising. The constructs related to employee vitality do not only origin from physicality. Duffy et al found that social undermining had a negative correlation with outcomes of the participants (Duffy, Ganster, & Milan, 2002). In 2002, Holman et al found that intensive performance monitoring and supervisory support had strong correlations with depression, and thus, negative relations with vitality. (Holman, 2002). When more negative stimuli are combined, this leads to a higher challenge for employees to fulfil their role sufficiently, and this potentially leads to negative effects for both the individual employee as the organization. Employees experiencing poor health and well-being are expected to be less productive, make lower quality decisions, have a higher change of being absent of work (Boyd, 1997) and structurally decrease valuable contributions to the organizational goals (Hooijberg, 1992).

The core human resource processes as described above demand a particular approach in relation to knowledge workers. Knowledge workers are characterized by high motivation to perform well (Drucker P. F., 1954), high commitment (Mládková, Zouharová, & Nový, 2015), driven by accomplishments and results, high demand for autonomy and an inherent disapproval for direction, supervision and formal organization processes. (Greenwood & Empson, 2003) (Lorsch, Lorsch, & Tierney, 2002) (Davenport, 2005). The positions of knowledge workers require creativity, innovation and problem solving. Moreover, to accomplish this result, knowledge work requires and knowledge workers demand continuous learning within the organization. (Reboul, 2006) Knowledge workers do not thrive in formal processes which limit their personal autonomy. Moreover, as a result of the work knowledge workers are engaged in, most of the knowledge is not codifiable which implicates knowledge ownership remains with the knowledge worker, and not with the firm.

This characteristics propose challenges for managers within knowledge intensive firms. First, the process of knowledge development within projects is often not linear, not tangible, not duplicable and difficult to measure in key performance indicators. (Ramírez & Nemhard, 2004) (Drucker P., 1999) However, on the contrary, firms are driven by commercial results, which demand from managers to accomplish business output with their teams. This contraposition poses a major threat for both knowledge worker motivation, energy levels and, as a result, productivity. Second, as mentioned in the section above, experience and expertise is owned by the different knowledge workers as tacit knowledge. This results in strong bargaining positions of knowledge workers in relation to the firm. (Howells, 1996) (Teece & Pisano, 2003)

1.2.2 The increased risk of burn-out with knowledge workers

As stated in the Chapter 1.1, burnout related symptoms have been increasing substantially over the last years within the Netherlands. Occupational stress, or as the Dutch Center for statistics calls “Work Pressure”, has been mapped in 2017, creating a list of common job roles and their perceived pressure of work. Generally, as a result of industrialization, globalization and automatization, we can observe a shift from industrial, practical work to more complex, cognitive work, often referred to as knowledge work. Knowledge-work consists of Knowledge-based tasks, which are defined by Ronald L. Jacobs as “(... the units of work that require individuals, in the presence of complex work situations, to call upon relevant sets of information, to decide which actions they should take based on the information, and to engage in those actions that will accomplish the unit of work.”. Following this definition, six of the ten occupations with high work pressures can be categorized as knowledge work. Moreover, the CBS states that high work pressure correlates significantly with high emotional heaviness of work. (Centraal Bureau van de Statistiek (CBS), 2017).

Much research is conducted in relation to performance management of knowledge workers within knowledge intensive firms. Especially in firms which can be categorized as “Knowledge Intensive Firms” (Mintzberg, 1983) human capital is the most valuable resource for the firm’s competitive advantage. (Noe, Hollenbeck, Gerhart, & Wrigh, 2017) Ranjan & Goyal state that skill, adaptability, knowledge and dedication of employees differentiate winning firms from the rest. (Ranjan & Goyal, 2008). However, the RIVM concluded that, following the definition of knowledge workers as introduced in this section, knowledge workers have a substantial higher burn-out risk. Moreover, the number of knowledge workers will increase in the following years.

Moreover, as proposed in section 1.2.2, knowledge workers experience high work pressure and stress levels compared to other occupations which potentially leads to, amongst other, health issues
and decrease of productivity. Early studies already found that long-lasting occupational stress links to the incidence of coronary heart disease, mental breakdown, poor health behaviors, job dissatisfaction, accidents, absenteeism, lost productivity, family problems, and certain forms of cancer. (Cooper & Cartwright, 1994). Moreover Quick et al noted that occupational stress led to behavioral changes such as (1) greater alcohol and drug abuse, (2) increased cigarette smoking, (3) accident proneness and (4) violence. Psychological consequences include: (1) family problems, (2) sleep disturbances, (3) sexual dysfunction and (4) depression. (Quick, Horn, & Campbell, 2008)

Popular books even called the depletion of increased problem of depletion of human energy at work the “Human Energy Crisis”. (Loehr, Loehr, & Schwartz, 2013)

1.2.3 The increase of data collection through smartphones not resulting in viable business applications

The amount of data health-related data that is collected with mobile phones keeps on increasing. Simultaneously with this development the interest in the potential value of this data has been increasing. In 2010, Deborah Lupton published her book on the “Quantified Self” phenomenon, in which she approached the human body as a *machine*, in terms of inputs and outputs. In her book, Lupton used the following definition for the *Quantified Self*:

“The quantified-self is a movement to incorporate technology into data acquisition on aspects of person's daily life in terms of inputs (e.g. food consumed, quality of surrounding air), states (e.g. mood, arousal, blood oxygen levels) and performance (mental and physical).”  

(Wolfe D., 2016)

The *Quantified Self* terminology was first proposed by Wired Magazine authors Kevin Kelly and Gary Wolf. However, Kelly and Wolf state, the “quantified self” attitude does not only reflect applications for healthcare related purposes. It reflects the broader societal trend which can be observed in which we intend to quantify as many core aspects of our existence as possible. (Wolf, 2021) People, groups or organizations have different reasons for quantifying social phenomena, but the most important reason is informed consent. Data allows us to quantify complex mechanisms and thus allow us to objectify our decision making process and minimize the subjectivity in decision making processes. Moreover, data has the potential of discovering underlying patterns which allow managers to develop policies more accurate. (George, Haas, & Pentland, 2014)

However, critics of the Quantified Self movement are skeptical. They acknowledge the fact that for specific user groups quantification is a useful and that specific data can support in complex decision making processes. However, following the critics argumentation, we should ask ourselves the relevance of one simple number, while the human body has proved to be an incredible network of different aspects that influence health, mood and productivity. Simply deducting or explaining your mood based on one variable is risky. (Wong, 2021)

By standard, mobile phones of Apple and Samsung can monitor daily life patterns, such as sleep, body movement and nutrition. Doctors and scholars agree that sleep, body movement and food consumption contribute to “vital” employees. Moreover, many companies adopt surveying techniques to measure other, subjective aspects that influence job vitality. On the contrary, much data is available of the business performance, such as hours worked, financial results, customer satisfaction or other *key performance indicators*. Organizations tend to quantify business performance with the intend to manage resources -financial, human and organizational- and account for governing and control entities such as Supervisory Board. As stated in the introduction, measuring and monitoring different aspects of the daily life are part of the *Quantified Self* approach. However, this surplus of personal data availability collected through smartphones has not yet shown to increase productivity. On the contrary, as introduced in Chapter 1.1, we see a shocking increase of burn-out related symptoms.

1.2.4 Human resource managements systems not able to fulfill the need of organizations and/or knowledge workers

Human Resource (HR) Departments are responsible for matching available human resources and performance management. As stated in the introduction, we see a shocking increase of burn-out related symptoms amongst knowledge workers within the Netherlands. While other core strategic resources within firms have extensive intelligent information systems, Human Resource Managements Systems (HMRS) or Human Resource Information Systems (HRIS), in which different
aspects of strategic human resource management are incorporated, are often missing in firms within all sectors. (Ranjan & Goyal, 2008) HRMS and HRIS propose the opportunity to analyze data and, if implemented correctly, contribute to strategic planning and competitive advantage and support business decision making. (Hierji, 2001) Moreover, multiple human resource management disciplines can be integrated, potentially leading to additional synergies compared to one-directional system adoption. (Boon, Den Hartog, & Lepak, 2019). The trend of digitization and increasing applications of the Quantified Self can potentially contribute to strategic human resource management and thus the decrease of the prevailing burnout challenge. (Lupton D., 2013)

However, nowadays, Human Resource Management Systems often focus on output, instead of input. The Quantified Self provides an analogy of the human body as a machine with input (e.g: sleep, nutrition, activities) and output (e.g: delivering services, thinking, brainstorming). When output structurally demands more than the energy that comes into the knowledge worker’s system, energy depletion occurs which ultimately results in an increased risk of burnout. In conclusion, human resource management systems should develop in order to facilitate the decrease of the societal burnout challenge amongst knowledge workers.

1.3 Scientific Knowledge Gaps
Three knowledge gaps are identified in relation to incorporating Quantified Self-methods within human resource management.

1.3.1 Lack of knowledge about the potential value for incorporation of vitality-related employee data in Human Resource Management Systems
Human Resource Management Systems (HRMS) contribute to strategic business decision making, by assessing the best methods which lead to future business objectives. (Enschers, 2002). HRMS can do this, through providing frameworks which facilitate fast, accurate and informed decision making (Fischer, 1999). Hunter et Al provide the core elements of HRMS, consisting of data-mining and analytics tools, including recruitment and payroll information, workflow management, reporting and analytics. (Hunter, 2006). Generally, these kind of systems can be described as Decision Support Systems (DSS) and Executive Information Systems (EIS). (O’Brien and Marakas, 2007). Ranjan et Al state, that “organizations need a way to couple advanced analytical solutions, predictive models and business rules with process automation, workflow operational systems and comprehensive organizational knowledge”. (Ranjan & Goyal, 2008). However, their research mainly focuses on structural, organizational elements of human resource management, such as the team size which should be incorporated for certain projects. Moreover they provide an extensive list of potential sources of relevant data. Cokins states that human research managers demand hard data, information on turnover, hiring, comparisons of compensation and benefits, ethnic, gender and cultural distributions (Cokins, 2004). Individual aspects related to vitality, such as sleep, body movement and other vitality-related aspects influencing the human battery of the employees, have not been researched. Boon et Al conclude that human resource management systems should provide integrative platforms that bundle human resource management disciplines and, as a result, create synergy across this disciplines. (Boon, Den Hartog, & Lepak, 2019). A successful generic, methodological and practical approach for human resource management system design has not yet been developed.

1.3.2 Lack of knowledge about which vitality-related metrics are valuable for incorporation in Human Resource Management Systems
Believers in the quantified-self approach, intend to quantify as many aspects as possible of the human life. They intend to approximate the human body as a machine, in terms of inputs -body movement, sleep- and outputs, which they promote to be “objective” measures. Quantified-self is often related to other data-focused subjects as transparency, optimization, feedback loops and biohacking. (Pantzar, 2015). Neo-liberals consider the quantified-self as a way to accomplish “self-maximization” and promoting “self-criticism”. (Lupton D. , 2013) Many aspects of the human body can be measured, such as stress, body movement, sleep quantity, sleep quality, heart rate, (Apple, 2021) (Samsung, 2021) (Fitbit, 2021) nutrition, (Foodprint Nutrition Tracker, 2021) blood pressure (Blood Pressure BP Watch, 2021), DNA, hair quality (Kerastase, 2021). Moreover metrics that are observed during corporate wellness programs are the Body Mass Index (BMI), Glucose-levels, Cholesterol levels, strength and flexibility and Heart Rate Variability (HRV). A surplus of data is available, but the question arises which metrics deliver the highest value on investment, considering the increasing focus of Corporate Wellness programs on “promotion of culture” and
shifting from “return on investment” to “value on investment”. (White, 2017). To determine the value of data, we need to understand how “data” leads to actionable information. Braganza defined the “Wisdom hierarchy”, in which he distinguished four levels in using data. He concluded that data are the raw materials, and if processed correctly just as materials for cars, can lead to information, knowledge and eventually wisdom. (Braganza, 2004). Due to the recent developments in the quantified-self field, little research has been conducted which data should be part of the analysis scope.

1.3.3 Lack of knowledge about Human Resource Management System structures in which personal data can be collected and used while staying compliant to ethical guidelines in the use of this data

The Quantified Self movement contributes to the omnipresent appearance of the big-data trend. This trend has many implications. Many researchers from different working fields have assessed the ethical implications of this global trend. With data comes power, that is what we know for sure. Facebook’s business model is funded on collection of data of individuals and selling this personal data to advertisers for personalized advertisements. The impact of this business model becomes clear with the example of an American store which identifies pregnancy earlier than women, based on their search results following from the search for specific shampoo products. The question arises: to what extent are we willing to share our data with others? The same applies for corporate wellness programs and the collection of personal data with the goal of increasing business performance. Researchers found three important concerns in relation to data collection within corporate wellness programs: (Ajunwa, Crawford, & Ford, 2016)

- Informed consent to collect the data;
- Data handling;
- Employment discrimination concerns;

Cooper states that informed consent consists of three factors: the right for informational privacy, the right to bodily integrity and the right to informed decision making (Cooper E. B., 1999). Logically, this leads to tensions in relation to incorporating personal information about the daily life-as the Quantified Self prescribes. Collecting personal data might be perceived as invasive. Second, general regulations considering handling and processing of data should be respected. For example, participants of wellness programs should be apprised if anything wrongfully happens with the data. (Ajunwa, Crawford, & Ford, 2016) Moreover, at last, data collection and data ownership potentially leads to employment discrimination. Employers have the tendency to decrease risks and thus costs, potentially firing higher-risk employees of the firm.

In conclusion, the question arises: in which way can we collect and use personal data, while remaining compliant to the ethical framework for corporate wellness programs as proposed by Ajunwa et al?

1.4 Research Questions
In this subchapter, the research questions are presented in order to fulfill the Research Objective.

Main Research Question
Derived from the problem statement, the research objective and the identified knowledge gaps, the researcher has formulated the following main research question:

How can quantified self (life logging, measuring multiple aspects of our daily life) contribute to strategic human resource management in knowledge-work firms in the Netherlands?

Research Sub-Questions
Based on the three identified knowledge gaps, I identified the following research sub-questions:

<table>
<thead>
<tr>
<th>KNOWLEDGE GAP</th>
<th>DESCRIPTION</th>
<th>RESEARCH SUB-QUESTION</th>
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<tbody>
<tr>
<td>1</td>
<td>Lack of knowledge about the potential value for incorporation of vitality-related employee data in Human Resource Management Systems</td>
<td>How can vitality-related employee data create value for Human Resource Management Systems?</td>
</tr>
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2. RESEARCH METHODOLOGY

In order to accomplish academic results it is required to follow a structured and comprehensive research method. This chapter describes the research methodology which is adopted in this thesis research. First, the research Design Research Approach Model (DSRM) of Peffers et Al is introduced. In the second subchapter, the DSRM is evaluated in relation to the Research Objective and elaborated per research step. Third, a visualization of the research flow diagram is presented.

2.1 The DSRM Approach of Peffers et Al (2007)

Since the 20’s and the continuous trend of digitization, information systems have been increasingly implemented within firms and organizations. They come in different categories, such as human resource management systems (Boon, Den Hartog, & Lepak, A Systematic Review of Human Resource Management Systems and Their Measurement, 2019). Peffers et Al concluded that throughout the years, little research had been conducted on the research methodology on how Information Systems should be researched. As a result, no standardized framework has been developed which potentially also has delayed the adoption of information systems as a whole. (Peffers, Tuunanen, Rothenberger, & Chatterjee, 2007) In order to create successful design artefacts, a design science methodology is required to ensure the thoroughness and the validation of the research. A methodology is defined as “a system of principles, practices, and procedures applied to a specific branch of knowledge”. (DM Review, 2021) Design science requires a different approach than fundamental, basic research. Hevner & March state the following: “Whereas natural sciences and social sciences try to understand reality, design science attempts to create things that serve human purposes”. (Hevner & March, 2003) Peffers et Al developed a research approach which serves with three objectives:

1. It is consistent with prior literature.
2. It provides a nominal process model for doing DS research.
3. It provides a mental model for presenting and evaluating DS research in IS.

The DSRM consists of six steps and is visualized in the picture below.

![Design Research Methodology process Model (Peffers et Al, 2007)]
Peffers et al’s aim was to develop a mental model building forward on existing literature and conducted research in a way which was “consensus-building”, instead of finding “nuanced differences”. The result is a commonly accepted framework which guides researchers in their design processes in order to create valuable artefacts. (Peffers, Tuunanen, Rothenberger, & Chatterjee, 2007) However, by stating the above, Peffers et al imply a generalist approach which implies room of incorporating “nuanced differences” which contribute to the specification of the research process. Essentially, Peffers et al have created a framework which has to be completed by the researcher in question. In subchapter 2.2, an elaboration is done of each step in the design process, in which the nuanced differences are specified. In Chapter 2.3, the adjust RDSM framework for this Research Thesis is showed.

2.2 Research Flow Steps
In this subchapter, the different research steps will be elaborated which are aimed to solve the main- and sub-research questions which are proposed in Chapter 1. The design research is guided by the steps in the DSRM.

2.2.1 Identify Problem & Motivate
In this step, “the specific research problem and (...) the value of the solution” is found and elaborated. (Peffers, Tuunanen, Rothenberger, & Chatterjee, 2007) The “justification” of the solution is of high relevance in this step, since it serves two important goals. First, the researcher and the audience are motivated to pursue the solution. Second, the audience is more reluctant to accept the solution of the problem is properly justified.

Understanding of the problem is found through literature research on four core components which determine the research area. First, the concept of vitality is researched, as the central concept which influences the performance of knowledge workers. Second, the focus group of knowledge workers of this thesis research project is analyzed and unscrambled. Third, literature research on Human Resource Management (HRM) and Human Resource Management Systems (HRMS) is conducted and last, the Quantified-Self approach is elaborated.

This step in the DSRM research methodology has multiple results. First, a comprehensive background is created which builds forward on existing research. Second, the scientific knowledge gaps are identified and third, the main research question and sub-research questions are presented.

2.2.2 Define objectives of the solution
The goal of this step is to “infer the objectives of a solution from the problem definition and knowledge of what is possible and feasible.” To arrive at the objectives, “the objectives should be inferred rationally from the problem specification.” (Peffers, Tuunanen, Rothenberger, & Chatterjee, 2007) This research has the goal, as presented in Chapter 1, to develop fundamental design framework for Human Resource Management Systems developers, firms or corporate wellbeing organizations in order to optimize the energy levels of the knowledge workers within their organizations. In order to be able to define the objectives of the solution, fundamental knowledge about the problem, the domain of potential solutions and the stakeholders should be present. To accomplish this, an extensive literature research is conducted, within the theoretical domains of this thesis research project. This theoretical domains consist of four central domains:

1) The domain of vitality, including research on the determinants which influence vitality, central psychological concepts and drivers and triggers of burn-outs;
2) The domain of knowledge workers, including research on the characteristics of knowledge workers and implications for (performance) management of knowledge workers;
3) The domain of performance management, including the fundamental approach in relation to this topic and the process of performance delivery from both a knowledge worker an organizational perspective;
4) The domain of Human Resource Management Systems, which includes the analysis of current human resource management systems.
5) The domain of artificial intelligence, including a high-level analysis of machine learning techniques.

A visualization of the five theoretical domains is presented in Figure 3.

The theoretical domains involved in this Thesis Research all contribute to the design objectives. The literature research will be concluded in the design elaboration of stand-alone elements of the conceptual model, which will be integrated in step 3 of the DSRM.

The result of this step in the DSRM is three-fold. First, the design objectives of the solution are formulated. Second, an elaboration is provided how the solution contributes to the solving of the underlying problem. Moreover, based on the literature research, a vitality framework is presented which provides an overview of the determinants and its interdependencies. This framework provides the answer on Research Question 2.

2.2.3 Design & Development Phase 1
After defining the design objectives build on the understanding of the core knowledge of the concepts in the theoretical domains as elaborated in Chapter 2.2.2. the next step in the DSRM approach is to design the artifact. Such artefacts are “new properties of technical, social, and/or informational resources”. (Hevner & March, 2003) Peffers state that “this activity includes determining the artifact’s desired functionality and its architecture and then creating the actual artifact.” (Peffers, Tuunanen, Rothenberger, & Chatterjee, 2007).

In this design research step two phases are identified. First, a conceptual framework is developed based on the conducted literature research which fulfills the design objectives as formulated in the “Design Objectives”-step in the DSRM. The conceptual framework provides understanding on the relation of the solution to its stakeholders, the relevant interactions between the stakeholders and the fundamental processes to accomplish this. The conceptual framework, in combination with the vitality framework, provides an answer on both the main research question and the sub-research questions. Through the two demonstration phases, rigorous feedback is collected, which results in the optimization and validation of the framework.

2.2.4 Demonstration Phase 1
Before going to the second phase, this conceptual framework is discussed with experts in the fields of health, vitality and data. The interviews are conducted semi-structurally. The first demonstration Phase has four goals. First, the relevant practical and theoretical insights distilled from the semi-structured interviews are integrated in the second version of the conceptual framework. Second, the conceptual framework is validated as a methodological instrument for the development of human resource management systems. Moreover, through validation, the conceptual framework is validated as a foundation for the development of the prototype in the second phase. Third, the vitality map is discussed, optimized and validated. Last, the Design Objectives are discussed with the interviewees.

2.2.5 Design & Development Phase 2
In the second Design & Development phase, a prototype of the final design artifact will be developed. This prototype will be used to interview knowledge workers and firms in the second “Demonstration”-phase. The goal of the second phase is two-fold. First, the design direction of the prototype is discussed with the interviewees. Second, from an explorative perspective, the conceptual framework provides a tool to concretize the conceptual framework to the interviewees (i.e. the experts). It is noted that in this Thesis Research, multiple disciplines are integrated, and that experts are not likely to be experts in all theoretical domains. Moreover, the conceptual framework is abstract and thus demands high levels of understanding of the experts. Through
presenting a concrete prototype, the interviewees can provide additional feedback on the conceptual framework.

2.2.6 Demonstration Phase 2
In this step of the DSRM, the goal is to “demonstrate the use of the artifact to solve one or more instances of the problem.” (Peffers, Tuunanen, Rothenberger, & Chatterjee, 2007) For the purpose of solving the design objectives of this thesis research project, the form of simulation is chosen. Through showing the end-users the interface of the mock-up and explaining how this solution can contribute to their individual performance management. Through a structured simulation with 30 knowledge workers the conceptual framework is discussed.

2.2.7 Evaluation
Peffers et Al state that the goal of this step “Observe and measure how well the artifact supports a solution to the problem.” Moreover, they state that “this activity involves comparing the objectives of a solution to actual observed results from use of the artifact in the demonstration.” (Peffers, Tuunanen, Rothenberger, & Chatterjee, 2007) After the simulation with the experts, the results from the two demonstration phases are analyzed against the background of the design objectives. At last, the research results and its limitations are discussed. No further iterations will be conducted, since in essence, in the prior step an iteration in the artefact design has been done. Moreover, time and resource constraints played in the exclusion of further iteration steps.

2.2.8 Communication
In the last step of the DSRM, the goal is to “communicate the problem and its importance, the artifact, its utility and novelty, the rigor of its design, and its effectiveness to researchers and other relevant audiences such as practicing professionals, when appropriate.”. The results of the Research Thesis will be communicated to this Thesis Report.

2.3 Research Flow Diagram
In Figure 4, the visualization of the research steps as elaborated in Chapter 2.2 is presented. In this Research Flow Diagram the DSRM steps are centered, complemented with the required input and the provided output per design step.
Figure 4 | Research Flow Diagram
3. LITERATURE RESEARCH & DESIGN OBJECTIVES

In this chapter, the core elements of the thesis' research question will be researched, analyzed and described. Through an extensive literature review, relevant theoretical concepts are assessed and, or combined in relation to the research question. Through conducting the literature research, research question two will be answered. The literature research will result in the design objectives which will be described in the next chapter.

The literature research consists of six subchapters. The first five subchapters will elaborate on the findings of the literature research in the five theoretical domains as presented in Figure 3. Subchapter 6 integrates these findings in the Design Objectives of the solution.

3.1 Identifying the knowledge worker

Knowledge workers are a distinct group of employees that work at knowledge intensive firms. (Mintzberg, 1983). The term “Knowledge Worker” was first introduced by Peter Drucker in his book “The Landmarks of Tomorrow” in which the author described the new world in which knowledge would become the main source of competitive advantage for firms (Drucker P., The Landmarks of Tomorrow, 1959) The research on knowledge work was increasingly embraced by researchers in the 60’s and 70’s of the last century as a topic in academic research, confirming Drucker’s prediction. (Bell, 1973) Fritz Machlup identified this moment in history as the start of the “information age”. (Machlup, 1962) Knowledge workers are increasing in advanced and emerging economies in which processes are automated and strategic challenges of firms are characterized by multi-disciplinary projects with high complexity. Knowledge workers are crucial to guide this challenges to its solution. Considering the upcoming challenges in relation to digitization, globalization and climate, knowledge workers will be the most important source in this solution. However, knowledge work difficult to manage by managers of knowledge intensive firms. Knowledge is broadly defined as “what we know”. Knowledge involves “the mental processes of comprehension, understanding and learning that go on in the mind and only in the mind, however much they involve interaction with the world outside the mind, and interaction with others.” (Wilson T., 2002) Managing knowledge has multiple managerial and business implications. In this chapter, the main characteristics of knowledge workers are identified and his managerial implications in relation to performance management.

3.1.2 Business implications of knowledge work

3.1.2.1 Knowledge is owned by the knowledge worker, not the company

To understand the business implications of knowledge work, it is important to distinguish between “knowledge” and “information”. Madden refers to an early definition of information “an item of information or intelligence; a fact or circumstance of which one is told.”. However, taking the contextual relevance into account, Madden proposes another definition for “information”. She defines information as “a stimulus originating in one system that affects the interpretation by another system of either the second system’s relationship to the first or of the relationship the two systems share with a given environment” (Madden, 2000). “Knowledge” is distributed by different sorts of communication, in which the constitutions of knowledge are transferred from one person to another person. These constitutions of knowledge are parts of information. However, the transformation, assimilation, comprehension and understanding of information to knowledge by the receiving individual is determined by the biological and psychological characteristics of this particular individual. Schultz states that this “knowledge structures” are biologically determined. (Schultz, 1967) Therefore, Wilson concludes, the knowledge created from the bits of information which communicated can never lead to the same knowledge as the original knowledge source. (Wilson T., 2002)

Following this reasoning, understanding of the business implications of working in knowledge intensive firms arise, often referred to as “knowledge management”. (Rowley, 1999) First, following Wilson’s explanation of the relation between knowledge and information, the first challenge arises: knowledge is owned by the individual, and not by the company. Firms intend to minimize the implications to create knowledge repositories to codify the knowledge within the organization and to duplicate the knowledge owned by the individual knowledge worker to the organization. (Steinmueller, 2000) However, complex knowledge generally remains intangible and in-codifiable of nature. (Bontisa, Dragonetti, Jacobsen, & Roos, 1999) A direct consequence of this intangibility of
knowledge is that if a knowledge worker decides to leave the firm, the knowledge leaves with him. This provides knowledge workers potentially with a valuable bargaining position. (Mládková, Zouharová, & Nový, 2015)

3.1.2.2 Innovation is not a linear process
Another important challenge in managing knowledge intensive firms is the management of knowledge creation. Knowledge creation is not a linear process, and is characterized by out-of-the-box solutions which require high levels of individual creativity. Innovation is “a process that begins with an idea, proceeds with the development of an invention, and results in the introduction of a new product, process or service to the marketplace”. (Edwards, 1984) Throughout the last decade, different methodologies and frameworks have been developed to facilitate employees within innovation processes to innovate as fast and effective as possible. In the 50’s, Bain focused on innovation processes within industrial organizations (Bain, 1956) An example of an innovation management approach for industrial organizations was the Stage Gate Innovation Process. In this innovation methodology, different steps (“gates”) are created which the multi-disciplinary teams should pass. Every step is characterized by higher organization commitment and higher allocation of organizational resources. A gate is “passed” if the report of the teams is approved by higher management. (Cooper R. G., 1990) However, this model is often criticized due to its highly structured nature and its potential negative consequences for knowledge worker creativity. (Conforto & Amaral, 2016) In conclusion, knowledge intensive work demands high levels of organizational autonomy to facilitate creative processes in order to develop innovative solutions.

3.1.2.3 Managerial tension between short-term results and innovation processes
Firms have the objective to remain competitive advantage. To ensure this long term position within the market, short term profits are required to finance the long term growth. (Coase, 1995) However, firms tend to have a focus on short-term results instead of long-term competitiveness. This motivation is stimulated by shareholder structures in which, inherently, short term financial results are required to be able to pay dividends to shareholders as a reward for their investments. This short-term incentives create a stimulus for managers within firms to focus on short-term results. (Collins, 2001) This often implies that innovations which can be potentially more valuable in the long run, are shoved off the table in favor of quick-wins on the short term. Simon Sinek refers to this phenomenon as a “winning mentality”. From Sinek’s analogy, managers approach their firm as a game with a start and end, and with a winner as a result. The winner often is defined by extensive Key Performance Indicator-structures (KPI), which also lead to appraisal from the Supervisory Board. However, Sinek states, managers within firms are not playing a game with start and end, but an “infinite game”. The objective of the firm is not winning on the short term, but staying as long as possible within the game. (Sinek, 2018) A concrete example is the postponement of climate innovations within Shell, in which director Ben van Beurden desires to act faster and take responsibility, but he is limited by short-term liabilities to Shell’s shareholders. (Mommers, 2019)

The incentivization for managers for short-term results on one side and the uncertain alinearity of innovation processes lead to tension within the working environment. On a project level, for instance within consultancy firms, short-term results are required while innovation a project level also implies that the road to the solution is not linear. The tension potentially results in high occupational stress and pressuring leadership which are both key determinants for burn-out related symptoms amongst knowledge workers.

3.2 Main characteristics of knowledge workers
3.2.1 Driven by accomplishment
Employees, in general, have different motivations to engage in their activities. Theory about ambition and achievements find their origin in the concept of role theory. A role generally refers to social locations or positions that embody expectations for behavior (Gross, Mason, & McEachern, 1958). The authors state that “human behavior is influenced to some degree by the expectations individuals hold of themselves . . . [and] that a person's location or position in social structures influences the kind of social relationships in which he is involved.”. Throughout an individual’s professional career but also its individual personal development, one can observe a sequence of different roles and thus different expectations. This developmental cycle starts with childhood,
followed by adolescence and different roles within an individual’s professional career. (Elder, 1975) (Rockwell & Elder, 1979) From this role framework, achievements is defined by two determinants. The first, is “role residing” or “role incumbency”. (Spenner, 1978) Shills described the ways of “role residing” of degrees of “interpersonal deference” or so-called prestige, and more generally to levels of “remuneration”, job security and other monetary or non-monetary rewards. (Shills, 1970) Secondly, achievement refers to “the level of role performance or accomplishment as assessed to standards of performance”. (Spenner, 1978) This definition complies to the self-efficacy framework of Bandura which is elaborated in Chapter 3.3, which states that self-efficacy is concerned “with people’s beliefs in their ability to influence events that affect their lives.”. (Bandura A., Self Efficacy, 2010) Self-efficacy is the core root of motivation, performance accomplishments and emotional wellbeing. (Bandura, 1978). As elaborated in chapter 3.1, knowledge work is characterized by high level of creativity, high levels of personal freedom and problem solving. This characteristics of knowledge work combined to the theory of self-efficacy and personal accomplishments lead to high levels of ambition and motivation for personal accomplishment with knowledge workers. (Mládková, Zouharová, & Nový, 2015)

3.2.2 Mobility in tasks and activities
A second characteristic of knowledge workers and knowledge work in general, as presented in Chapter 1, is the ownership of cognitive resources of the knowledge worker. Inherently, the knowledge worker generally owns high levels of bargaining power in relation to its employer. As a result, knowledge work is characterized by higher levels of mobility amongst different firms. (Sutherland & Jordaan, 2004). This is generally not desired by firms, taking into account that knowledge worker is difficult to codify and thus difficult to transfer amongst knowledge workers. If a knowledge worker decides to leave the company, this generally implies the loss of important knowledge and expertise for the firm while this knowledge is the main source of competitive advantage. (Matusík & Hill, 1998) On the contrary, the mobility of tasks and activities potentially might also create opportunities for human resource managers. Mobility of tasks and activities does not appear across firms, but also within a firm. Wright et Al found that knowledge worker mobility consists of five main contextual dimensions: organizational context and roles, geographical and spatial context, social context and teams, institutional and cultural norms, and temporal dynamics. (Wright, Tartari, Huang, Di Lorenzo, & Bercovitz, 2017) This implies that the mobility of tasks and activities might be adopted as an instrument to approach the desires of knowledge workers, for example in relation to the demand for personal development (Chapter 3.1.3).

3.2.3 Demand for personal development
Researchers agree on the specific needs approach knowledge workers demand in relation to personal development in comparison to other employee groups. This phenomenon relates to the strong, personal ambitions of knowledge workers which are described in Chapter 3.1.1. (Mládková, Zouharová, & Nový, 2015). Moreover, matching specific needs of knowledge workers is an important priority for knowledge intensive firms, taking into account that markets identified as knowledge intensive industries are prone to high levels of mobility of human capital (as described in Chapter 3.2.2). This mobility potentially has severe consequences for the competitive advantage of firms. Therefore, knowledge intensive firms are willing to match the personal needs of knowledge workers in order to decrease their intention to switch jobs and increase retention at their job in the firm. (Sutherland, Torricelli, & Karg, 2002) Sutherland, Torricelli & Karg conclude that personal growth and career development is the most important driver for retention for knowledge workers in a firm. This approach differs essentially from the traditional human resources methodologies which find their spring in the early 90’s and which are based on the era of industrial development. Human Resources practices focused on efficiency and standardization, while the new knowledge work era focuses on freedom, innovation and creativity. (Tampoe, 1993) Increasing attention within the firm for personal and career development increases the retention of the knowledge worker and its knowledge within the firm.

3.2.4 Demand for individual autonomy
Autonomy is, accompanied by psychological safety and personal development, one of the three psychological basic needs which are presented by self-determination theory (Ryan & Decl, 2017) This basic psychological need has higher importance amongst knowledge workers than other employee groups. Researchers found that individual autonomy and team autonomy has a major
impact on team effectiveness. The higher the structural, methodological interrelations across team develop, the lower the effectiveness of the teams become. (Janz, Colquitt, & Noe, 2006) This implies major challenges for managers of firms. Firms, inherently to their commercial goals, generally desire and express control mechanisms in order to guarantee the fulfillment of company goals. However, this organizational demand for control and short term results (as elaborated in Chapter 3.1.2) on one side and the individual demand for knowledge workers create an challenging paradox in the management of knowledge workers in knowledge intensive firms. This paradox implies that high levels of control within knowledge intensive firms lead to lower levels of output compared to lower levels of control. (Langfred & Rockmann, 2016) Moreover, lower levels of control and higher levels of autonomy are associated with higher levels of individual wellbeing and vitality. (Pérez-Zapata & Pascual, 2016)

3.3 Performance Management: How does individual effort contribute to organizational goals?

As introduced in Chapter 1, Human Resource Management has four important goals: Selection, appraisal, rewards and development. As discussed in Chapter 3.1, Knowledge Workers are a peculiar group of employees which require a specific approach. Human resource management should deal with the specific requirements and desires for knowledge workers in order to facilitate their contribution to the organizational goals. The task of human resource management is to create an environment which helps the individual knowledge worker to perform. In this Chapter, performance management is elaborated from an organizational perspective analyzing how individual performance of knowledge workers contributes to organizational goals of the firm. Finally, from the individual perspective of the knowledge worker, it is analyzed how individual effort leads to performance.

3.3.1 The Performance Management Framework of Ferreira and Otley

Business managers have the responsibility to guide manage their teams in such a manner that business targets are met. From early work, often was spoken of “management control” or “managerial control”. (Anthony, 1965) Anthony defined “management control” as the process through which managers assure that resources are obtained and used effectively and efficiently in the accomplishment of the organization's objectives”. However, as elaborated in Chapter 3.1, knowledge intensive firms do not flourish when controlled tightly, since knowledge workers prefer a strong sense of autonomy in their work. Therefore, we firms require a more contingent, contextual approach to facilitate knowledge workers in their performance. Ferreira and Otley view Performance Managements Systems (PMS) as “ the evolving formal and informal mechanisms, processes, systems, and networks used by organizations for conveying the key objectives and goals elicited by management, for assisting the strategic process and ongoing management through analysis, planning, measurement, control, rewarding, and broadly managing performance, and for supporting and facilitating organizational learning and change.”. This approach conforms to the desire for the specific requirements of knowledge workers, including autonomy (Mládková, Zouharová, & Nový, 2015) and the inherent non-linearity of innovation processes (Conforto & Amaral, 2016).

The framework builds forward on the work of David Otly. Otly provided a valuable conceptual framework which incorporated objectives, strategies, plans target-setting, incentive and reward systems and information feedback loops. (Otley, 1999). Secondly, the framework incorporates the work of Robert Simons which has focused more on the control mechanisms that managers have within firms. (Simons, 1995) Integrating the strengths of both frameworks and adopting a different approach than Anthony (1965), Ferreira & Otley focus on broader management of control than only focusing on “compartmentalized approaches”, they arrive at a framework which addresses the following questions:

1) What is the vision and mission of the organization and how is this brought to the attention of managers and employees? What mechanisms, processes, and networks are used to convey the organization's over-arching purposes and objectives to its members?

2) What are the key factors that are believed to be central to the organization's overall future success and how are they brought to the attention of managers and employees?
3) What is the organization structure and what impact does it have on the design and use of performance management systems (PMSs)? How does it influence and how is it influenced by the strategic management process?

4) What strategies and plans has the organization adopted and what are the processes and activities that it has decided will be required for it to ensure its success? How are strategies and plans adapted, generated and communicated to managers and employees?

5) What are the organization's key performance measures deriving from its objectives, key success factors, and strategies and plans? How are these specified and communicated and what role do they play in performance evaluation? Are there significant omissions?

6) What level of performance does the organization need to achieve for each of its key performance measures (identified in the above question), how does it go about setting appropriate performance targets for them, and how challenging are those performance targets?

7) What processes, if any, does the organization follow for evaluating individual, group, and organizational performance? Are performance evaluations primarily objective, subjective or mixed and how important are formal and informal information and controls in these processes?

8) What rewards — financial and/or non-financial — will managers and other employees gain by achieving performance targets or other assessed aspects of performance (or, conversely, what penalties will they suffer by failing to achieve them)?

9) What specific information flows — feedback and feed-forward —, systems and networks has the organization in place to support the operation of its PMSs?

10) What type of use is made of information and of the various control mechanisms in place? Can these uses be characterized in terms of various typologies in the literature? How do controls and their uses differ at different hierarchical levels?

11) How have the PMSs altered in the light of the change dynamics of the organization and its environment? Have the changes in PMSs design or use been made in a proactive or reactive manner?

12) How strong and coherent are the links between the components of PMSs and the ways in which they are used (as denoted by the above 11 questions)?

(Ferreira & Otley, 2009)

Analyzing these questions, we conclude that performance management comprises a wide range of factors which all have influence on the evaluation of the Knowledge Worker’s performance.

The framework provides a clear framework how, from an organization level, the mission and vision of the organization is transformed into the individual targets of knowledge workers. However, this framework does not yet include how the individual knowledge worker with its characteristic traits individually contributes to the (individual) target setting and how performance is provided.

Figure 5 | The performance management systems (PMSs) framework, by Ferreira and Otley (2009)
3.3.2 How the Knowledge Worker contributes to performance

Knowledge workers, just as any other employee, have specific resources which can be of value of the company. Some of these resources -such as intelligence- cannot be depleted over time, but some -such as energy- can. (Hobfoll, 2002). This resources contribute to the organizational goals as described in the previous chapter through different stages.

The first stage in the performance process is putting “effort” in work. Boner et Al distinguish two kinds of effort. The first category, “greater effort”, refers to effort which is considered to contribute directly to the output of the individual knowledge worker. The second category, is effort towards learning, which is believed to contribute to performance in a delayed manner, since new skills or knowledge first have to be developed before the contribution to performance occurs. Effort has three dimensions: direction, intensity and duration. (Bonnera & Sprinkle, 2002).

The first of these dimensions, “effort direction” refers “to the task or activity in which the individual chooses to engage (i.e. what an individual does).”. The second dimensions, “effort dimension”, refers “to the length of time an individual devotes cognitive and physical resources to a particular task or activity (i.e. how long a person works).”. The last dimension, “effort intensity”, refers “to the amount of attention an individual devotes to a task or activity during a fixed period of time (i.e. how hard a person works). “. Kanfer explained that effort intensity “essentially captures how much of one’s total cognitive resources are directed toward a particular task or activity.”. (Kanfer, 1990)

On the contrary, it is important to understand how effort contributes to performance. This occurs to successfully fulfilling the tasks which are formed by the managers as a result from the strategies and plans. Plans are, from this perspective, a combination of tasks which should be fulfilled simultaneously or in sequence of each other to contribute the organizational goals. Tasks are composed of three core “building blocks”: products, (required) acts and information. These core, fundamental are the components of the concept of “task complexity”. Wood defines products, or in other words, outputs, as follow:

“Entities are created or produced by behaviors which can be observed and described independently of the behaviors or acts that produce them. In NPI terms, products are the measurable results of acts. Tasks are identified and differentiated from one another by the products associated with them”. - (Wood, 1986)

Secondly, acts are required, or in other words input. Wood defines acts as follows:

“For the creation of a defined product can be described at any one of several levels of abstraction, varying from a very specific activity (e.g., clasping fingers) to a more complex pattern of behavior with an identifiable purpose (e.g., lifting). It is the latter, i.e., the pattern of behaviors with some identifiable purpose or direction, which we define as acts and treat as the basic unit of behavioral requirements. The direction of an act is typically implicit in the verb used when referring to the act (e.g., reading, walking, identifying) and provides a focus to the lower level mental and physical activities that make up the act. It is this directional aspect which separates one act from another.” - (Wood, 1986)

And third, as second component of input is introduced, namely “information cues”. Wood describes information cues as follows:

“Information cues are pieces of information about the attributes of stimulus objects upon which an individual can base the judgments he or she is required to make during the performance of a task. As such, they are descriptions of certain properties of the stimulus complex for a task and not the raw unprocessed data of the stimuli. Not all task stimuli act as cues and not all cues are information cues. Stimuli that are used to make discriminations during the performance of a task are cues, and when these cues are presented in the form of facts that can be processed to make conscious discriminations, i.e., judgments, then they are what we refer to as information cues.” - (Wood, 1986)

These three core constructs are valuable in the evaluation of human performance since they define the concept of task complexity. In the following chapter, the concept of Self Efficacy is
introduced as proposed by Albert Bandura. This concept introduces this definition of the self-perception of employees to take control of their own actions. The perceived level of taking control of your own actions is a direct result of the congruence of and individuals perceived resources, such as skills, knowledge and energy, on one side, and the task complexity of the tasks which should be fulfilled by the individual. (Bandura, Freeman, & Lightsey, 1999) (Wood, 1986) (Bandura A., 1978)

Much research has been conducted on the different elements of task characteristics. As a selection, scholars have been involved in research in relation to order of information cues (Ashton & Ashton, 1988), framing (Kida, 1984) and task attractiveness (Fessler, 2000).

3.3.3 Connection of the constructs of effort and tasks
As described in the subchapters of this chapter, individual tasks for a knowledge worker are the result of an deliberate process starting at the mission and vision of a company crystalizing down through key success factors, strategies and plans to target setting. Performance evaluation, and thus the implied line of performance management, is the evaluation of the fulfilled tasks of individual knowledge workers against the background of the targets of the company. On the contrary, we have found that the process of fulfilling tasks from the knowledge worker’s perspective is the result of the employment of non-depletable resources, such as knowledge and skills, and depletable resources, such as energy. Energy employment contributes through the fulfillment of tasks, through delivering effort with its three effort dimensions: direction, duration and intensity.

Building forward on the work of Kida (1984), Fessler (2000) and Ashton (1988), we can conclude that the dimensions of task complexity can be translated to the dimensions of effort. By doing this, we can connect the input and output of the knowledge worker’s depletable resources allowing us to propose the following Knowledge Battery Framework.

![Knowledge Battery Framework](image)

This framework provides an analytical tool which helps to understand how particular task contribute to the depletion of the knowledge worker battery. As long as the input and output, which results in performance, are in balance, the knowledge workers output will be sustainable and the risk of burn-out’s will not be present. The concept of Self-Efficacy and the Job-Demand Resources (JD-r) Model, which will be discussed in the following chapter, creates understanding how the battery charge relates to the tasks that are required by the knowledge worker.
3.4 The Vitality-Map: An integrative framework

In order to develop new Human Resource Management Systems or e-Health solutions with the aim of maximizing employee performance and decrease burn-out’s by balancing the charge and discharge of the human battery, it is significative to understand which determinants influence the human battery. First, the relevant theoretical frameworks are analyzed, including Vitality, Stress, Self-Efficacy and the Body-Mind-Spirit-Model. Second building forward on this theoretical concepts and frameworks, the Human Battery Model is introduced which helps us to understand how the mechanism of charging and discharging of the human battery occurs. And third, the Vitality Map is introduced, enabling understanding which determinants influence the human battery and how we can measure this determinants.

3.4.1 Introducing Vitality

In this sub-chapter, first the concept and the definition of vitality is introduced Second, the concept of stress is defined and its implications for performance management within organizations.

3.4.1.1 A definition of vitality

Vitality has been defined in multiple ways. Frederick defined vitality as “the subjective feeling of being alive and alert” (Ryan and Frederick, 1997). Harvey introduced the definition of “professional vitality: as “a multidimensional feature and characteristic possessed by individuals who are able to consistently perform the work of their chosen profession with passion, vigor, facility and satisfaction” (Harvey, 2003). Hobfoll firstly introduced the analogy of the human battery as a resource which can be depleted over time. This resource allows “helps people regulate their behaviors and emotions in compliance with organizational or group norms and expectations.” And, similar to other depletable resources such as financial resources, the resources should be replenished in time (Hobfoll, Conservation of Resources: A New Attempt at Conceptualizing Stres, 1989). Quinn and Dutton embraced the relevance of human energy, stating “human energy is an affective experience that includes a sense of positive arousal, eagerness to act, and the capability to act (Quinn & Dutton, 2005).

As stated in Chapter 2, human capital in knowledge intensive firms is crucial to stay ahead of competition and thus maintain competitive advantage. Vitality is inseparable connected to individual performance and thus has multiple positive organizational outcomes. Researchers found that vitality has a positive effect on job performance (Carmeli, Positive work relationships, vitality, and job performance, 2009), innovation (Carmeli & Spreitzer, 2011), agility (Dries, Vantilborgh, & Pepermans, 2012) and safety, organization values, organizational commitment (DeJoy, Dell, Vandenberg, & Wilson, 2010). Individual energy resources enable knowledge workers to manage challenges and take advantage of opportunities. (Hobfoll, Social and Psychological Resources and Adaptation, 2002) (Thomas A. Wright, 2007). Knowledge workers experiencing vitality feel alert, energized, and spirited (Bostic, Rubio, & Hood, 2000; Spreitzer, Sutcliffe, Dutton, Sonenshein, & Grant, 2005). Knowledge workers who describe themselves as the opposite—often recalled as fatigue—feels depleted, tired, and sluggish (McNair, Lorr, & Droppleman, 1992; Watson & Clark, 1994). Following the analogy of Hobfoll, human energy extracted from the human battery can be considered to be the fuel for the organization. (Fritz, Lam, & Spreitzer, 2011)

Research found that different determinants influence vitality of employees. When more negative stimuli are combined, this leads to a higher challenge for employees to fulfil their role sufficiently, and this potentially leads to negative effects for both the individual employee as the organization. Employees experiencing poor health and well-being are expected to be less productive, make lower quality decisions, have a higher change of being absent of work (Boyd, 1997), and structurally decrease valuable contributions to the organizational goals (Hooijberg, 1992).

3.4.1.2 Stress: A source of energy drainage or a stimulus to keep going forward?

Stress is often perceived as a negative state-of-mind during the execution of our occupation. The argument that stress has only negative implications, however, is not valid. The term “stress” originally is borrowed from the field of physics. Similar as for, for example, constructions, humans are stressed by external forces and are resilient to the application of that force. (Hobfoll, Conservation of Resources: A New Attempt at Conceptualizing Stres, 1989) However, following the analogy of stress in the field of physics, the human body will lose its resiliency at some point leading
to both psychological and physical breakdown. (Cannon, 1932) Stress and individual vitality are often directly related to each other. However, it is valuable to understand that certain levels of stress are valuable for both individuals as organizations. From an organizational perspective, a stress-related concept which is often proposed by change management scholars is the **Burning Platform.** Nichols stated that “if the organization sits astride the fabled “burning platform,” the threat is grave and the time for action is limited.” (Nickols, 2010) All developments of individual and groups are a result of behavioral change. Managers can introduce all sorts of business plans, but on an individual level this plan always demand individual employees to show new behavior. (Gill, 2002) Therefore, it is important to understand what drives people to adapt their behavior. People are prone to change their individual group behavior if three conditions are met. First, individuals should have the capabilities to change their behavior. If individuals know that they do not have the skills or competences to unlearn old habits and learn new habits, they are not likely to participate actively in their behavioral change. Second, the environment of the individual should facilitate the behavioral change. And last, the last determinant allow individuals or groups to change behavior is motivation. Motivation directly relates to the concept of the **Burning Platform.** Individuals tend to act more actively in behavioral change if they experience negative consequences of their current behavior. For example, when sales managers are not fulfilling their targets they will not get bonuses, which a direct negative consequence of their behavior. If the sales manager has the skills to acquire new customers and he has the environment which allows him to do that, the sales manager is likely to participate in behavioral change. Stress is the most important factor influencing the motivation to behavioral change of both groups and individuals. (Tiggelaar, 2018). Therefore, we can conclude that stress can considered to be a useful tool for motivation within change management. However, stress should always stay within the limits of the resiliency of a particular individual to avoid burn-out risks.

3.4.2 The Psychology behind Vitality

In this chapter, two relevant theoretical psychological frameworks are provided which help us to develop understanding how individual psychology relates to vitality.

3.4.2.1 The Concept of Self-Efficacy

As introduced in section 3.3.1, vitality is an important but comprehensive concept which has been researched for many years. In the introduction and in Chapter 2, the philosophy of “The Quantified-Self” has been introduced which by many scholars is considered as a major opportunity to contribute to the diminishing of the Human Energy Crisis. However, despite the investments of companies as Fitbit, Google and Apple, the breakthrough has not yet been accomplished.

Self-Efficacy is a psychological model that has been developed by the famous psychologist Albert Bandura. Perceived Self-Efficacy is “concerned with people's beliefs in their ability to influence events that affect their lives.”. This fundamental concept is considered to be the root of human motivation, personal accomplishments and emotional wellbeing. Perceived self-efficacy of individual human beings is determined based on four sources of information, the so-called Efficacy-Activated Processes. First, cognitive processes occur, in which individual goals are set based on the perceived skills of the employee. A positive correlation persists between the perceived presence of competencies and the height of the goals set, which implicates that employees with higher perceived self-efficacy will, following the mechanism of this cognitive process, will set higher individual goals. Bandura states that individuals who have a high sense of self-efficacy will visualize success trajectories that provide positive guidelines for performance. The second Efficacy-Activated Process is the Motivational Process. Motivation is mostly generated through cognitive-motivation. Bandura describes the process as follows:

“They form beliefs about what they can do, they anticipate likely outcomes of prospective actions, and they set goals for themselves and plan courses of action designed to realize valued futures.”

This implicates that people act on their beliefs about what they think they can do and on the expected outcomes of different sets of actions. When an individual thinks there are positive outcomes of a set of actions but he thinks he is not able to do what it takes to successfully fulfill the job, the individual is not motivated to engage in the activity.

The third Efficacy-Activated Process are Affective Processes. In this source of perceived self-efficacy, personal beliefs in coping capabilities play an important role in the self-regulation of
emotional states of human beings. Beliefs of Self-Efficacy influence the “nature and intensity of emotional experiences”. This implicates that people have negative emotional experiences in relation to aversive action paths which will result in the sponsoring of courses of action that decrease the distressing environments. This mechanism of self-regulation is often referred to as “Exercise of Control”. Exercises of control describes the mechanism that human beings do not generate aversive or distressed emotional states if they believe they can exercise control over the course of actions which lead to the desired outcome. This affective process is an important factor when developing understanding in relation to negative mood states, depression and, as a result, the risk of burn out’s. Bandura describes three possible contributions of negative self-efficacy to depression. The first route is unfolded by unfulfilled aspiration of personal ambitions. The second route is through “a low sense of social efficacy to develop social relationships that bring satisfaction to one’s life and cushion the adverse effects of chronic stressors.”. The third route to depression comes forth of “control efficacy”, which occurs when people do not have a feeling of control on “ruminative thought”.

The fourth and last Efficacy-Activated Process are selection processes. Bandura describes that individual beliefs of own capabilities directly influence the decision trajectories of people. People have a higher change to engage in activities which they believe are within the boundaries of their own caping capabilities. People with a low perceived self-efficacy in a particular area, experience potentially difficult tasks as “personal threats”. Difficult tasks are a potential threat to point people on their personal deficiencies. On the contrary, people with a high sense of self-efficacy in the same working area are more likely to perceive the same difficult tasks of challenges. Moreover, Bandura concludes that “..people who have a strong sense of efficacy, by contrast, approach difficult tasks as challenges to be mastered rather than as threats to be avoided; set challenging goals and sustain strong commitment to their goals; concentrate on how to perform successfully rather than on disruptive personal concerns in the face of problems; attribute failures to insufficient effort or deficient knowledge and skills that are remediable; redouble their effort in the face of obstacles; quickly recover their sense of efficacy after failures or setbacks; and display low vulnerability to stress and depression.”

The work of Bandura has globally been widely adopted and is the fundament for further research on performance management within organizations. (Bandura, Freeman, & Lightsey, 1999) (Bandura A., 2010) (Bandura A., 2006)

3.4.2.2 The Body-Mind-Spirit Model
The second conceptual framework which is relevant in performance management is the Body-Mind-Spirit Model which has percolated the healthcare methodology in last decades. Traditionally, when someone was sick, someone broke his arm or if other physical complaints occurred you went to the doctor which helped you with your complaints. If you had psychological complaints, such as depression, unprocessed trauma’s or burn-out related symptoms, you went to visit a social worker or a psychologist. However, in other continents such as Asia a more holistic approach was adopted, in which spiritual elements were integrated in healthcare. (Chan, Petula, & Chow, 2002) However, in the last decades, the western healthcare methodology has oriented in a technology-oriented direction. (Puchalsk, 2001). Chan et Al state that this technology-oriented healthcare has its focus on isolated symptoms instead of the patient itself.

Analyzing burn-out related symptoms, we inherently see the validation of this approach of holistic health in which different elements interrelate with each other. Burn-out related symptoms consist, amongst others and as stated in the introduction, of fatigue, negative mood states and deterioration of sleep quality. Sleep deterioration is a physical symptom caused by long periods of stress, which is a mental symptom. However, just like the western healthcare approach, most corporate wellness programs focus on particular determinants. (Gubler, Larkin, & Pierce, 2017).

3.4.2.3 Job Demands-Resource Model (JD-R)
The JD-R Model, as developed by Rotterdam’s management researcher Arnold Bakker, is a model which is based on two major prior models, namely the Demand-Control Model (DCM; Karasek, 1979, 1998) and the Effort-Reward Imbalance Model (ERI; Siegrist, 1996). Bakker states that “the basic assumption of both the DCM and the ERI-model is that job demands particularly lead to job strain.
(and in extreme cases to burnout), when certain job resources are lacking (autonomy in the DCM; salary, esteem reward and security/career opportunities in the ERI-model).” The strength of these models -namely its simplicity- is also its weakness, since a complex web of variables is reduced to a selection of variables. At the basis of Bakker’s JD-R Model lies “the assumption that whereas every occupation may have its own specific risk factors associated with job stress, these factors can be classified in two general categories (i.e. job demands and job resources), thus constituting an overarching model that may be applied to various occupational settings, irrespective of the particular demands and resources involved.” Bakker emphasizes that not all job demands are sources of stress, but they can also exercise positive effects. Following Bakker, Job Resources refer to:

- Functional in achieving work goals;
- Reduce job demands and the associated physiological and psychological costs;
- Stimulate personal growth, learning, and development;

In Figure 6, a visualisation of the JD-R Model is presented.

3.4.2.4 Conclusion
All psychological models provide a holistic approach of an individuals’ functioning or “self-efficacy”. However, the models have advantages which differentiate them to the other. In the Vitality Map and the Conceptual Framework the models are integrated.

3.4.3 Determinants influencing the Knowledge Worker Battery
In this chapter, the different determinants which influence the Knowledge Worker Battery are summarized. The determinants are selected based on an extensive literature research. Publications are selected when they are cited more than one hundred times.

The selection of determinants is categorized in two categories with two levels, resulting in a framework with four levels. The first category is non-adjustable. Non-adjustable refers to the levels which are inherent part of the knowledge worker, which are part of its DNA of which are non-adjustable for other reasons. The second category is adjustable. These are factors which are subject to change under influence of external factors. The first level, is biological. Biological -or genetical relates to the “origin” and the biological characteristics with which a human being is born. The second level, the psychological level, refers to the personal traits of individuals which are a result of both nature and nurture. The third layer is identified as personal. This level describes the factors which are external and thus influenceable and within the center of the circle of influence of the individual. (Covey, 1989) The last level, environmental, refers to environmental factors which are a result of for example actions of others. Within the environmental level, a differentiation is made between personal determinants and professional determinants. Personal environmental determinants lay in the private domain, while professional environmental determinants lay in the professional domain.
Based on the literature research and confirmed by the experts interviews, are the interrelations between the determinants. The human being, following the Quantified-Self analogy, can be considered as a network of moving parts, each with its own dimensions and characteristics. Every aspect of this machine depends on the functioning of all other parts. For example, the impact of external environmental factors (e.g.: unsafe working environment created by a manager) is determined by the personal traits of that particular person, but also by the meaning that particular employee adheres to its work. Moreover, the impact of the environmental factors is also influenced by the sleep conditions of that person, which is on its part a result of the worker’s health conditions and, for example, the stress that person experiences from the workload as imposed in that period. In conclusion, the Vitality Map provides a network of determinants and its interdependencies and provides an accurate framework for performance analysis and policy development.

3.4.3.1 The Vitality Map

3.4.3.2 Biological

Age
Age in relation to burn-out has been a subject for research for many years. However, in contrast with other determinants part of the Vitality Map, the results are often not conclusive. (Brewer, 2004). For example, Laub (1997) researched the extent in which younger teachers had a higher risk on burn-outs than their older colleagues. He indeed found this correlation, which resulted in his conclusion that age was a significant determinant in burn-out development. (Laub, 1997) This conclusion implies that differentiations in policy should be developed in order to compensate this additional risk for younger colleagues. In contrast, Koenert (1998) concluded the exact opposite after conducting his research. (Konert, 1998). Concluding on the inconclusive results on the relation between burn-out and age, Gomez-Urquiza et Al (2016) conducted an extensive meta-analysis on 51 publications, in order to find a conclusive answer on this relation, They found that age was indeed a relevant determinant in the development of burn-out’s.

However, adding to this conclusion, researchers also found that experience might be a burn-out determinator. Maslach et Al stated that “age is clearly confounded with work experience, so burnout appears to be more of a risk earlier in a career”. This is congruent with the psychological
theory of self-efficacy of Albert Bandura, which is analyzed in Chapter 2. Bandura states in his research that people “(...)form beliefs about what they can do, they anticipate likely outcomes of prospective actions, and they set goals for themselves and plan courses of action designed to realize valued futures.”. This implies, that if a knowledge worker is new to the job or has low levels of work experience while being expected to deliver professional input, tension occurs between the perceived skills of the knowledge worker and the tasks of the organization.

In conclusion, both age and work experience are a relevant determinant in burn-out development. However, experience can also contribute to compensating the youngness of a knowledge worker. On the contrary, lack of work experience with older knowledge workers might also result in an increased risk of burn-out.

**Cardiovascular, Nerve & Immune System**

The cardiovascular, nerve and immune systems are vital systems in the human body which allows blood flows, the diffusion of oxygen and nutrition through the human body, the defence on sickness and diseases and the transmission of impulses throughout the body in order to coordinate, for example, the limbs. Stress has a major effect on the different systems within the human body.

Research have found a direct correlation between stress and the functioning of the cardiovascular system. “Burnout-plus tension” were associated with “somatic complaints, cholesterol, glucose, triglycerides, uric acid, and, marginally, with ECG abnormalities.” (Melamed, Kushnir, & Shirom, 1992). There is a strong link between psychological perceptions of stress and physical effects on particular systems within the human body. Brotman et al (2007) add that “psychological stress elicits measurable changes in sympathetic-parasympathetic balance and the tone of the hypothalamic-pituitary-adrenal axis, which might negatively affect the cardiovascular system both acutely—by precipitating myocardial infarction, left-ventricular dysfunction, or dysrhythmia; and chronically—by accelerating the atherosclerotic process.” This research provides a broad view on how both physical as psychological stressors can result in, for example, increased blood pressure. An overview on how these stressors contribute to, for example, increased heart rate, is shown in Figure 9. As described in Chapter 3.3.3.3, the effect of psychological stressors is determined on two determinants. The first, is “Personality Traits”, in which is described that knowledge workers - or in general, human beings - perceive psychological stressors in different ways, depending on their psychological traits they have. For instance, people with high sensitivity and empathy are more reluctant to burn-outs than knowledge workers with lower levels of sensitivity and empathy. In conclusion, the psychological traits and the functioning of the cardiovascular system are both moderators for the development of burnout with knowledge workers. (Burke, Greenglass, & Schwarzer, 2007)

Building forward on this knowledge, daily stress (such as occupational stress) have an effect on the cardiovascular system and, as a result, an increased risk of cardiovascular events. For example, researchers found that that upcoming deadline of tasks were associated with "a sixfold increase in myocardial infarction", and that "chronic work-related stress could carry a two to three times higher risk of cardiac events, especially when employees perceive little control over their work environment.” (Kivimaki, et al., 2002) Moreover, the functioning of the cardiovascular system deteriorates with age. Epstein (1992) proclaims that “cardiac output tends to decrease with advancing age, both at rest and during exercise (...), which is only party reflect decrease in muscle demands and skeletal-muscle mass". Moreover, increasing age have an effect on the diastolic function and blood-pressure regulation (Epstein, 1992)
When stress is experienced, “there is an increase in both heart rate and blood pressure.” The immune system is temporarily suppressed, and metabolism becomes catabolic. Among patients with burnout, an increased incidence of common cold, flu-like illness and gastroenteritis has been reported”. (Danhof-Ponta, van Veen, & Zitman, 2011)

Gender
In 2010, Purvanova conducted an extensive meta-analysis on papers which proclaimed hypotheses conclusions on the role of gender in burnout development. Till this moment, researchers were not conclusive, similar as the role of age and ethnicity, about the role of gender. For this Thesis Research, the results of this meta-analysis are used. Purvanova et Al conclude that there are slight differences between men and women in terms of depersonalization, burnout risk and emotional exhaustion. In conclusion, gender is a relevant determinant to incorporate in the Vitality Map. In addition, gender should explicitly distinguished to sex. Researchers found that “gender, but not sex, was significantly correlated with patterns of social support”. In elaboration, “femininity (in both sexes) was associated with seeking and receiving emotional support, and with seeking and receiving support from women and masculinity (in both sexes) was linked only with receiving tangible support. (Maslach, 2001)

Ethnicity
In recent burnout studies, ethnicity has been a subject of analysis. About the significance, however, has not been a conclusive decision yet. Lopez et Al (2017) concluded, after a qualitative study amongst 3,614 students, that “trauma-related disparities may differ across internalizing and externalizing concerns.” (López, 2017) Combining this conclusion to the two determinants in the psychological dimension of the Vitality Map, this might imply that different ethnic groups have different ways of processing emotional stressors, which results in a differentiation of burnout risk. This is confirmed by a similar research, which found that “children from low-income family environments appear to be at greater risk of negative mental health outcomes following trauma exposure compared to adolescents from high-income families.” (Andrews III, et al., 2015) However, the trauma process is, as explained under “Life Events” under Chapter X, on its own a mediating effect. Therefore, ethnicity is a second-degree determinant.

On the contrary, multiple researchers have not found a significant relationship between ethnicity and burnout in burnout research projects. For example, Garcia et Al (2020) found “no differences by race/ethnicity were observed for depressive symptoms or career satisfaction.” Maslach et Al (1984) found that “burnout was not related to client characteristics, such as (...) ethnicity (...)”. The results are inconclusive, and thus the conclusion is that ethnicity is not a strong determinant for burn-out development. Since place of birth are always part of someone’s personal profile, this determinant is easy to collect. Moreover, place of birth might not only grasp ethnicity, but also culture, which is a relevant factor in someone’s personal development.

3.4.3 Psychological

Personality Traits
As introduced in Chapter 1 and Chapter 2, knowledge workers work in “knowledge intensive firms”. Knowledge intensive firms rely on knowledge workers to develop innovative and creative solutions. As a result, the occupational stressors are mostly psychological. The way psychological stressors (e.g.: occupational stress, life trauma’s, second shift, et cetera) are perceived by an individual knowledge worker, is determined by its psychological traits. Knowledge workers with particular psychology traits or “personality types” can even be resistant to burnout, while other personality types have a high susceptibility for burnouts. For example, introverted people have a higher risk for burnout development in comparison to extroverted people. (Layman & Guyden, 1997) In addition, Shapard et Al (2004) state that “employees who were sensitive, idealistic, overly enthusiastic, and empathic were prone to burnout, as were individuals who were anxious and obsessive. By identifying individual traits that might make a person susceptible to burnout, supervisors and human resource professionals hopefully can improve their success at identifying employees who need burnout prevention programs and subsequently enrolling them in such programs.”.
Amongst researchers, there is unanimous agreement on the role of psychological traits in the development of burnouts. In essence, psychological traits determine the perception of the knowledge worker on all incoming environmental impulses. Some knowledge workers might not even experience particular environmental impulses (such as decreased psychological safety, “second shift” or “marriagal status”) while others experience high levels of stress of this same event. In conclusion, personality traits are a critical factor in determining risk profiles and burnout assessment.

Stressors and life events
During lifetime, human beings are prone to countless amounts of external impulses. Traumatizing life events have shown to have significant impact on the psychological dimensions of the human brain. Researchers have found that life events and “trauma’s” potentiality have a chronic effect. Moreover, the perception of life events (similar as other environmental impulses) are moderated by the psychological traits of that person. (Tennant, 2002) Moreover, as stated by Brotman et Al (2007) “acute physical stressors such as surgery, trauma, and intense physical exertion are well-known triggers of cardiovascular events.”. An ongoing development is the acknowledgement of emotional stressors, such as anger, fear, surprise, and severe grief, accomplishing the same physical consequences. This even resulted in the medical diagnosis “broken heart syndrome”. (Virani, Khan, Mendoza, Ferreira, & de Marchena, 2007) Brotman et Al provide the following example in their Lancet publication:

For example, on the day of the Northridge earthquake in Los Angeles, CA, USA in 1994, the number of cardiac deaths within the city and surrounding county in individuals who did not undergo direct physical trauma or increased physical exertions was two to five times higher than the usual rate. Many of these events took place in patients with coronary artery disease, suggesting that the psychological stress precipitated by this natural disaster led to acute plaque rupture or morbid arrhythmia in patients with pre-existing heart disease. A catastrophic emotional event might not be necessary to trigger a myocardial infarction in a susceptible patient. In patients with coronary disease the risk of acute myocardial infarction in the short period after an anger outburst seems to be twice that for other periods, and in one study, emotional stress was a more common precipitant of acute infarction than was physical exertion.

(A., Leor, Poole, & Perritt, 1997) (J Leor, 1996)

The example as posited above applies for people with coronary disease. However, severe emotional stress might even result in severe consequences for non-coronary diseased human beings.

Coping Mechanisms
As a result from the Demonstration Rounds, Coping Mechanisms has been incorporated in the Vitality Map. Coping Mechanisms has been identified by Interviewee 7 and Interviewee 8 and, following the assessment protocols as elaborated in Chapter 5, this determinants is included after validation by academic research. Coping Mechanisms determine “the consequence of stress on performance”.
Personal Values
Personal values is identified by Interviewee 2 as a relevant determinant for burnouts. She states that personal values, inherently, imply great relevance and importance for that particular person. Personal values can consist of, for example, as integrity. Meaning, as part of the “Personal”-level of the Vitality Map can provide can overlap personal values. For example, in healthcare, the personal value “Caring for each other” is omnipresent, which is directly incorporated in the profession of, for example, the doctor or the nurse. Integrity is an example of a personal value which can provide a lot of energy if its available on the work floor, but might cost a lot of energy if it’s not available. The role of values within the development of burnouts is, as assessed, following the assessment protocol as described in Chapter 5, with literature. (Altun, 2002). Altun showed that “that nurses’ personal and professional values play an important role in the degree of burnout they experience.”. Moreover, “equality, altruism and aesthetics were ranked first by those experiencing high levels of emotional exhaustion, and freedom was a priority value for those with a low degree of emotional exhaustion.”. On the contrary, “freedom, altruism and truth were ranked first by those with prominent feelings of personal accomplishment, and equality and aesthetics were priority values for those with less feeling of personal accomplishment.”.

3.4.3.4 Personal
In this level, three domains are identified, which refer to the Body-Mind-Spirit Model which is described in Section 3.2.2.2. Within this three categories, multiple determinants are identified which play a role in the charging or discharging of the human battery of the individual. This determinants are elaborated in this chapter.

Body
In relation to the Body category, we distinguish three determinants influencing human energy: Sleep, Physical Activity and Nutrition.

Sleep
Researchers have done much work on the effect of sleep on the energy levels of human beings. At the very beginning of the human race, sleep was required for hunters and gatherers to fulfill their daily activities. Nowadays, this demand for sleep is still present. (VanItallie, 2006) Sleep is an important factor in charging the human battery. Scott & Judge (2007) found that increasing feelings of insomnia “was associated with increased feelings of hostility and fatigue and decreased feelings of joviality and attentiveness.”. Moreover, higher experiences of insomnia resulted in lower levels of job satisfaction. (Scott & Judge, 2006) Rosekind et Al (2010) found, in a study with 4188 participants, that “(…) compared with at-risk and good-sleep groups, insomnia and insufficient sleep syndrome groups had significantly worse productivity, performance, and safety outcomes. Scholars have estimated that the potential costs of sleep problems costs organizations around 1.900,- each year, which consists of the replacement of salary, decreased productivity and absenteeism. (Leslie & Swanson, 2010) (Rosekind, et al., 2010) But there is an interesting second dimension of sleep. As described above, sleep is an important determinant which influences human energy in both ways. If individuals get enough sleep, they will be more productive. Sleep is therefore an importance actionable determinant for charging the human battery which is easy to measure and easy to improve. However, there is more about sleep. Scholars found that sleep is not only a determinant in charging the battery, but that sleep is simultaneously also a symptom of burnout. Eksedt et Al conducted an extensive research on a group with burnout related symptoms and a control group. They found that the identified burnout group had “(…) more arousals and sleep fragmentation, more wake time and stage-1 sleep, lower sleep efficiency, less slow wave sleep and rapid eye movement sleep, and a lower delta power density in nonrapid eye movement sleep in the burnout group.” Besides that, the burnout patients “ pronounced sleepiness and mental fatigue at most times of the day for weekdays without reduction during weekends.”. They concluded that occupational burnouts are characterized by impaired sleep. (Eksedt, et al., 2006) In conclusion, continuous depreciating sleep is both a predictor as a indicator of burnouts and therefore an inevitable factor in the vitality map.
Nutrition
Nutrition is, essentially, the most important source of energy sources for human beings.

Physical Activity
Physical activity is widely acknowledged as an important determinant in relation to vitality of knowledge workers. For example, among many others, Willis and Campbell described the theoretical relationships between exercising and leadership, corporate wellness and health promotion. (Willis & Campbell, 1992). Physical activity also has a broad effect on personal health, which goes further than the perception of “vitality” within firms. As a start, physical activity directly contributes, sided by caloric intake, to weight gain and, as a result, obesity. (Giovannucci, et al., 1995). But there are many more potential negative influences of low physical activity or its results. For example, physical activity has been shown to have a negative correlation with chronic diseases and “blood pressure increase, atherogenic lipoprotein profile, blood clotting/fibrinolysis, insulin-mediated glucose uptake, bone and muscle strength, autonomic nervous system regulation”. (Haskell, Blair, & Hill, 2009)

We can conclude on the fact that there is a strong relationship between physical activity and chronic diseases. As a result, there are many national positive effects of a physical active society. Leizmann et Al (2007) concluded that physical activity is negatively related with mortality. Vitality within firms or organizations is often linked to occupational stress or the risk on burn-out’s. However, considering the definition of vitality as described in Chapter 3.1, reducing chronic diseases and as a result absenteeism as a result of these diseases, directly contributes to the organizational goals.

However, the influence of physical activity goes further than the effect on chronic diseases. Researchers have shown there is a significant relationship between perceived stress and physical activity. Moreover, this relationship differs between different genders and ethnicities. (Nguyen-Michel, Unger, Hamilton, & Spruijt-Metz, 2006). We can conclude that physical activity is relevant determinant to incorporate in performance management within firms.

Spirit
Within this category, two determinants have been identified: Meaning and Relational Connectivity.

Meaning
Meaning has shown to have significant effect on the charging or discharging of the human battery. Meaning can be interpreted in multiple ways, but in essence meaning is embodied by the “significance and meaning of their work to beneficiaries”. (RN, 2015) Researchers have shown that when employees, or human beings in general, have the feeling of doing work that is relevant for someone or something, they are more creative, satisfied, engaged and committed to it (Cohen-Meitar, Carmeli, & Waldman, 2009). Moreover, researchers have found a relation between employees with high commitment and engagement to their work. Employees with a high level of work engagement have lower risks of burnout, anxiety, depression and absenteeism. (Vicente González-Romá, 2006; Schaufeli W.B, 2009) On the contrary, employees with high engagement and commitment to their work have shown to deliver higher job performance. (Demerouti & Bakker,, 2006) Moreover, we found in Chapter 3.1 that knowledge work is characterized by its nature of creativity and innovation. Scholars have found that the satisfaction of knowledge workers, which is positively influenced by the presence of high meaning of work, “mediates between two knowledge management processes (knowledge creation and knowledge sharing) and innovation significantly. (Kianto, 2018)

Relational Connectivity
Human beings have always been part of groups as a result of their need of interpersonal relationships. This need for social interdependency also exists on the work floor. Positive relationships have shown to have a positive influence on, for example, organizational learning, psychological safety and learning behavior. (Dutton A. C., 2008) Quinn and Dutton (2008) even found that this positive effect was not only experienced emotionally, but also physically, linking organizational psychology directly to the body and health of employees. They found that positive relationships at work create direct and ongoing consequences for an employee’s cardiovascular, immune, and neuroendocrine systems. (Dutton & Heaphy, 2008) Steptoe et Al (2004) state that loneliness scores
from their research were “not associated with gender, age or socioeconomic position, but were lower in married than single or divorced participants, and were positively related to social isolation, low emotional support, ratings of depression, hopelessness and low self-esteem, and to reported sleep problems.” (Steptoe, Owen, Kunz-Ebrecht, & Brydon, 2004) On the contrary, the lack of positive relations can deplete psychological resources. The valuable relationships created on the work floor have not been defined in terms of length. Both short, one-time interactions as the presence of long-term work floor relationships can have a positive effect on the perceived relational connectivity of employees. (Heaphy, 2003)

In conclusion, relational connectivity is an important determinant that shows direct effect on the psychological and physiological resources of employees. Moreover, interventions can be developed which facilitate the process of relationship development amongst employees.

**Mind**

In this category, six determinants are identified which influence the charging of the human battery. These determinants are *Inner Peace, Learning and Development, Perceived Skills, Resilience* and *Mindfulness*.

**Inner Peace**

Inner Peace, accomplished by rest or recovery experiences, has a positive influence on the human battery. (Dam, 2021) Recovery Experiences are an important factor in achieving inner peace. After long work hours and occupational stress, recovery experiences provide an important tool to reduce stress. This experiences is accomplished through different manners, such as relaxation and psychological detachment of work. This recovery experiences can take place during the weekends, and result to higher joviality and lower levels of fatigue at the end of the weekend. (McInroe, 2010) This positive effect of recovery experiences does not only occur in weekends, but also during workdays. Another research of Sonnentag et Al (2008) found that recovery experiences during the week were associated with higher levels of energy on the next workday. (Sonnentag, 2008)

**Learning & Development**

Learning and development, or in a broader sense, personal growth have a significant influence on vitality of knowledge workers. From a pedagogical perspective, researchers determined three psychological basic needs: autonomy, connectivity and competence. Learning and development can be considered as a tool to continuously strengthening the basic psychological needs. (Stevens, 2002)

The explicit effect of learning and development on vitality of employees have been found later on. Spreitzer et Al (2005) found that “thriving at work”, which is proposed as an integrated construct which consists of “learning” and “vitality”, is directly related to generally positive perceived constructs such as resilience, flourishing, subjective well-being, flow and self-actualization. (Gretchen Spreitzer, 2005). The strong, positive interrelation between learning and vitality is confirmed by the findings of VandeWalle, Brown, Cron & Slocum (1999) who found that adopting a “learning orientation” was more effective than adopting a “goal orientation”. Adopting a goal orientation is not effective without providing learning-elements when managing teams within a firm. Moreover, when team members are facilitated to adopt a learning orientation, they will more open to embrace new opportunities instead of being resistant to new chances of circumstances. This mentality, which has similar characteristics as “growth mindset” has been proven to increase vitality and vigor. (VandeWalle, 1999).

**Perceived Skills**

In Bandura’s psychological model of *Self Efficacy*, one of the *Efficacy-Activated* processes is described by perceived skills. Bandura states that not the absolute level of skills determine whether an individual has a high level of Self-Efficacy, but the perceived level of skills. Perceived level of skills also interrelates with multiple other factors within the Vitality Map, such as Psychological Safety and Organizational Autonomy. As Bandura prescribes, a high level of perceived skills in relation to the tasks leads to high engagement and low risks of anxiety and burnout. Low levels of perceived skills lead to a depletion of psychological resources. More about Self Efficacy is described in Chapter 3.3.
3.4.3.5 Environmental Professional

**Role Conflict & Ambiguity**

Role conflict and ambiguity are two similar constructs, but are rooted differently. High levels of both constructs have been associated with an increased risk of burnout (Cordes & Dougherty, 1993; Low, Cravens, Grant, & Moncrief, 2001). Both constructs relate to role theory and are part of a more comprehensive framework. Role theory, essentially, describes three terms of immediate applicability:

1. Actor - The individual considered in abstraction from his personality and roles
2. Role - The set of complementary expectations regarding the actor in his interaction with other individuals
3. Personality - The system of need dispositions reacting to the alternatives presented by the existence of the different roles.

(Getzels & Guba, 1954)

Role conflict might appear when “one demand placed on an individual conflicts with one or more other demands placed on him or her”, while “role ambiguity refers to a lack of understanding by an individual of the demands placed on him or her”. (MA & Carron, 2001)

As mentioned under “Workload”, role conflict, role ambiguity and workload contribute, jointly, to perceptions of “occupational stress”.

**Workload**

Researchers have been unanimous about the role of workload or “occupational stress” in the burnout development process. Countless different research project on particular target groups have been conducted, and each research concluded on the substantial role of workload on burnout. For example, research have been conducted on healthcare workers (Portoghese, Galletta, & Coppola, 2015), teachers (Van Droogenbroeck, Spruyt, & Vanroelen, 2014), students (Jacobs & Dodd, 2003), accountants (Sweeney & Summers, 2002) and physicians (Wen, et al., 2016). Workload is the amount of work that is required to be done by a particular individual. Workload contributes, in combination with other stressors within the professional environment domain in the Vitality Map, to the perception of occupational stress of an individual.

Workload is associated linked with the Knowledge Battery Framework as presented in Figure 6. In essence, workload is the amount of tasks which are expected to be finished by an individual knowledge worker. As described in Chapter 3.2, the process of performance delivery starts at charging the battery, to result in performance delivery. The tasks (or workload) that knowledge workers are expected to finish, have three dimensions, namely direction, intensity, and duration. Effort is the amount of energy which the knowledge worker should invest to finish the task successfully. On the contrary, tasks (or task complexity) can be translated in the same way. This framework provides understanding on the different workload dimensions that influence the development of burnouts. For example, Sweeney et Al (2002), have concluded that an increase of burnouts amongst accountants occurs in the “busy season”, which is the period in the first quarter of the year in which the Financial Statements are composed. The main root of this phenomenon lies in the duration and intensity dimension, due to increased working hours (often more than 12 hours a day) and deadlines as a result of piling up work. Amongst healthcare workers, as presented by Portoghese et Al (2015), the burnouts are caused by “emotional exhaustion”, a result of high responsibility and high pressure during shifts. However, taking the maximum of shifts for healthcare workers into account, burnouts amongst healthcare workers are mainly influenced by the intensity of the job, and not the duration.

Moreover, applying the concept of self-efficacy (as explained in Chapter 3) of Albert Bandura (2012), stress is caused by the Efficacy Activated Processes, for example in the case that the expected task is not congruent to the knowledge workers perceived skills. As a result, diagnosis of burnouts amongst knowledge workers might conclude that to high intensity or too much work was the main cause of the burnout, while, following Bandura, the root may also have lied in the lack of
perceived skills of that particular knowledge worker. In conclusion, workload is an important significant determinant in the burnout development process.

**Autonomy**

Following the Job Demands-Resource Model (JD-R) and the Self-Efficacy Model as explained in Chapter 3, energy sources have a positive impact on the engagement and commitment of knowledge workers to the mission and vision of the organization. The JD-R Model prescribes that “energy sources play an external motivational role, because they increase the willingness to conduct compensating effort, increasing the chance of fulfilling the work objectives.”. However, energy sources can also play an “intrinsic motivational role”. Deci & Ryan found that human beings have three basic psychological needs. These needs can be compared to the basic physical needs, such as exercising, sleep and nutrition. This basis psychological needs are autonomy, competence (elaborated under “Perceived Skills”) and relational connectivity (elaborated under “Relational Connectivity”). Moreover, as elaborated in Chapter 3, knowledge workers have an increased demand for the basic need of autonomy. (Taris, 2013)

**Reward Systems**

Researchers have found that both financial and non-financial rewards contribute significantly to the motivation and satisfaction of employees. (Galanou et al.) 2010. Job satisfaction can be considered as a proxy for a combination of determinants within the Vitality Map. For example, job satisfaction depends on the employees work environment (as described in Chapter 3.3.3.5), the organization level of support (as described under “Relational Connectivity” and “Learning and Development”) and employee status. When employees have high levels of satisfaction, “they are more likely be stable, productive, and strive toward the aims of organization”. (Jessen, 2018).

Researchers found that an imbalance between internal resources spent (effort, energy) in relation to low external rewards (promotion prospects, compliments) resulted in in an increased risk of burnouts. (Bakker, Killmer, Siegrist, & Schaufeli, 2008). In a quantitative research, researchers found that both material and emotional rewards have a positive effect on job satisfaction, a negative effect on burnout. However, emotional rewards were more effective. (Koo, Yu, Chua, Lee, & Han, 2019) In conclusion, rewards systems are a valuable tool to contribute to employee satisfaction and, as a result, increase in job engagement and decreased risk on burnout development. Reward systems should be balanced between both job demands and individual effort and balanced in terms of emotional and material rewards.

**Psychological Safety**

Psychological Safety is a construct which has been introduced in the 1960’s by scholars, and by organizational researchers identified as a significant factor in relation to organizational phenomena such as teamwork, team-learning and voice. Psychological Safety was re-introduced by Harvard Professor Emy Edmondson, who contributed to the renaissance of the construct from the 1990’s till now. Edmondson defines Psychological Safety as “people’s perceptions of the consequences of taking interpersonal risks in a particular context such as a workplace”. Psychological Safety mediates the effect of leadership behaviours, and “voice, engagement and knowledge sharing”, which on itself plays a mediating role between psychological safety and creativity. (Edmonson & Zhike, 2014) This last construct is of great importance and is highly valuable within firms, especially in in knowledge intensive firms, in which innovation and creativity are two core ingredients to develop new, cutting-edge solution (see Chapter 3).
Moreover, on an organizational level, psychological safety plays an important role as a contributor to organizational performance. Figure 9 visualizes the relationship between Psychological Safety and High-Quality Relationships, which on itself is an determinant on the personal-level (part of the Spirit-dimension) of the Vitality Map, which is further elaborated under “Relational Connectivity”. Moreover, psychological safety contributes to organizational learning, which is a valuable process in the development of new knowledge and innovation, which determine the competitive advantage of knowledge intensive firms (see Chapter 3).

Non-Professional

**Second Shift**

Bearing, delivering and raising children, especially in the early years, demands a lot of energy and effort of young parents. Becoming a parent has been identified as one of the most important life events for people. (Hansen, 2012). Moreover, a challenging paradox arises in the earliest phase of parenthood. On one side, becoming a parent of a first child, contributes to perceptions of life meaning. On the contrary, Evenson & Simon (2005) found that new-parents rated lower levels of life satisfaction and higher levels of depressive symptoms compared to individuals without children. (Evenson & Simon, 2005) This even led to the introduction of a new phenomenon, parental burnout, which refers to “to the emotional exhaustion of parents, emotional distancing from their children, and reduced feelings of parental accomplishment and efficacy” (Roskam, Raes, & Mikolajczak, 2017). However, the “second shift” potentially contributes directly to occupational burnout due to less moments of rest and higher perceptions of pressure. (Hochschild & Machung, 2012)

From a cultural perspective, mothers are expected to be perfect mothers. Researchers have found that these pressure on young mothers substantially increase levels of stress and guilt. Mothers experience fear to be categorized as “bad parents”, especially when children and a career ambitions are combined. (Okimoto & Heilman, 2012) Researchers concluded that “feeling pressure to be a perfect mother was positively related to parental burnout, and this relation was mediated by parental stress, by a stronger cognitive prevention focus aimed at avoiding mistakes as a mother, and by higher maternal gatekeeping behaviours taking over family tasks from one’s partner.” (Meeussen & van Laar, 2018)

In conclusion, the substantial impact on the life’s of early parents is a widely- embraced determinant in the burnout development. This determinant is an example on how particular determinants might occur for specific groups in specific moment in their lives.

**Work/Life balance**

Work & Life Balance is a determinant which is highly dependent on the personal preferences and the life phase of a particular individual. As introduced in the previous subchapter (“Second Shift”), events at home have a major influence. Researchers have found that an unhappy feeling about work/life balance, contributed to the feelings of job satisfaction and, thus, increased the risk of burnout. (Starmer, Frintner, & Freed, 2016) Moreover, high levels of workload can be compensated by a stable setting at home, through establishing relationship outside of the job (see subchapter about Relational Connectivity). Moreover, it is important for individuals to accomplish a threshold level of inner peace. (see subchapter about Inner Peace), in order to allow your mind and body to process the impulses from the job.

Since 2007, there has been an increase of interpersonal connectivity due to the introduction of the smart phone. Due to this development, everyone is always available to get contacted. This development increases the integration of work and life, since the workplace is, practically, taken...
home by the employee. This phenomenon often increases the amount of external impulses during the day, also outside working hours, and thus decreases the amount of quality resting moments. (Baron, 2010)

Moreover, the recent COVID-pandemic has contributed to the work/life-balance tension for employees. For almost 18 months, the advice of the Dutch Government has been to minimize office visits and work from home as much as possible. Experts believe this development is not temporary. (Kramer, 2020) As a result, there is risk of further increase in tension in work/life balance for employees. Logically, the extent to which employees are able to deal with this development depends on their personal preferences and personal characteristics.

**Marriage Status**

Cordes and Dougherty (1993) found that married individuals have a lower risk of developing burnout than singles who are not married. In addition, Gómez-Urquiza et Al (2016) found that “gender, age and marital status (...) moderated the relationship between age and burnout and may be crucial for the identification of high-risk groups.” (Gómez-Urquiza, Vargas, De la Fuente, Fernández-Castillo, & Cañadas-De la Fuente, 2016). This theory is acknowledged by Jackson (1993) who also concluded that demographic factors as gender, age, and marital status have a moderating relationship on burnouts for human beings.

In relation to biological roots in the cardiovascular system, researchers have found that women with a coronary disease-diagnosis have a higher risk on recurrent cardiac events compared to women without marital stress. (Orth-Gomér, Wamala, & Horsten, 2000) Moreover, based on the Nurses’ Health Study, “caring for a sick spouse at home nearly doubled the risk of death from coronary events”. (Lee, Colditz, Berkman, & Kawachi, 2003) In conclusion, both the marital status as the current social status of the relationship (e.g.: stable or not stable) is an important determinant on burnouts and a broader definition of health.

**Weather Conditions**

Weather conditions have an influence on affective experience, and as a result, influence the mood of individuals. Kööts et Al found that “(...) momentary ratings of positive and negative affect were weakly related to temperature, positive affect was also related to sunlight. However, momentary ratings of fatigue showed a distinct tendency for greater incidence of sleepiness in the cold and dark. Age group was one of the most important moderators of the weather-emotion models. The influence of weather on emotions interacted with being outdoors. Personality traits also explained a small portion of variance in the influence of weather on affective states.”

This conclusion is supported by the publication of Taylor et AL (2017), who developed a machine learning algorithm to forecast student mood. Multi-Kernel learning was used to calculate stress, energy and mood levels for the following days. Using multiple statistical analysis, they found a significant relationship between weather and mood.

**The Unknown**

As introduced by Interviewee 5, “The Unknown” represents all small determinants which have not been researched or identified. For example, the sound of birds, people chitchatting on the terrace, the reception of a surprise, et cetera. Through extensive artificial intelligence analysis potential new determinants can be identified. The unknown represents unknown factors in both the personal as the professional environment.

**3.5 Human Resource Management Systems (HMRS)**

In this sub-chapter, the background and importance of Human Resource Management Systems are elaborated. First, the relation between human resource management systems are identified. Second, the main challenges of Human Resource Management Systems are elaborated and the critical success factors are identified.

In Chapter 3.2, the importance of performance management, as part of human resource management, is presented. Performance management contributes to the personal effectiveness of,
within the context of this Thesis Research, knowledge workers, increases their retention within the firm and decreases risks of burn-out and the inherent costs for the firm. Taking the importance and the ownership of knowledge by the knowledge worker into account (as presented in Chapter 3.1), the management of knowledge workers is the most important practice within knowledge intensive firms. The responsibility of management of knowledge workers is mainly distributed amongst the senior managers of firms. Researchers emphasize the importance of an coherent, integral approach of human resource management, considering the multi-disciplinary background of the human resource management practice. When practicing human resource management, for example, performance management, this practice is likely to depend on other dimensions of the human resource practice, such as selection, reward or appraisal. As a result, a complex web of management practices occurs which should be incorporated in order to create an holistic view on the matter and to be able to create synergies across human resource management practices within the firm (Boon, Den Hartog, & Lepak, 2019). In order to support senior managers within firms with this responsibility, Human Resource Management Systems are developed. Human Resource Systems support senior managers and HR managers within firms and facilitate the development of synergies amongst this HR practices. Moreover, HRMS are considered to have the potential to function as Executive Information Systems (EIS). An Executive Information System (EIS) is “a computer-based information system designed to provide senior managers access to information relevant to their management activities.” (Leidner & Elam, 1993). Leidner & Elam state that “trends as globalization and intense competition increasing the importance of fast and accurate decision making, the use of these systems by executives may become a particularly important component of their decision-making behavior.” HMRS should incorporate the dimensions of the EIS to provide an integral, comprehensive information system to allow management of the firm to develop policies with informed consent. For example, researchers found that multiple HRMS had the intent of increasing involvement with their employees, for example by involving them into decision processes or the development of new HR practices. Another cluster of HMRS are engagement HMRS, which focus on the interaction with their employees. A third cluster focused on the performance management of employees. (Lepak, 2008). The researchers found in their meta-analysis of Human Resource Management System Literature, The most widely adopted practices are training/development (89%), participation/autonomy (71%), incentive compensation (69%), performance appraisal (66%), selection (58%) and job design (50%). Researchers emphasize the coherence and interdependency of these practices and conclude that synergies between these practices can only occur if the different human resource practices are integrated. (Boon, Den Hartog, & Lepak, 2019).

### 3.6 Incorporating the value of machine learning

#### 3.6.1 Healthcare Challenges

Artificial intelligence is defined as “a broad scientific discipline with its roots in philosophy, mathematics and computer science that aims to understand and develop systems that display properties of intelligence.” (Panch, Szolovits, & Atun, 2018) Artificial Intelligence within the health discipline is gaining more interest. Health and medicine are traditional businesses which expect high challenges in the near future due to major global trends such as overpopulation and extended life expectancy. This results in a greater demand for health services, higher societal demands from healthcare providers and increasing expenditures on health as a whole. (Atun, 2015) Moreover, traditionally, healthcare is a market which is characterized by higher resistance for new technological developments. Artificial Intelligence (AI) might be a viable tool to support the healthcare branch to overcome these challenges.

Secondly, healthcare is still focusing on curative approaches. When somebody starts to experience symptoms, it waits till the moment that the symptoms increase and decide to go the doctor. The doctor starts the procedure and, hopefully, helps to overcome or minimize the symptoms of the patient. However, considering the major challenges that healthcare is facing, a fundamental change of approach is required in order to minimize the healthcare pressure. This fundamental new approach demands a change of mindset amongst all stakeholders within the sector, including the patients. Researchers showed that patients are willing to engage in preventive healthcare if it’s likely to reduce their risk of healthcare threats substantially. (Jayanti & Burns, 1998) In relation to the subject of this Thesis Research, an holistic longitudinal approach is required which structurally incorporates all dimensions of health and vitality. For example, researchers found that the impact on health of “simply” being happy is comparable to smoking or not. (Veenhoven, 2007) Adopting the
Vitality Map (as elaborated in Chapter 3.4) in this approach, artificial intelligence has the potential to play an important role in preventive healthcare. Nevertheless, the development of artificial intelligence has not yet reached the point in its development. In Chapter 3.5.3, the current position of AI research in relation to performance management and vitality management is presented.

3.6.2 Artificial Intelligence Typologies
Researchers have distinguished between the following typologies. In Figure 15, the different techniques are summarized, following the summarization of Panch, Szolovitis and Atun (2018).

<table>
<thead>
<tr>
<th>TECHNIQUE</th>
<th>DESCRIPTION</th>
</tr>
</thead>
<tbody>
<tr>
<td>MACHINE LEARNING</td>
<td>A sub discipline of AI, where computers programs (algorithms) learn associations of predictive power from examples in data. Machine learning is most simply the application of statistical models to data using computers. Machine learning uses a broader set of statistical techniques than those typically used in medicine. Newer techniques such as Deep Learning are based on models with less assumptions about the underlying data and are therefore able to handle more complex data.</td>
</tr>
<tr>
<td>DEEP LEARNING</td>
<td>Deep learning methods allow a machine to be fed with large quantities of raw data and to discover the representations necessary for detection or classification. Deep learning methods rely on multiple layers of representation of the data with successive transformations that amplify aspects of the input that are important for discrimination and suppress irrelevant variations. Deep learning may be supervised or unsupervised. Deep learning methods have been responsible for many of the recent foundational advances in machine learning.</td>
</tr>
<tr>
<td>SUPERVISED LEARNING</td>
<td>Training computer programs to learn associations between inputs and outputs in data through analysis of outputs of interest defined by a (typically human) supervisor. Once associations have been learned based on existing data they can be used to predict future examples. This is one of the most established areas of machine learning with multiple examples inside and outside health care.</td>
</tr>
<tr>
<td>UNSUPERVISED LEARNING</td>
<td>Computer programs that learn associations in data without external definition of associations of interest. Unsupervised learning is able to identify previously undiscovered predictors, as opposed to simply relying on known associations.</td>
</tr>
<tr>
<td>REINFORCEMENT LEARNING</td>
<td>Computer programs that learn actions based on their ability to maximize a defined reward. This approach is influenced by behavioural psychology and has been applied with considerable success in gaming where there is perfect information, many possible options and no real world cost of failure.</td>
</tr>
</tbody>
</table>

Figure 12 | Artificial Intelligence Typologies (Panch, Szolovitis and Atun (2018))

3.6.3 Artificial Intelligence integration in performance management
Each artificial intelligence typology has its advantages and disadvantages. Researchers have been exploring the opportunities of incorporating artificial intelligence methodologies in human resource management systems. However, the accuracy of artificial intelligence and machine learning technologies are still lacking in order for incorporation within preventive healthcare applications. (Bogomolov, 2013)
In 2017, Taylor et al conducted a research at Harvard University, funded by, amongst other, Samsung which focused on the development of a new typology of machine learning. The research involved the measurement of Smartphone collected data, such as self-reported health, stress, mood and energy. The goal of the research was twofold. First, the developed model should be able to function with incomplete datasets. Second, the developed model should develop the ability to forecast mood, energy and stress for upcoming days. The researchers hypothesize that “these models suffer from a common problem: the inability to account for individual differences. What puts one person in a good mood does not apply to everyone else.” Moreover, they state, in congruence with the reasoning behind the Vitality Map, that “the stress reaction experienced by an introvert during a loud, crowded party might be very different for an extrovert (and) individual differences in personality can strongly affect mood and vulnerability to mental health issues such as depression.” The researchers conclude that “a generic, omnibus machine learning model trained to predict mood is inherently limited in the performance it can obtain.” (Suhara, Xu, & Pentland, 2017)

Therefore, researchers introduce a new typology of machine learning model, which is based on the methodology of transfer learning. Transfer learning is a methodology “in which models are learned simultaneously for several related tasks, but share information through similarity constraints (and) allow each person to have a model tailored specifically for them, which still learns from all available data.” MTL allows the model to account for individual differences in, for example, personal traits. This is congruent with the contextual approach which is required for burn-out prevention and performance management.

The to-be designed artefact should incorporate forecasting mechanisms which allow current trends to be extrapolated in order to support managers in policy adjustments and developments.

Generally, forecasting methodologies are based on the input of prior data, thus $X_{-1}$, $X_{-2}$, et cetera. Following Taylor et al, this kind of forecasting techniques are “less than desirable”, since “it implies that a person must input their mood every day in order to obtain predictions about tomorrow.” (Taylor, Jacques, Nosakhare, Sano, & Picard, 2017) If one person forgets or chooses not to fill in the mood, energy or sleep-related data, this implies that the system will not be able to forecast the parameter for the following days. This lack of flexibility decreases the value of the system. MTL allows to forecast mood or similar parameters without requiring the input of historical data of that particular knowledge worker. (Wilson A., 2007)

The model of Taylor et al “begin by clustering users based on their personality and gender, and treat predicting mood for a given cluster as one prediction task. The model is built on different layers. The basis layers consist, for example, of age, personality, job cluster, geography. Every layer above that, adopts a more personal layer. A visual representation on the functioning of this model is shown in Figure X. Figure 13 | Multi-kernel machine learning (Taylor et Al, 2017)

The research of Taylor et al has high similarities with the suggested approach for performance management in this Thesis Research. First, Taylor et al (2007) concluded that machine learning models should allow the system to work with incomplete data. Second, the model should allow the system to connect and integrate different determinants on different levels of the model.
3.7 Identification of Design Objectives

3.7.1 The Identification Process
As introduced in Chapter 1, this Thesis Research addresses a relevant societal and commercial challenge for firms. In order to solve this persevering problem, a practical tool should be developed which helps firms and consultants to shape their human resource management systems approaches. In Chapter 3, the results of an extensive structured literature research is elaborated. This literature research consist of researching and analyzing five theoretical domains. This theoretical domains are described in Chapter 3 and visualized Figure 3. The goal of this literature research is to expose the root problems and essential theoretical interrelations between the different constructs in the domain of the problem. After developing understanding of the central theoretic domains which circumvent the problem, the objectives of the solution can be determined.

3.7.2 Design Objectives

<table>
<thead>
<tr>
<th>Design Objectives #</th>
<th>Conclusions from literature research &amp; interviews</th>
<th>Design Objective</th>
</tr>
</thead>
<tbody>
<tr>
<td>DO1</td>
<td>HMRS and HMS are system-driven instead context-driven</td>
<td>A solution that is context-driven instead of system-driven and thus collects the data which is relevant, instead of which is available.</td>
</tr>
<tr>
<td></td>
<td>The Quantified-Self approaches put measuring as much as possible central, instead of measuring what is relevant for one person.</td>
<td></td>
</tr>
<tr>
<td>DO2</td>
<td>HMS and HMRS often focus on one dimension of vitality, instead an integral approach of the different dimensions.</td>
<td>A solution which adopts a holistic approach and integrates all the dimensions of human resource management in its approach;</td>
</tr>
<tr>
<td></td>
<td>In organizations, different dimensions of performance management are organized and approached separately, while the directly relate to each other.</td>
<td></td>
</tr>
<tr>
<td>DO3</td>
<td>HMRS and HMS adopt a reactive instead of preventive approach in relation to burnouts</td>
<td>A solution which allows internal stakeholders to intervene in time</td>
</tr>
<tr>
<td>DO4</td>
<td>HMRS and HMS do not have value if they emphasize the known limitations (e.g.: to high weight) of someone; they should help to change behavior in order to change this limitation.</td>
<td>A solution which integrates mechanisms which facilitate behavioral change;</td>
</tr>
<tr>
<td>DO5</td>
<td>Knowledge workers require autonomy and personal development, and experience obligations and boundaries as stressful and constraining.</td>
<td>A solution which fullfills the desire for autonomy and personal development of knowledge workers</td>
</tr>
<tr>
<td>DO6</td>
<td>HMRS and HMS are often difficult to use and cost to much time</td>
<td>A solution which is intuitive and easy to use</td>
</tr>
<tr>
<td>DO7</td>
<td>An important factor in the restraint to share personal data with managers, since they could use this information for privacy purposes.</td>
<td>A solution should differentiate data sharing in between different stakeholders and allow an individual to choose with whom he shares information;</td>
</tr>
<tr>
<td>DO8</td>
<td>Artificial intelligence (multi-task kernel learning) has proven to be able to contribute to the forecasting of mood and energy based in multi-factorial input</td>
<td>A solution which incorporates multi-kernel learning to forecast burn-out risks amongst employees.</td>
</tr>
<tr>
<td>DO9</td>
<td>Multiple cases occur in which positive reward systems have a positive influence on employee engagement in wellness programs</td>
<td>A solution which incorporates reward systems for data sharing and engagement complementing conventional reward systems</td>
</tr>
</tbody>
</table>

Figure 14 | Design Objectives
4. DESIGN & DEVELOPMENT PHASE 1 | DEVELOPING THE CONCEPTUAL FRAMEWORK

As introduced in Chapter 2, the goal of the design phase is to develop the artefact. Such artefacts are “new properties of technical, social, and/or informational resources”. (Hevner & March, 2003) Peffers state that “this activity includes determining the artifact’s desired functionality and its architecture and then creating the actual artifact.” (Peffers, Tuunanen, Rothenberger, & Chatterjee, 2007)

In Chapter 4, the design objectives are described which are the result of a structured literature research. In this Chapter, following the RDSM approach of Peffers, the actual artefact is developed, which should incorporate the design objectives as described in Chapter 4. As a result, the artefact solves the problem statement and answers the research question. The artefact for the purpose of this Research Thesis, essentially, consists of two elements. First, a holistic performance management system design framework is introduced in which the core components and the interrelations of the human resource management system are described. This framework essentially provides a practical tool which can be used by human resource managers and consultants to develop human resource management systems or approaches within their own organizations. The second element provides a front-interface design which provides a concrete example of how the front interface can be visualized. This first element incorporates Design Objective 1 to 5 and 7 to 9. Design Objective 6 is incorporated by element two. Design Objective 6 relates to the “intuitive” design of the application the end-user is going to use. Logically, this cannot be achieved through only delivering a performance management system design framework.

4.1 The Performance Management System-Framework (PMSF)

Building onwards on the understanding of the problem as developed through the structured literature research, the Performance Management System Framework is developed. The VPMSF consists of two levels and three columns. The columns represent two areas of human resource management as introduced in Chapter 1, namely Performance Management and Strategic Planning. Within performance management, a subdivision is made of Self-Management and Reward Management.

Two levels are distinguished. The basic level describes the basic process of charging and discharging the human battery resulting in performance. In Chapter 5.2, every building block and its relation to one or multiple design objectives is elaborated.
4.2 Structure of the Conceptual Framework

In this subchapter, the structure of the framework is explained in relation to the problem statement and the design objectives. In Chapter 5.3, the different building blocks of the Performance Management System Framework will be elaborated, starting with the core performance delivery process which is categorized in “Battery (dis)charge”. In Chapter 5.4, the different processes in the Performance Management Systems Framework are elaborated. And last, the analyzing and presenting of the information to its end users, namely knowledge workers, vitality coaches and organizational stakeholders through dashboards are described.

As described in, Chapter 3, performance management is defined as “the evolving formal and informal mechanisms, processes, systems, and networks used by organizations for conveying the key objectives and goals elicited by management, for assisting the strategic process and ongoing management through analysis, planning, measurement, control, rewarding, and broadly managing performance, and for supporting and facilitating organizational learning and change.” (Ferreira & Otley, 2009).” Ferreira & Otley provide an extensive framework for performance management systems. The PFMS builds onwards on the framework which is described in Figure 4. However, not all dimensions are explicitly incorporated in the HMRS Framework. The goal of this Thesis Research is to develop a tool which supports organizations to structure and optimize the management of human resource sources within their organization. By definition, Human Resource Management Systems (HMRS, Chapter 3.4) and Decision Support Systems (DCS, Chapter 3.4), are implemented to support in the “conveying (to) the key objectives” of the organization. As a result, not all dimensions of Ferreira’s and Otley should be incorporated in the artefact. First, “Mission & Vision” is not explicitly incorporated. However, this dimension is implicitly apparent within the system, since “Meaning” is one of the determinants within the Vitality Map. A clear mission and vision with, for example, societal relevance, contributes to the perception of “Meaning” of an individual knowledge worker, thus potentially contributing to the charging of the Knowledge Worker Battery (KWB). On the contrary, compliant to all determinants within the Vitality Map, the opposite might also occur. A mission and vision which is incongruent with the personal beliefs of the knowledge worker, increases the risk of energy depletion, resulting in a potential risk for the Knowledge Worker.

Design Objective 2 states that the solution should adopt a holistic approach and integrates all the dimensions of human resource management in its approach. Second, Design Objective 3 prescribes that the solution should allow policy makers, managers and other stakeholders within firms to intervene in time. Third, the artefact should fulfill the desire for autonomy and personal development of knowledge workers. As a result, building onwards on the literature research, two main columns are defined. The first, is performance management, which consists of “self-management” and the second is “reward management”, which incorporates management actions for rewarding employees for their effort and contributions to the key objective of the organization. The second column is Strategic Planning. As introduced in Chapter 1, human resource management consists of four important tasks:

1) Selection - Matching available human resources to tasks
2) Appraisal - Performance management
3) Rewards - To motivate and stimulate employees to deliver
4) Development - Developing high quality employees

Appraisal, rewards and development relate to performance management, the “Strategic Planning” of resources relates to the first domain of human resource management, namely selection. Selection of available human resource to tasks is essential in human resource management decrease, since, as visualized in the Vitality Map and following the theory of Albert Bandura, stress and burn-outs are often rooted in occupational stress (e.g.: too much work for an individual knowledge worker) or in a discrepancy in perceived skills and the tasks one individual should fulfill. When the data about an individual knowledge worker indicates that the knowledge worker is excessively stressed and the root of this problem lays in the workload (e.g.: not necessarily the duration, but potentially also the intensity or direction of the work the knowledge worker is expected to deliver). Therefore, contributing to Design Objective 3, stakeholders within the firm
should have a dashboard which provides them relevant information about their employees. Secondly, the dashboard should allow policy makers and managers to intervene on an organizational- and team-level if the information on the dashboard indicates intervention is required. Interventions could consist of switching human resources amongst divisions or hiring new employees to increase knowledge, experience of available time. But, on the contrary, analyzing the task complexity and the task dimension (e.g.: direction, duration and intensity) the organization could also decide to develop policies to influence other determinants within the vitality map. Strategic Planning can be considered as the integrative set of policies and decisions aimed to contribute to the conveying of key objectives within the organization. As a result, the performance management systems framework incorporates all four dimensions of human resource management. In conclusion, the framework can be categorized as a human resource management system.

The PFMS Framework has two layers. The bottom layer, describes the fundamental process of performance delivery. Adopting Lupton’s Quantified Self analogy, this fundamental process can be described as the charging and discharging of the human battery. (Lupton D., 2016) Following this analogy and similar with, for example, cars, one is performing durably when the charging and discharging balance of the battery is balanced. In the situation that a deficit occurs in the charging and discharging balance of an individual knowledge worker, it’s energy resources are depleted. The second step in the performance delivery process is effort. As elaborated in Chapter 3.3, effort is the intermediate phase between energy and performance. In the section in which the performance delivery process crosses strategic planning, tasks are described. The tasks are derived from the mission and vision of the organization and the resulting key success factors. (Ferreiraa & Otley, 2009) The tasks are divided across the management teams of the teams within the organization. Effort will result in performance in the situation that the effort dimensions is congruent with the required tasks dimensions and fullfills the prescribed quality requirements of the task. The upper level of the PFMS framework prescribes the processes which connect the fundamental processes in the performance delivery framework to the output of the human resource management system.

Decision Support Systems should provide actionable information which supports managers of firms in strategic decision making processes. The output of the human resource management system are visualized in two dashboards for two segregated stakeholder groups. The first dashboard provides an overview of the current status of the energy levels of all employees. This dashboard is only visible for specially appointed company doctors, vitality coaches or other trustees. The information which is provided to them is strictly confidential and cannot be transferred to managers or other stakeholders within the firm. This information sharing protocol should be aligned with the current privacy protection protocols which ensures the privacy of the knowledge workers within the firm. As elaborated in Chapter 3, data privacy is a significant barrier for corporate wellness programs and employee engagement. Secondly, a different dashboard is provided for the managers and other decision makers within the firms. The information is provided on an individual level, a team-level and an organizational or division level. On an individual level, the dashboard provides an integrative overview of the medical and performance status of the individual knowledge worker. This dashboard is similar as the individual knowledge worker profile dashboard, but only provides information on a team, division and organization level. The information provided in this dashboard is anonymized. This implicates that minimum quantity of team members within a team should account for eight. The data is processed through multi-kernel machine learning which allows the dashboard to analyze and aggregate the information.

4.3 Building Blocks of the Conceptual Framework
In this Chapter, the building blocks of the Conceptual Framework are elaborated.

This building block relates to the Design Objective 2, which prescribes that should adopt a holistic approach and integrates all the dimensions of human resource management in its approach. To accomplish this, the Vitality Map is developed, as a result of the literature research. In Figure 13 shows how the Vitality Map is relates to the knowledge worker battery. This framework provides understanding on how the four levels of the Vitality Map contribute to the charge or discharge of the knowledge worker battery.
Essential in this framework, is how determinants on different levels interact with each other. For example, to take the determinant “Workload”, which is categorized in the professional environmental level, the extent to which the workload contributes to charging or discharging of the knowledge worker battery, depends on, for example, the sleep quantity and quality of an individual (on the personal level), the personality traits (on the psychological level) and the gender and age of the individual (from the biological level). For example, high levels of workload might lead to charging of the knowledge worker when the knowledge worker is rested and has and eccentric character. However, the contrary (discharging) might occur in other configurations of the Vitality Map. The Knowledge Worker Battery is discharged through the Energy-Effort-Performance process, as elaborated in Chapter 3.2.3.

4.3.3 Dashboards - From data to information

4.3.3.1 Individual Profiles

Data collection and intervention
Data is collected through a combination of different data collection instruments. This instruments are further elaborated in Chapter 5.4. In order to fulfill Design Objective 4, which relates to the facilitation of intervention for vitality coaches within or outside the firm, data should be processed to information and presented to the vitality coach. The vitality coach is shown personal information of individual employees with the intent to support the prevention of burn-out related cases. In the situation that the individual profile indicates an increased risk of burn-out or an increase of burn-out related symptoms, the vitality coach can decide to approach the employee in order to check the current health- or performance status of the employee. As posed by Interviewee #1, it is extremely important that the approach of the individual knowledge does not become a “self-fulfilling prophecy”. Interviewee #1 states that “the availability of information can contribute to the process of burn-out”. This is often based on the ambition of knowledge workers who do everything they can to maximize performance. This key characteristic of knowledge workers is elaborated in Chapter 3.

In order to prevent this “Self-Fulfilling Prophecy” risk, user guidelines should be very clear and should incorporate at least the following two guidelines:

1) Intervention is intentionally conducted as a prevention method. This implies that an approach of a vitality coach is always preventive and therefore does not indicate any persistent burn-out related syndrome;

2) Approaches of vitality coaches are conducted systematically, also among knowledge workers who do not have an increased burn-out risk. Vitality coaches follow a standardized interview protocol. Knowledge workers do, as a result, not know whether they are approach due to an increased burn-out risk notification or an routine-questionnaire.
Privacy and Data Security
Following Design Objective #5, the privacy of all participating knowledge workers should be guaranteed. Therefore, adequate measurements should be taken to fulfill this design objective. To fulfill the design objective, the following three measurements should be taken:

1) Privacy and data regulation of the firm should be compliant to the National and European Privacy and Data guidelines, which are described on the website of the European Commission (Data Protection, 2021). Through doing this, the firm is responsible and accountable for any mistakes in relation to the collection and sharing of personal data of its employees.

2) Vitality Coaches, company doctors or other employees or external consultants who are responsible for the monitoring and intervention of the employees of a particular firm, should be obliged to sign a Non-Disclosure Agreement (NDA) with appropriate fines for intentional and/or unintentional mistakes. Through doing this, the individual consultant becomes juridically personal compliant for any mistakes in relation to the collection and sharing of data and any interventions done based on this data.

3) Any consultant should always be cleared of any potential conflict of interest to avoid misuse of the data for any other goal than the prevention or curation of burn-out related symptoms and/or performance enhancement. For example, the consultant should not have any other relationship within or without the firm with the individual knowledge worker which is coached, helped or supported in any other way by the consultant.

Levels of the individual profile
The individual profile should consist of four levels:

1) The Knowledge Worker Energy Overview - Level - The first level provides an indication of the individual knowledge worker’s battery. A three step indication is suggested:
   a. High Energy Levels. This indication is indicated with a full battery. This indication implies minimal burn-out risk, low room for improvement and does not require intervention
   b. Average Energy Level. This indication is indicated with a 2/3 charged battery. This indication implies average burn-out risk, average room for improvement and does not require intervention.
   c. Low Energy Level. This indication is indicated with a 1/3 charged battery. This indication implies above-average burn-out risk, high room for improvement and does require preventive intervention.

2) The Knowledge Worker Battery Overview-Level The second levels provides a dashboard of the individual knowledge worker. The same dashboard is shown as shown in the individual knowledge worker’s profile. Two dashboards are shown:
   a. Health Dashboard - This dashboard provides an overview of the three dimensions of the body-mind-spirit model and the determinants which are part of this level of the “Personal”-level of the Vitality Map which is drawn in Picture 8. This dashboard provides an overview of the three dimensions which determine knowledge worker vitality. Secondly, it provides an overview and the current status of the adjustable determinants which are directly in the circle of interest of the knowledge worker and the vitality coach which allows the vitality coach, as Design Objective X prescribes, to analyze the energy status of the knowledge worker and the root of potential problems and allows the vitality coach to develop adequate interventions.
   b. Performance Dashboard - This dashboard provides an overview of the skills and competences of that particular knowledge worker. The skills and competences which are shown in this dashboard are determined based on the professional requirements of that particular firm on one side and the professional ambitions of the individual knowledge worker on the other side. The knowledge worker is asked, as part of a monthly performance survey, to assess their own skills in relation to the demanded skills for the professional tasks of the knowledge worker. As a result, the Skill Dashboard provides an overview of the perceived skills of the knowledge worker in relation to the professional challenges, which is indicated by Bandura (1999) as the most important source for energy charge or discharge. Moreover, this overview indicates the learning requirements for that particular knowledge worker and allows the consultant to develop interventions, such as e-learning or offline
training programs, in order to develop the skill dashboard of the employee. A 1-10 scale is used, in order to monitor trends.

The Health Dashboard should have the option for knowledge workers to make it invisible. This feature has been emphasized by Interviewee 1, who explained the potential risk of this overview as an additional stressor for the knowledge worker. The information within the Health- and Performance Dashboard is combined into the energy level indication as presented in level 1 of the individual dashboard. The design for these dashboards are developed in the Design & Development Phase 2 and are presented in Chapter 7.

3) **The Determinant-Overview Level** - The third level provides an in-depth overview of the construction of the two dashboard. This overview consists of two elements:
   a. An overview of the determinants which are posed in the Vitality Map and the results of the measurements which are collected through the instruments which are described in the following Chapter. This overview of determinants only applies for the Health Dashboard.
   b. A trend analysis, with an overview of the results in a particular period of time. As a result, individual results are presented in the context of a development over time.

4) **The Intervention-Overview Level** - Level four provides a planning and overview of the actions and interventions which are planned in the upcoming period. This actions and interventions consist of four categories:
   a. Systematically generated personalized surveys and other instruments, based on the results of machine-learning algorithms which are generated based on the results of previous instruments. More information about this Machine Learning algorithm is described in Chapter 3 and Chapter 5.
   b. Personalized interventions which are developed by the Vitality Coach. This interventions are based on the personal observations of the Vitality Coach.
   c. Personal interventions which are demanded by the individual knowledge worker.
   d. Interventions and actions which are posed by policy developers of the firm, such as generic surveys, corporate wellness programs and e-learning programs. This interventions are distributed on different group levels.

Cross-company analysis
The dashboards should also allow individual profiles to be aggregated to groups, such as teams, divisions or even offices. The aggregated data allow vitality coaches to develop understanding trends and organizational challenges in order to advise the firm’s decision and policy makers.

4.3.3.2 Organization Dashboard
The Organization Dashboard is the dashboard which is shown to managers, policy developers, executives and other internal stakeholders of the firm in order to support decisions and policy development. The dashboard allows the firm’s decision maker to develop generic understanding about the challenges which occur throughout the company and, based on these understanding, develop interventions.

The Organization Dashboard consists of the same four layers as the Individual Profiles Dashboards. However, the data is not shown on an individual level but on a group, division or office-level. This implies that individual data is aggregated. To allow the decision support system to function adequately, visualizations of the aggregated data should be presented by the system.

The Knowledge Worker Energy Overview-level
This level provides an overview of the total amount of knowledge workers in a particular group, division or office in each category. The three categories are elaborated in Chapter 5.3.3.1. Policy Developers can determine the ratio at which they decide to intervene.

The Knowledge Worker Battery-Overview Level
This level provides a summarized overview of the status of the determinant-classes which influence knowledge worker energy levels. In relation to the Health Dashboard, the different dimensions which determine health are visualized based on the aggregated input data. Policy developers should
see the average score and the quantity of individual scores. As a result, policy developers know which battery is the main cause of battery discharge.

In relation to the Performance Dashboard, the same applies. As posed in Chapter 5.3.3.1, a 1-10 score is adopted in which the 10-score relates to “Complete congruence between perceived skills and expected professional output” and the 1-score relates to “No congruence between perceived skills and expected professional output”. The Organization Performance Dashboard should show both average scores as an overview of the quantity per score per skill. Based on this information, policy developers understand which skills should be developed or which expected professional output should be mitigated.

The Determinant-Overview Level
This level shows an overview of the aggregated data on a group, division or organizational level of the Vitality Map. Per determinant an overview is shown which provides the policy developer of the required information to develop understanding about the current status of that particular determinant. For example, in relation to physical exercise, an overview is shown of the average duration of exercising per day and the quantity of knowledge workers per exercise category (less than 30 minutes a day, between 30-60 minutes per day, et cetera). Through this information, policy developers understand which determinant-dimensions the to-be developed intervention should incorporate.

The Intervention-Overview Level
As posed in Chapter 5.3.3.2, the fourth category of personal programs are distributed by company policy developers. For example, policy developers might be interested to send out generic employee satisfaction surveys, to improve safety awareness through e-learning or want to distribute corporate wellness programs which stimulate exercising during working hours. This interventions are developed based on the policy developers analysis of the first three levels of the Organization Dashboard, and are distributed about selected groups. If a particular intervention is only relevant for one particular group, division or company department, the intervention is only distributed amongst that particular group.

4.3.3.4 Machine Learning
As elaborated in Chapter 3, Multi-Kernel Machine Learning Algorithms are capable of predicting n+1 results based on incomplete data. Multi-Kernel Machine Learning Algorithms are, in essence, built on multiple different layers. A visual representation on how this works is shown in Figure 14. The first layer are generic determinants, such as weather and biological determinants (also see Figure 15). The next layers are determined based on the particular group that particular individual, such as gender, occupational group, demographics, geographics, age, personal traits, et cetera. Through this algorithm, data should not be complete in order to provide an accurate approximation of, for example, the energy profile of a particular knowledge worker. The research of Taylor et Al (2017) concluded that Multi-Kernel Machine Learning is highly appropriate for calculating and predicting mood, energy and stress-related determinants based on smartphone collected data.

The Machine Learning Algorithm is used for three applications. First, individual profiles which are not complete due to insufficient data are completed by the algorithm. Second, trend analysis in hindcast is extrapolated in order to predict future developments which allow policy developers to assess their interventions based on future results. And third, personal data collection is established based on the predicting features of the machine learning algorithm. As elaborated in Chapter 3, all determinants relate to each other, and all determinants have a higher likelihood of significance for particular knowledge worker groups. For example, women and men of an age around 30 have a higher likelihood of burn-out due to their “second-shift”. As a result, the machine learning algorithm will develop surveys for these particular groups collecting personal information about these particular determinants in order to assess this risk.

4.4 Relationships between the building blocks
In this Chapter, the relationships between the building blocks of the conceptual framework are elaborated.
4.4.1 Collection and sharing of data

4.4.1.1 Between the Body-Mind-Spirit Charging stations and the dashboards

As elaborated in Chapter 5.3.3.4, Machine Learning Algorithms are incorporated in order to facilitate personal data collection. In Chapter 5.3.3.1, the different categories of intervention and data collection are presented. The personalized data collection origins from four user groups: the algorithm, the vitality coach, the firm policy developers and the knowledge worker itself. In this chapter, the different methods which are incorporated are elaborated.

Survey Design Features

The system should incorporate an easy-to-use and intuitive survey design feature, which allows vitality coaches and policy developers to design their own surveys and questionnaires. As a result, questionnaires can be distributed about particular organizational determinants, such as employee satisfaction, leadership culture and employee contribution.

Validated Questionnaires

The artefact should have a database of validated questionnaires on the determinants for which these are available. An example is the burnout questionnaire of Maslach (1999). These questionnaires are scientifically validated and allow the system to, in these particular example of Maslach, to diagnose burnout’s and to take preventive measures. Similar questionnaires have been developed for, for example, sleep and “second-shift”-related burnouts. These validated questionnaires can also be distributed by the machine learning algorithm.

Quantitative Measurements with Smartphones or Smartwatches

As described by Lupton (2010), Smartphones and Smartwatches are able to measure many functioning features of the human body. For example, Smartwatches can measure GPS-data (and thus exercising activities), heart rate and heart rate variability. Both the vitality coach as the machine learning algorithm can suggest to measure particular features of the human body in order to get more understanding about particular determinants of the Vitality Map. This measurements can be structurally or for a particular period in time. For example, if a particular knowledge worker rates high levels of occupational stress for a longer period of time, the vitality coach (or the machine learning algorithm) can ask the knowledge worker to share its hearth rate variability and sleep for a period of two weeks. Based on the collected data, the Vitality Coach can ensure that occupational stress is still in acceptable margins. Moreover, if the particular knowledge worker does not have a Smartphone or Smartwatch available, firms might consider to establish a shared-device center which the Vitality Coaches can use to collect data. If it is required to collect data in relation to sleep or heart rate, the device is send to the knowledge worker and send back after the determined period of time.

Quantitative Measurements with other devices

As elaborated in Chapter 3, corporate wellness programs often incorporate body check-ups in order to check whether the knowledge worker population is in health conditions. This is an expensive execution. The artefact allows firms to continuously monitor their knowledge worker population and only invite high-risk knowledge workers for further elaborative check-ups, including cardiac research or BMI-measurements. The results are uploaded to the personal health profile of the individual knowledge workers to retain an central point of analysis.

4.4.1.1 Between the effort and the dashboards

In Taylor’s et Al (2017) research, the researchers found that incoming dials and text messages provide a significant indicator for occupation burnouts. Extrapolating this conclusion, the personal calendar of a particular knowledge worker might also be a relevant indicator of occupational stress. As elaborated in Chapter 3, effort has three dimensions, namely direction, duration and intensity. The second dimension can be distilled from the calendar directly. If a particular knowledge worker is worker many hours, this can be distilled from its calendar since all appointments are scheduled in the calendar of the knowledge worker. Logically, not all working hours are incorporated which provides a limitation for these data collection feature. For example, checking emails and making presentations or not always scheduled in a calendar. Two solutions are proposed to minimize the impact of this limitation. The first solution is to adopt machine learning algorithms to develop a multiply factor for working hours, based on previous measurements and occupational group. The second solution is, that the measurement tools of Taylor et Al’s research is extended to three sources. The first tool is the measurement of Smartphone activity, which has already been
incorporated in their research, and which involves amount of incoming and outgoing calls and text messages. The second tool is the proposed calendar feature in this Thesis Research. The third tool is laptop screen activity. The proxy of this three tools, expending the tools of Taylors et Al (2017) research, might be a significant indicator for occupational workload of knowledge workers. This should be explored in further research.

However, not all three dimensions representing effort are incorporated. Therefore, in the scenario that the Vitality Coach or the machine learning algorithms analyses that occupational stress might be a significant determinant for a particular knowledge worker, additional information about direction and intensity should be collected in order to acquire a complete overview of the occupational workload. This overview can be acquired through the collection of four additional data points over a particular, depending on the assessment of the Vitality Coach or the machine learning algorithm, of time. The first data point is the direction of effort. This data point can be collected through calendar integration with the design artefact through sending a survey to the knowledge worker about the kind of work a particular appointment in its calendar involves. The second data point is the intensity of effort, which can be collected through asking the knowledge worker after every calendar appointment how intense, for example on a 1-10 scale, the appointment was perceived. The collection of both the direction and intensity of effort data points can be conducted at the same time. The third data point is stress, which can be collected through daily surveys in the morning and is collected through a single-question survey with a 1-10 scale. The fourth data point is energy, of which the collection can be combined with the stress data point and which is collected on the same way with a single-question survey with a 1-10 scale. Through connecting the stress and energy data points on one side and the dimensions of effort on the other side, an approximation of the occupational workload in the future and its impact on the knowledge worker can be conducted.

4.4.2 Personal interventions
The personal interventions consist of two kind of interventions. The first is human intervention of the Vitality Coach, the second is the distribution of e-Learning.

Intervention of the Vitality Coach
If the individual profile of the knowledge worker indicates a particular risk or another reason for the Vitality Coach to approach the knowledge worker, a human-based intervention can be considered. As emphasized by Interviewee 2, 3 and 4, it is important that the intervention does not become a “self-fulfilling prophecy”. Moreover, the Vitality Coach should be aware that the intervention is done based on decision support system which runs on data, and as a result, the information might not be complete or not completely accurate. Therefore, the intervention should always have an explorative character to ensure end-users (i.e: knowledge workers) to stay calm.

Distribution of e-learning
Based on the collected information and the Health- and Performance Dashboard of the individual knowledge worker, e-learning modulus can be considered as an appropriate intervention. E-Learning modulus are easy-to-follow, do often not take much time, and can function as nudges in order to accomplish behavioral development of the knowledge worker. This last feature has been emphasized to have significant value by Interviewee 4 and 5. The artefact should incorporate Learning Management Systems (LMS) features and thus provide the infrastructure to incorporate external e-learning modulus. As a result, an extensive database can be created of e-learning modulus for all determinants which allows the artefact to present e-learning modulus for the determinants which are relevant for a particular knowledge worker. Moreover, e-Learning might also be distributed for the development of skills in the situation that the personal skill assessment of the knowledge worker indicates this individual need.

Offline Training
In essence, offline training aims to serve the same goal as e-learning. Training is more expensive, but might have more impact in particular cases or needs of knowledge workers. Offline training is scheduled similar as e-learning through the intervention overview level.

4.4.3 Rewards
As elaborated in Chapter 3, rewards systems are an integral part of human resource management. Reward systems are traditionally to motivate employees in order maximize output. Rewards systems
should be extended from evaluation in hindsight to enhancement and optimization during the process of professional task fulfillment. Employees should be motivated to share information about their health, skills and performance in order to allow themselves and their environment (e.g.: vitality coaches or appointed consultants) to optimize performance. When this information becomes available, this allows the stakeholders to act directly and not wait for evaluation at the end of the year, when the positive results of evaluation cannot influence last year.

Different kinds of reward systems, as described in Chapter 3, can be incorporated. However, based on the argumentation of Interviewee 5, rewards systems should encourage internal sources of motivation (e.g.: personal development and/or ambition) of knowledge workers instead of external sources of motivation (e.g.: money, bonuses). Therefore, human resource managers and human resource management system developers should incorporate rewards systems which encourage internal sources of motivation. We suggest the “We invest in you, if you invest in yourself”-principle. This implies that knowledge workers are rewarded when they show that they are conscious about their personal health and development. This can be measured in terms of shared data (e.g.: amount of filled in surveys) or amount of fulfilled interventions (e.g.: amount of e-learnings which are finished). Every finished intervention can be rewarded with a personal development budget, such as budget for external coaching, professional courses and/or fitness-programs. The key characteristic of these rewards is that they both serve the personal ambition of the knowledge worker (as elaborated in Chapter 3) as the firms strategic goals.

4.4.4 Planning of tasks
Based on the information on the Organisation Dashboard, managers and policy developers within firms can assess the strategic planning and distribution of tasks across the firm. For example, when particular divisions experience high levels of workload, stress or other sources of increased burn-out risk, the managers can decide to distribute tasks across other divisions of the firm. Moreover, other interventions can be developed in order to optimize the energy levels of the individual knowledge workers. For example, new hires might be considered, but also the training of employees might be an adequate intervention if the organization dashboard shows that not the workload, but the perceived skills of the employees is the main source of stress. Due to the increased information which is available for managers and other stakeholders in the decision support system, more accurate and adequate interventions can be developed.

4.5 demonstration of design phase 1
As introduced in Chapter 2, the RDSM of Peffers et Al is adopted. This research approach allows space for iteration rounds between the Design & Develop Phase and the Evaluation Phase. In this Thesis Research, two design phases are introduced, each followed by a demonstration phase. The demonstration phases consist of two rounds of semi-structured interviews. In the first design phase, a conceptual framework is developed which provides a design tool which managers and policy makers within firms can adopt to develop human resource management systems for their organizations. This design phase is followed by the first demonstration round, in which experts out of the different theoretical domains are interviewed to validate the conceptual framework and to collect relevant feedback. In this Chapter, the relevant information and conclusions from the first Design, Development & Demonstration round is presented. First, the interviewees are presented. Second, the interview protocol is elaborated to ensure the fulfilment of the objectives of the first evaluation round.

4.5.1 Interviewees selection & overview
Human Resource Management Systems incorporates multiple theoretical domains (also see Figure 3). Moreover, Human Resource Management is a discipline which has been practiced since the introduction of professional occupation. Therefore, it is important to carefully select interviewees in order to incorporate all the perspectives of the theoretical domains into the assessment of the conceptual framework. Moreover, taking the academic background and the inherent limitation of time, is it even more important to be rigorous in the selection of interviewees.

In order to maximize information collection of the interview, knowledge sampling methodologies has been adopted. Marshall (1996) proclaims that there are three categories of naturalistic
sampling: convenience, judgement and theoretical sampling methods. Random sampling is used for quantitative applications, but not for qualitative studies considering the fact that “studying a random sample provides the best opportunity to generalize the results to the population but is not the most effective way of developing an understanding of complex issues relating to human behaviour”. (Marshall, 1996). For the goal of this of Thesis Research, the “Judgement Sampling” methodology is adopted. This sampling methodology is more rigorous compared to “Convenience Sampling”, which is the “the least costly to the researcher, in terms of time, effort and money, but may result in poor quality data and lacks intellectual credibility” (Marshall, 1996). Adding to this, a “maximum variation sample” is adopted, which is implied through the incorporation of the five theoretical domains which are researched for the design of the artefact.

The same sample is interviewed for the first and second round of the evaluation phase, in order to build forward on the existing knowledge and commitment to this Thesis Research. In Figure 17, an overview is presented of the experts which are interviewed in this research. The information about the interviewees is anonymized due to privacy regulations.

<table>
<thead>
<tr>
<th>INTERVIEWEE #</th>
<th>ABBREVIATION</th>
<th>BACKGROUND</th>
<th>THEORETICAL DOMAIN EXPERTISE</th>
</tr>
</thead>
<tbody>
<tr>
<td>INTERVIEWEE 1</td>
<td>IN1</td>
<td>Vitality Coach of leading Vitality Consultancy Firm Vitality &amp; Health, Knowledge Workers</td>
<td></td>
</tr>
<tr>
<td>INTERVIEWEE 2</td>
<td>IN2</td>
<td>Professor of Utrecht Medical Centre (UMC) and Amsterdam Medical Centre (AMC) Vitality &amp; Health</td>
<td></td>
</tr>
<tr>
<td>INTERVIEWEE 3</td>
<td>IN3</td>
<td>Freelance Vitality Coach &amp; Burnout Specialist Vitality &amp; Health, Knowledge Workers</td>
<td></td>
</tr>
<tr>
<td>INTERVIEWEE 4</td>
<td>IN4</td>
<td>Founder of vitality management start-up Human Resource Management Systems, Artificial Intelligence</td>
<td></td>
</tr>
<tr>
<td>INTERVIEWEE 5</td>
<td>IN5</td>
<td>Medical Director of leading Burn-Out Clinic Vitality &amp; Health, Performance Management, Human Resource Management Systems</td>
<td></td>
</tr>
<tr>
<td>INTERVIEWEE 6</td>
<td>IN6</td>
<td>Account Director of leading Burn-Out Clinic Vitality &amp; Health, Knowledge Workers, Human Resource Management Systems, Performance Management</td>
<td></td>
</tr>
<tr>
<td>INTERVIEWEE 7</td>
<td>IN7</td>
<td>Human Resource Manager of a large insurance company Performance Management, Knowledge Workers</td>
<td></td>
</tr>
<tr>
<td>INTERVIEWEE 8</td>
<td>IN8</td>
<td>Human Resource Director of a large insurance company Performance Management, Human Resource Management Systems, Knowledge Workers</td>
<td></td>
</tr>
</tbody>
</table>

Due to unexpected circumstances within the firm of the Interviewee 7 and Interviewee 8, their interview is conducted together at the same moment (see Appendix A for the transcription).

4.5.2 Interview Set-Up
As stated by Denzin & Lincoln, the adoption of qualitative research methods by researchers encompasses “crosscuts (of) disciplines, fields, and subject matters”. (Denzin, 2000). In order to extract the maximum value of expert interviews, extensive preparation of the interview. Jacob et Al (2012) elaborated on the basic principles of conducting interviews, and support to establish rigorous interview protocols. The established the following core principles on interview protocols which are adopted in this research process. Taking the limited time for this Thesis Research into account, a limited amount of interviews can be conducted. Therefore, the interview protocol should be very concise in order to maximize the valuable information which can be distilled from the interview.
Various typologies of qualitative interviews have been identified by scholars. Daniel W. Turner (2010) summarizes the three typologies of qualitative interviews which can be adopted by researchers to retrieve information from experts in the field. Turner describes three categories. The first, is a “informal conversational interview”. McNamara (2008) states that “With the informal conversational approach, the researcher does not ask any specific types of questions, but rather relies on the interaction with the participants to guide the interview process”. The second typology is described as the “General Interview Guide Approach”. This approach is described as “more structured than the informal conversational interview although there is still quite a bit of flexibility in its composition (Gall, Gall, & Borg, 2003).” Therefore, as stated by Turner, the risk of this research approach is “the lack of consistency in the way research questions are posed because researchers can interchange the way he or she poses them. With that in mind, the respondents may not consistently answer the same question(s) based on how they were posed by the interviewer”. As a result, the value of the interviewee is dependent on “the ability of the researcher (...) to ensure that the same general areas of information are collected from each interviewee; this provides more focus than the conversational approach, but still allows a degree of freedom and adaptability in getting information from the interviewee”. (Turner, 2010) The third category in qualitative interviewing is the “standardized open-ended interview”. This qualitative interview approach is described as “extremely structured in terms of the wording of the questions. Participants are always asked identical questions, but the questions are worded so that responses are open-ended” (Gall, Gall, & Borg, 2003). As a result of the same questions, this interview methodology allows researchers to codify their data best of the interview methodologies. However, considering the extensive expression of interviewees as a result of the open-ended questions, this interview might also result in codification problems for the researcher. Therefore, as concluded by Gall, Gall, and Borg (2003), this methodology is particularly valuable to “reduce(s) researcher biases within the study, particularly when the interviewing process involves many participants.”.

The interview conducted for the first Design & Development Phase has two main objectives. The first, is to validate the conceptual framework and ensure that the framework fulfills the design objectives. Only exception to this is Design Objective 6, which refers to the usability of the tool by its end-users and therefore is not yet incorporated in the conceptual framework and therefore not yet incorporated in the this phase of the artefact design. Second, the interview aims to gather new information. For example, new determinants within the Vitality Map could be discovered through interviewing. Considering the design objectives of this interview, the amount of interviewees and the advantages and disadvantages of the three described interview methodologies, the “General Interview Guide Approach” is adopted.

4.5.3 Interview protocol
Taking into account that the interviewees do have limited time to get a comprehensive view of the solution, efforts are made to ensure that the objectives of the first evaluation phase are fulfilled. This is accomplished by drafting an easy to understand visual tool which helps the interviewees to easily understand the building blocks and interrelations of the conceptual framework. The use of semi-structured interviews are used in order to leave space in the conversation for the professional expertise of the interviewee. Human Resource Management Systems are a broad field of operations, and “a global multi-billion dollar business” (Interviewee 5). Moreover, Interviewee 5 states that “no company worldwide has found the holy grail yet, even not Silicon Valley companies as Fitbit, Google and Apple”. Especially in the first phase of design and evaluation, this semi-structured interviewee approach creates the opportunity to ask follow-up questions which are not directly described in the interviewee protocol. This interview structure potentially results in the identification of additional relevant determinants in the conceptual framework.

The duration of the conducted interviews was between 60 and 90 minutes, depending on the available time of the interviewee and the natural course of the conversation. The interview essentially consists of three parts:

1. Personal introduction of the researcher and the interviewee.
In this part of the interviewee, the researcher also discusses personal experiences of the interviewee in relation to human resource management systems. The main question which is asked is the following:

- “Do you have personal experiences with human resource management systems?”
2. Introduction of Thesis Research. 
This is done by introducing the problem statement and the different theoretical domains which are incorporated in this Thesis Research.

3. Validating the design objectives. 
Before explaining the conceptual framework, first the design objectives are validated. A list of design objectives is presented to the interviewee, in which both the complication, challenge or opportunity from the literature research is presented, which results in the Design Objectives. The results of this step are used in the optimization of the conceptual framework in the First Design Phase. The main question which is asked is the following:
➢ “Do you recognize the design objectives which are presented? Which one would you add, delete or adjust?”

4. Validating the Vitality Map-framework and exploring its potential missing determinants. 
In this step, the Vitality Map is explained. Part of this explanation are the different levels in which determinants are identified. All interviewees have experience in relation to management of knowledge workers, identification of burn-out’s, prevention of burn-out’s or IT solution which are aimed at performance enhancement. As a result, all interviewees are expected to have basic knowledge about the fundamental determinants and relations which influence the risk of knowledge worker burn out. The main question which are asked are the following:
➢ “Do you recognize the Vitality Map as a visualization of the determinants which influence the energy levels of knowledge workers, and thus potential burn-out?”
➢ “Which adaptations would you suggest for the Vitality Map, for example in its structure and the determinants which are included?”

5. Validating the Conceptual Framework. 
In this step, the Conceptual Framework is introduced. This Framework provides the visualization on how the design objectives can be accomplished. The Conceptual Framework is discussed with the interviewee with the goal of retrieving additional information about the framework. An important note in this step, is that the solution is new for the experts, and that much knowledge is required about both the fundamental dimensions of the framework. Interviewees might have in-depth expertise about one or two dimensions, but as visualized in Figure 3, the solution interacts on the boundaries on the five (artificial intelligence, human resource management systems, vitality & health, performance management and knowledge workers. As a result, some interviewees might found it difficult to comprehend the integrated potential of the solution. Potential additions are adjustments are discussed with the interviewee. The main questions which are asked are the following:
➢ “What would you, from your professional perspective, adjust or add to the conceptual framework in order to improve the framework?”
➢ “Do you consider the conceptual framework as a potential contribution to current human resource management systems on the market?”

6. Recap, conclusion and finalization of the interview. 
At the end of the interview, the interview is summarized and the interpretations of the researcher are discussed with the interviewee in order to minimize the risk of biases and/or misunderstandings. The interviews are transcribed in Appendix A.

4.5.4 Data Analysis
For this analysis of the interview, constant comparative analysis is adopted. This strategy, following Thorne (2000), involves “taking one piece of data (one interview, one statement, one theme) and comparing it with all others that may be similar or different in order to develop conceptualisations of the possible relations between various pieces of data.”.

Based on the interview, quotes relating to these two goals are distilled and analysed for potential adjustment or addition. In order to incorporate the proposed recommendation of the interviewee, three criteria are determined:

i. **Scientific alignment** - If existing literature or scientific research confirms the argumentation of the interviewee, a higher likelihood of adoption of the recommendation is appointed.

ii. **Congruence with statements of other interviewees** - If statements of interviewees are not congruent with other statements of themselves or with other interviewees, the recommendation will be appointed a lower chance of incorporation.
iii. **Valid deductive reasoning** - This Thesis Research incorporates five theoretical domains, which might result in conflicts of theoretical domains and new insights due this cross-domain research. Moreover, interviewees might be experts in a selection of these theoretical domains, but are never experts in all. As a result, deductive reasoning is a valuable method to develop new insights. If the deductive reasoning is valid, the recommendation is adopted.

### 4.5.5 Conclusions & Modifications

As elaborated in Chapter 6.2, the first goal of the first Demonstration Phase is to validate the conceptual framework. First, the design objectives were discussed with the experts. Minimal additions or adjustments to the design objectives were presented and thus, it is concluded the output of the literature research and the starting point of thesis research is accurate. Second, after nine interviews, we can conclude that the conceptual framework is validated. The experts were unanimously enthusiastic about the design of the conceptual framework. Third, the Vitality Map was presented. The experts concluded on the Vitality Map as a valuable visualization of the potential sources of burnout. Experts provided recommendations for minor adjustments and additions. In Figure 18, an overview is presented of the recommended adjustments and additions of the interviewees.

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>RECOMMENDATION</th>
<th>ACTION</th>
<th>INTERVIEWEE</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>REWARDS</strong></td>
<td>Exclude external sources of motivation, but only adopt internal sources of motivation, such as personal ambition or meaning in work</td>
<td>Adjust</td>
<td>IN4 &amp; IN5</td>
</tr>
<tr>
<td><strong>VITALITY MAP</strong></td>
<td>Include an additional determinant which represents all unknown factors</td>
<td>Add</td>
<td>IN4</td>
</tr>
<tr>
<td><strong>VITALITY MAP</strong></td>
<td>Change the categorization intrinsic/extrinsic to adjustable and non-adjustable.</td>
<td>Adjust</td>
<td>IN2</td>
</tr>
<tr>
<td><strong>VITALITY MAP</strong></td>
<td>Provide an holistic approach which facilitates self-management of the knowledge worker in relation to both health as skills development</td>
<td>Adjust</td>
<td>IN1, IN2, IN3</td>
</tr>
<tr>
<td><strong>VITALITY MAP</strong></td>
<td>Add resilience as a separate determinant in the personal adjustable section</td>
<td>Add</td>
<td>IN1, IN2</td>
</tr>
<tr>
<td><strong>PERFORMANCE</strong></td>
<td>Adapt the visualization of performance and tasks, in such a way that task follow from the firm-side of the framework and effort on the knowledge worker-side of the framework</td>
<td>Adjust</td>
<td>IN2</td>
</tr>
<tr>
<td><strong>PERSONAL INTERVENTION</strong></td>
<td>Add intervention protocols, which help vitality coaches to intervene at the right way and which ensure that the knowledge worker does not become stressed about the fact that he has been approached</td>
<td>Add</td>
<td>IN1 &amp; IN4</td>
</tr>
<tr>
<td><strong>PERSONAL INTERVENTION AND DATA COLLECTION VITALITY MAP</strong></td>
<td>Incorporate a text-message based design which is known with the target group and easy-to-use, and which intuitively fulfills the Design Objective which relate to autonomy.</td>
<td>Add</td>
<td>IN4, IN8 &amp; IN9</td>
</tr>
<tr>
<td><strong>VITALITY MAP</strong></td>
<td>Categorize “Weather Conditions” separately from the professional and personal environmental factors</td>
<td>Adjust</td>
<td>IN2</td>
</tr>
<tr>
<td><strong>DATA COLLECTION</strong></td>
<td>Ensure that the adaptability of the frequency of notification of the system, since this notification are an important source of stress.</td>
<td>Adjust</td>
<td>IN1</td>
</tr>
<tr>
<td><strong>VITALITY MAP</strong></td>
<td>Coping mechanisms should be added to the psychological dimension of the Vitality Map-Framework.</td>
<td>Add</td>
<td>IN8 &amp; IN9</td>
</tr>
</tbody>
</table>
5. DESIGN & DEVELOPMENT PHASE 2 | DEVELOPING THE PROTOTYPE

As elaborated in Chapter 2, the design research framework is modified for the purpose of this Thesis Research. Two Design & Developments phases are incorporated, and two Demonstration Phases. As introduced in Chapter 5, the first Design & Development phases is the most comprehensive, since it incorporates eight out of nine Design Objectives, only excluding Design Objective 6. However, the development of a prototype has two main objectives. The first, is to validate the design direction which fulfills Design Objective 6. Secondly, considering the required expertise and knowledge for the understanding of a new-developed artefact, a concrete example on how the artefact works contributes to the level of understanding of the interviewee and facilitates more specific feedback. Therefore, a prototype is developed in Design & Development Phase 2, which incorporates the guidelines of the conceptual framework into practice. In this chapter, the different design features of the prototype are introduced. Moreover, it is explained how of each design feature relates to the design objectives.

Screenshots of the developed prototype are included in Appendix II.

5.1 Text-Based Front Interface

The front-interface of the prototype associates with the front-interface of Whatsapp. This interface and the interaction of individuals with the system incorporates multiple essential characteristics which comply to the Design Objectives.

First, in relation to Design Objective 6, the system is easy and intuitive to use. Almost all professionals are familiar with text-based message systems which makes it easy to adopt. As introduced in Chapter 3.4, high levels of complexity and required new capabilities to adopt the system result in low levels of user engagement and user adoption of the system. Moreover, the text-based communication system interface provides an interface between human and computer interaction. The algorithm (as elaborated in Chapter 5) which develops personal questionnaires and e-learning programs communicates through chatting with the user of the system. This algorithm is personified in the system, which allows the user to interact with the artificial intelligence algorithm in an intuitive way.

Second, text-based applications comply to the design objective which prescribes high levels of autonomy of the knowledge worker. Using text-message based applications, it's upon the user of the application whether it replies the incoming text messages, or not. This feature distinguishes text-based application to human resource management systems such as Intuo or Unit4, which are organized based on external data-management systems. Within the context of this Thesis Research, the knowledge worker can decide itself whether it is going to participate on organizational surveys, personal questionnaires and e-learning programs. Knowledge workers who are engaged and committed to the organization and their own personal development will have a higher likelihood of participation than others, or will adopt more features of the system than others. Moreover, a relevant feature of text-based systems is that the user decides itself when it is going to reply to other users or to other required actions. The text-based communication system simply leaves the messages (or actions) unopened. Taking into account that all Dutch knowledge workers have experience with text-based systems, this feature will inherently provide a planning and activity integration mechanism. When the knowledge worker has time to interact with the system, it simply walks through the messages that are still open.

Third, in relation to Design Objective 4, users of text-based systems are familiar with its inherent small nudges which remind them to react. As introduced in Chapter 3.5, nudging provides a valuable learning mechanism which has proven to be an effective tool to accomplish behavioral change. Text-based systems are characterized by a high frequency of activity, but with low levels of information per activity. As a result, the system can use the text-message features for both sharing
surveys, e-learning modulus as small nudges, such as reminders for exercising, daily progress monitoring or e-mail checking.

Fourth, in relation to Design Objective 3, internal and external vitality consultants of the firm can intervene easily and check-in with the user. Users are familiar with small messages, and as a result, will not be bothered if a small message from a consultant comes in. As a result, the threshold for approaching knowledge workers will be lowered, which increases the likelihood of burnout prevention.

And fifth, in relation to Design Objective 7, the solution should allow differentiation of data sharing among different stakeholders. Text-message systems incorporate this fundamental key characteristic. Sending information to one addressee, ensures the user that the same message is not shared with other contacts in its address book. This feature, hypothetically, contributes to the perception of safe data-sharing and thus the compliance to Design Objective 7.

5.2 The Address-Book

Every user of text-based communication systems is familiar with its feature of approaching external people, such as family, friends or relatives. Another characteristic is that this address book can be used (or within the context of this Thesis Research, consulted) if support of any kind is desired. In essence, the text-based communication system puts the user in the center of the offline world and organizes all its potentially relevant contact around the user, and allows the user to get in contact whenever the user desires to. Within the context of this Thesis Research, this characteristic fulfills Design Objective 5, which prescribes that the knowledge worker expectations in relation to autonomy within its performance management and, in a broad sense, its management in general.

The address-book in the context of this Thesis Research is expanded. First, general business contacts of the firm are shown in the address book, which facilitates the artefact to become the basis for corporate communication through the company. Secondly, all internal and external consultants are adopted in the address book, which results in a network of professional experts organized around the knowledge worker. Depending on the firm’s organizational resources and the particular demands of the organization, this network consists of vitality coaches, sleep coaches, business coaches or any other expert. Third, e-learning modulus are incorporated in the address book on all determinants of the Vitality Map. The knowledge worker decides which contacts it wants to use.

5.3 The Personal Profile

Users of text-based communication systems are familiar with a profile which incorporates their personal information. This personal information is owned by the user and is sharing with other users based on personal data-sharing settings. For example, Whatsapp allows its users to share their personal status or the last moment of activity (“Last seen on XX:XX”) with their peer users. This characteristic of the text-based communication system is extended with the health and performance information of the user, adopting the same fundamental mechanism. The user is the owner of the information, and it shares this information with other users if the user decides to. This characteristic complies to Design Objective 5. The personal profile consists of three information sources. The first, is general personal profile, such as age, gender and occupation. The second, is the health dashboard, in which all health-related information of the knowledge worker is collected and combined in an overview which is easy and intuitive to understand. Third, is the performance dashboards, which provides an overview of the skills of the knowledge worker in relation to the expected professional output. The knowledge worker owns the information about itself, and decides itself on which dimension of the health and performance dashboard it wants to act.

As posed by Interviewee 4 and 5 in the first Demonstration Phase, the system should allow the knowledge worker to decide to make the information for themselves. The Interviewees emphasize the potential stressor this might create for particular groups of knowledge workers, especially the ones with high levels of ambition. This feature might also be turned-off as the result of advice of the vitality coach.
The Personal Profile should be as complete as possible for both the vitality coach as the artificial intelligence algorithm to be able to develop appropriate interventions. As introduced in Chapter 5 in the conceptual framework, rewards systems are introduced, following the proposed “We invest in you, if you invest yourself” principle. This principle involves, for example, targets of data sharing, participation in organizational surveys and e-learning participation. When more information the knowledge worker shares with the system, the profile becomes more complete, and the more accurate the proposed interventions will become. The knowledge worker is rewarded through additional resources for health optimization and/or personal development, feeding the internal motivation of the knowledge worker (also see Chapter 3).

5.4 The Organizational Dashboards
As elaborated in Chapter 5, the organizational dashboards consists of four levels. An example on how the first level can be designed is shown in Appendix III.

5.5 demonstration of design phase 2
In demonstration phase 2, the second design phase will be presented to the interviewees. In the first demonstration round, the conceptual framework is presented and discussed with the interviewees. The interview protocol for the first demonstration round is described in Chapter 6. The results of the second round of interviews are summarized in Chapter 7.5.5.

5.5.1 Interviewee Selection & Overview
As introduced in Chapter 6, two rounds of interviews are conducted with the same interviewees. This approach has two main advantages. The first, is that the interviewees can build forward on the knowledge and experience which is created in the first round of interviews, which develops a more comprehensive understanding of the subject. Second, the fundamental research methodology and the background of the research are explained in the first interview, which saves time in the second round of interviews. This is valuable, taking the limited time of the interviewees into account.

5.5.2 Interview Set-up
The interview is set-up adopting the same methodology as in the first demonstration phase, since the goal of the demonstration phases are similar. The goal of this second demonstration phase is to collect new insights and information about the prototype and the conceptual framework. The second, is the validation of the design direction of the prototype. The integral design of the artefact is outside scope of this Thesis Research. The adopted research methodology for this Thesis Research is elaborated in Chapter 6.2.

5.5.4 Interview Protocol
As stated in the introduction Chapter 7.5.2, the same group of interviewees are interviewed in two rounds. As a result, interviewees are generally informed about the background of the objectives. In this interview, therefore, is brief and has one three main objectives. First, the approach for incorporating Design Objective 6, which is not incorporated in the Conceptual Framework should be validated. Second, the visual design of the conceptual framework is discussed with the experts with the intent to validate the design direction. And third, adjustments and additions to the prototype and the conceptual framework are collected in order to optimize both the conceptual framework as the prototype. Taking into account that the conceptual framework is theoretical, a practical and concrete visualization might help interviewees to develop more in-depth understanding about the tool. Adjustment and additions which are posited by the experts throughout the interview are collected and summarized in Chapter 6.4. The following interview protocol is applied:

  1. **Checking in on each other**
  2. **Introduction of the prototype**
In this step, the goal of the development of the prototype is explained. Goal of this explanation is to manage expectations and to create space in the conversation for discussion and interaction.

  3. **Validating the direction of fulfilling Design Objective 6**
In this step, the prototype is introduced. Since Design Objective 6 focusses on the intuitive and easy use of the application. In order to accomplish this, the researcher has chosen to use a
communication-based design, which is recommended by Interviewee X. Objective of this step of the interview protocol is to validate the direction of the design, in order to fulfill Design Objective 6. Implications and limitations of this step of the interview protocol is discussed in Chapter 9. The main question which is asked is the following:

➢ “Do you think this design direction will accomplish high adoptability amongst knowledge workers?”

4. Collecting additional information and insights for final optimization

The objective of this step is to gather recommendations, adjustment and additions for further optimization of the tool. This is accomplished by showing the interviewee the different elements of the tool, and inviting the interviewee for feedback on particular elements of the prototype. The main question which is asked is the following:

➢ “Are there any adjustments and/or additions that you would suggest in order to optimize the tool?”

5. Recap, conclusion and finalization of the interview.

At the end of the interview, the interview is summarized and the interpretations of the researcher are discussed with the interviewee in order to minimize the risk of biases and/or misunderstandings.

5.5.4 Data Analysis

Similar as Demonstration Phase 1, the output and recommendations of the interviewees are weighted in order to decide whether the recommendations are incorporated in the final prototype. Four criteria are adopted. The first three are congruent with the selection criteria which are described in Chapter 6.4. The following four criteria apply:

i. **Scientific alignment** - If existing literature or scientific research confirms the argumentation of the interviewee, a higher likelihood of adoption of the recommendation is appointed.

ii. **Congruence with statements of other interviewees** - If statements of interviewees are not congruent with other statements of themselves or with other interviewees, the recommendation will be appointed a lower chance of incorporation.

iii. **Valid deductive reasoning** - This Thesis Research incorporates five theoretical domains, which might result in conflicts of theoretical domains and new insights due this cross-domain research. Moreover, interviewees might be experts in a selection of these theoretical domains, but are never experts in all. As a result, deductive reasoning is a valuable method to develop new insights. If the deductive reasoning is valid, the recommendation is adopted.

iv. **Congruence with conceptual framework** - The recommendations should be congruent with the conceptual framework which is validated in the previous Demonstration Phase. However, hypothetically, it might be possible that the practical character of the prototype results in new insights among the interviewees. If this occurs, the recommendation is weighted based on the first three criteria only.

5.5.5 Conclusions & Modifications

First, in relation to the first goal of this Demonstration Phase, it is concluded that some adjustments and additions should be made in order to optimize the design of the artefact in relation to the design objectives. An overview of the adjustments and additions which fulfilled the criteria as posed in Chapter 7.5.4 are presented in Figure 19.

In relation to the second goal, it is concluded that the design direction is validated. All experts emphasized the potential value the artefact might have. It is noted that the potential value depends on the final design and the technical performance of the solution. Therefore, it is emphasized that the design direction is validated and not the final design.

<table>
<thead>
<tr>
<th>CATEGORY</th>
<th>RECOMMENDATION</th>
<th>ACTION</th>
<th>INTERVIEWEE</th>
</tr>
</thead>
<tbody>
<tr>
<td>PERSONAL INTERVENTIONS</td>
<td>Provide a feature which allows the knowledge worker to turn notifications of, since one of the main sources of burnout is the “always-on” mentality</td>
<td>Add</td>
<td>IN4</td>
</tr>
<tr>
<td>INDIVIDUAL PROFILE</td>
<td>Provide a feature which allows the knowledge worker to turn-off its health profile, since this model might become a</td>
<td>Add</td>
<td>IN4 &amp; IN5</td>
</tr>
</tbody>
</table>
stressor for particular groups of knowledge workers

**INDIVIDUAL PROFILES**
Ensure that the visualization of data is correct, and do not facilitate misinterpretations  
Adjust  IN6 & IN9

**INDIVIDUAL PROFILES**
Include a feature which manages expectations in relation to the accuracy of interventions  
Add  IN6 & IN9

Figure 19 | Overview of additions and adjustment of Demonstration Phase 2

### 6. DISCUSSION

#### 6.1 Evaluation in relation to design objectives

In this Chapter, the artefact design will be evaluated in relation to the design objectives.

In the design, the fundament on which the artefact is build is the web of determinants which influence the knowledge worker battery level. The determinants, as explained in Chapter 3, each either charge or discharge the knowledge battery. For example, if workload is applied in appropriate terms within the acceptable margins, or when too much (i.e: the knowledge worker is too busy and becomes stressed) or too little workload (i.e: the knowledge worker has little to do which results in in confidence in own capabilities) is applied. All Interviewees have been unanimous about the added value of the Vitality Map, which provides a comprehensive summary of a meta-analysis of conducted research in relation to vitality management and burnouts. Moreover, after minor additions after the first Demonstration Phase, the Vitality Map is completed. In comparison with existing human resource management systems, the artefact incorporates, as a result of the Vitality Map, all determinants which influence the knowledge worker battery. The artefact allows, through its intuitive design and artificial intelligence integration, the knowledge worker to collect information based on calculated risks based on similar profiles or previous input of the knowledge worker. Every instrument which is adopted either to intervene or to collect data as based on this Vitality Map and the personal profile of the knowledge worker.

As elaborated in Chapter 9.1.1, the artefact is built on the Vitality Map. This discussion of the Vitality Map is incorporated in the Interview Protocol for the first round of interviews in Demonstration Phase 1. The Vitality Map is the result of an extensive literature research which is summarized in an easy-to-use framework. During the interviewees, the interviewees were asked for clarity of the framework and recommended additions or adjustments. The adjustments which incorporated if the adjustment criteria were add (i.e.: coping mechanisms, the unknown). The interviewees are agreed unanimously on the clarity and comprehensiveness of the framework.

It is emphasized by multiple interviewees that the information is often available, but it lacks of an holistic approach (as prescribed in Design Objective 2) which allows the firm or the particular person to integrate this information. Interviewee 9 & Interviewee 10 elaborated on the relation between a huge Dutch firm with its external company doctors. They concluded on the available information and they hypothesized that if this information was combined, prevention could be accomplished instead of curation of burnout related symptoms. As a result of the compliancy to Design Objective 2 and the segregation of personal data streams, the artefact allows to create a personal profile which involves the information which is required to develop preventive policies.

As published by Ben Tiggelaar (2018), behavioral change starts with an insight about behavior, health or any other related aspect. The second step is development, in which learned behavior or habits should be consciously changed in order to accomplish the desired result (e.g.: lower weight, more often exercising, higher vitality). The last step is to maintain the changed behavior, in order to prevent falling back in the same, undesired habits. Much research has been conducted about this topic, and researchers conclude on the required mix of support mechanisms which facilitate behavioral change. In line with this reasoning, blended learning mechanisms becomes blended change support mechanisms. The artefact incorporates a toolkit of instruments which fulfill the criteria of blended learning and support mechanisms, such as nudging (i.e.: small messages to
remind the user of its personal goal), e-learnings (i.e.: to develop more in-depth about a certain topic) and offline training and coaching. Moreover, this approach contributes to the contextualized approach of the knowledge worker who decides itself which kind of support mechanisms is preferred, providing a personal and contextualized approach for each user of the system.

Interviewees agreed on the psychological basic needs of knowledge workers for personal development and autonomy. Interviewees were unanimous about the congruence of text-based design of artefact with this Design Objective. Interviewee 7 & 8, working for a huge insurance firm, emphasized that the artefact would be appropriate for the knowledge worker population of the organization. They hypothesized that the tool would distribute to much autonomy and responsibility with the user of the artefact, which might result in an increase of stress due to this responsibility. In the interview, it is concluded that this potential burden might be minimized through the appropriate implementation of the artefact. Users should constantly feel that there are many support lines available and that the system does not replace conventional supporting tools such as evaluation talks manager and informal talks with colleagues near the coffee machine. The artefact combines, in essence, already existing communication streams and should create the feeling of additional resources, instead of an increased responsibility for own health and performance. This additional responsibility adheres the risk of causing stress for the knowledge worker, especially the knowledge workers with high levels of ambition (IN3). In conclusion, the conceptual framework and prototype facilitate the feeling of personal autonomy and personal development, but should limit this autonomy to minimize the risk of creating a network of individual knowledge workers instead of a synergetic team.

A prototype is developed which is built on the conceptual framework, which is discussed and validated in the first Demonstration Phase. However, it should be emphasized that the visual design of the application is outside of scope of this Thesis Research. The Researcher has chosen for the development of the prototype for two reasons. The first reason, is that the conceptual framework provides an abstract overview of the design of the system, but does not yet provide a concrete example on how the system should work in practice, which might limit the feedback of the experts during the Demonstration Phases due to their limited comprehensiveness. Secondly, the prototype shows a design direction of the artefact. The interviewees agreed unanimously on the potential of the design direction. It is recommended for further research to build forward on the developed prototype.

As shown in Chapter 6, the interviewees come from different occupation which relate to the theoretical domains which are incorporated in this Thesis Research. It is concluded that this Design Objective earns different levels of interest from different expert groups. Most of the Interviewees did not focus or provide feedback on this Design Objective. However, Interviewee 7 and Interviewee 8 emphasized that this Design Objective poses the greatest challenge for the success of the artefact. They emphasize on the strict regulations of sharing personal data with the employer, and discussed openly during the interviewee that the external firms which provide health services might be in a better position to adopt this solution. Moreover, they stated that the system will be able to comply to governmental and corporate guidelines in relation to personal data sharing, but that this does not inherently imply that employees will be enthusiastic to participate. They have a strong experience with critics and anxiety in relation to personal sharing and expect the implementation of the artefact within their organization to be a long and challenging trajectory. It is concluded that the Design Objective can be met, but that efforts should be made to emphasize the compliance to data regulation policies in order to accelerate adoption within firms.

Multi-kernel learning has shown, following Taylors (2017) research at Harvard University, that multi-kernel machine learning has the potential to complete personal profiles and predict future outcomes based on incomplete data in a short period of time. However, considering the new application of this artificial intelligence technology and the scope of this Thesis Research is it not able to draw final conclusions on this Design Objective.

Based on the interview with Interviewee 4 and 6, the reward system approach has been modified. The Interviewee emphasized the value of internal sources of motivation and sketched the risks of external sources of motivation and its hypothesized effect. As a result, most Interviewees concluded on the potential of rewards systems in data collection and personal interventions. Multiple interviewees agreed on the similarity of the ASR Vitality example, which is, in essence, the same
approach for a similar topic. However, the impact of reward systems within the context of the artefact as designed in this Thesis Research should be researched to draw final conclusions.

### 6.2 Evaluation of the two demonstration phases

It is concluded that the two phases of Demonstration have resulted in the validation of the Design Objectives, the Vitality Map, the Conceptual Framework and the design direction of the Prototype. The results of the research are, therefore, positive. The additions and adjustments which were recommend in both demonstration phases were on content level and not on a structural level.

The interviewees were carefully selected based on the five theoretical domains on which this Thesis Research is conducted. Nine interviewees have been selected. The interviewees were experts within one our multiple theoretical domains which resulted in high levels of expertise within this particular theoretical domains. However, in evaluation, the positive results of this Thesis Research might also result of the abstract level of design. The interviewees are experts within one or more theoretical domains, but this does not implicitly mean that the experts do have the required expertise to develop comprehensive understanding across all theoretical domains and the developed artefact as a result. On the contrary, this challenge for interviewees to provide in-depth feedback is also a result of the innovativeness and newness of the conducted research. This, by definition, is the goal of academic research. Therefore, it is noted that the interviewees were, on itself, not able to cross-analyze the deliverables across the five theoretical domains of this Thesis Research. Moreover, this effect might be mediated by the limited amount of time which the experts had for the interview. The interviewees were all executives or high-level vitality coaches which led to limited sources of time for the interviews which limited the in-depth discussion.

The development of the prototype contributed to the concreteness of the conceptual framework. Some interviewees had difficulty with the level of abstractness of the conceptual framework. It is noted that in situations in which the interviewee had limited experience with human resource management systems, the conceptual framework might be to abstract to pose critical remarks. However, this limitation has been minimized due to the second demonstration phase in which a concrete prototype is presented to the same selection of interviewees. All interviewees concluded that the new tools were built on a fundamental integration of academic knowledge across the five theoretical domains. This fundamental integration across multiple domains is the main basis for the newlines, innovativeness and value of the presented models in this Thesis Research and as a result contribute substantially to the current human resource management environment.

### 6.3 Limitations & Recommendations

Three limitations of this Thesis Research are noted in relation to this Thesis Research. The first limitation, are the infinite conclusions on Design Objective 6, 7, 8 and 9. The conclusions are made based on the literature research, but further research is required to draw finite conclusions. It is only possible to draw finite conclusions on these Design Objectives after testing of the artefact amongst groups of knowledge workers. This testing is outside of scope of this Thesis Research.

The second limitation, is that the prototype which has been demonstrated in Demonstration Phase 2 is not a final design. It is posed in Chapter 6 en Chapter 8, that the interviewees provide a validation for the design direction, and explicitly not for the design. Moreover, it is emphasized that the adoption of the artefact depends completely on the usability and design of the artefact. This final design of the artefact is not within scope of this Thesis Research. Moreover, this research paper resulted in the development of multiple practical tools which human resource managers and IT managers can adopt in the development of their in-company HMRS.

The third limitation, is the limited available time of the interviewees and the limited available time for this Thesis Research. Eighteen interviews are conducted in two design phases, which provides a proper basis for further research but provide its limitations on its rigor. More interviewees should be conducted following the General Interview Guide Approach in order to draw more rigor conclusions about the results of this Thesis Research. Moreover, preferably, more interviews with a broader range of interviewees would be incorporated in the Demonstration Phases. This potentially would have led to a broader range of feedback.
As posed in Chapter 6 and Chapter 8, the conceptual framework and the design direction are validated. In further research, the prototype should be developed to the next phase and tested amongst groups of knowledge workers in order to validate the design of the prototype and to draw finite conclusions on Design Objective 6, 7, 8 and 9.

7. CONCLUSIONS

7.1 Answers to Research Questions
The summarized answers of the main research questions and the sub-research questions are addressed in the Table 1.

<table>
<thead>
<tr>
<th>#</th>
<th>RESEARCH QUESTION</th>
<th>ANSWER</th>
<th>DETAILS</th>
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<tbody>
<tr>
<td>MR</td>
<td>How can the quantified self (life logging, measuring multiple aspects of our daily life) contribute to strategic human resource management in knowledge-work firms in the Netherlands?</td>
<td>Through incorporating the design and development guidelines as presented in the Performance Management System Framework (PFMS) which fulfills the Design Objectives as concluded from the literature research. A prototype is developed which provides a visual direction of the implementation of the PFMS.</td>
<td>Chapter 3.6, Chapter 5 &amp; Chapter 6</td>
</tr>
<tr>
<td>RQ1</td>
<td>How can vitality-related employee data create value for Human Resource Management Systems?</td>
<td>Through adopting an holistic approach, which integrates multiple resource practices and which adopts a contextual approach in relation to data collection.</td>
<td>Chapter 3, Chapter 5 &amp; Chapter 6</td>
</tr>
<tr>
<td>RQ2</td>
<td>Which vitality-related employee metrics are valuable for HMRS?</td>
<td>An integrative, holistic framework (Vitality Map) is presented which provides a practical basis for the incorporation of data in human resource management systems</td>
<td>Chapter 3.3</td>
</tr>
<tr>
<td>RQ3</td>
<td>How can personal vitality-related data of firm employees be collected while staying compliant with ethical guidelines in relation to the use of data?</td>
<td>(a) Complying to the national and European guidelines and (b) Separating data distribution processes between external consultants (such as vitality coaches) and internal stakeholders (such as managers of teams);</td>
<td>Chapter 3.4</td>
</tr>
</tbody>
</table>

Figure 20 | Overview of Research Questions (RQ’s) and the corresponding answers

It is concluded that the quantified-self philosophy provides great value for human resource departments within firms. It is concluded that burnouts provide a major risk for the competitive advantage of firms and incorporating the quantified-self provides an approach which contributes to the minimization of the increasing challenge for firms. However, it is noted that the classical Quantified Self methodology, as developed by Lupton (2010) does not fit the needs of the
knowledge worker and the human resource management system. The classical monitoring of sleep, physical activity, hearth-rate and nutrition does only cover a small domain of the Vitality Map which is developed in this Thesis Research, since the root of burn-outs often lies in the domain of motivation, psychology, mental challenges. (Bandura A., 1978) The Quantified-Self has the risk of losing itself in capturing as much as possible in data, and as a result, only incorporating the determinants which are directly measurable in the assessment of health, As posed in Chapter 3 and covered in Design Objective 1 and 3, this systematic approach (instead of contextual) which covers only parts of the Vitality Map (instead of adopting a holistic approach) misses the point of performance management of knowledge workers. This is illustrated by Bandura (2010) concept of self-efficacy, which has been widely adopted amongst psychologists and psychiatrists as the basis for performance management of employees. This concept of self-efficacy does not incorporate one of the determinants which are measured by the Quantified-Self fanatics. On the contrary, it is noted that the concept of self-efficacy on itself is not holistic, since it does not incorporate determinants such as sleep, physical activity and nutrition which influence the energy levels of the knowledge worker.

The second sub-research question is answered in Chapter 3.4, in which the Vitality Map is developed. The Vitality Map provides a comprehensive overview of all determinants which influence the knowledge worker battery. The Vitality Map incorporates the methodologies of both the Quantified-Self as Bandura’s Self-Efficacy. As stated in Chapter 9, based on the conducted qualitative research, that the Vitality Map covers all determinants which influence the knowledge worker battery and provide a framework which visualized the interaction of this network of determinants. In relation to the first sub-research question, the conclusion is clear. Human resource management systems and firms might benefit substantially from the collection of vitality-related employee data if two requirements are met. The first, is that Vitality Map is adopted, which provides a holistic and comprehensive framework which incorporates all determinants which influence the knowledge worker battery. Second, human resource management systems should adopt personalized data collection and interventions in order to develop a complete profile of the knowledge worker, which allows the external consultants to develop personalized interventions.

And last, in relation to the third research sub-question, it is concluded that personal vitality-related can be collected and used while staying compliant to ethical and juridical guidelines in relation to data. This can be accomplished, in essence, through the incorporation of the data streams which are elaborated in the conceptual framework which is developed in the first Design & Development phase. This segregation of data streams allows the employer to collect actionable data for strategic planning of resources without compromising the rights and preferences of the employee. On the contrary, it allows external consultants of the firm to intervene in time and develop preventive measurements in order to prevent burnouts and burnout-related complaints. Moreover, as emphasized by Interviewee 8, the differentiation of information streams and the privacy of coach-coachee conversations is, in the current situation, a prevailing topic which is tackled by company’s through open communication with their employees.

This Research contributed to scientific research in the integration of multiple theoretical domains in a practical approach for human resource management systems. Generally, scientific research focusses on generic management practices in relation to performance management, or on the contrary, the in-depth research of specific determinants within the Vitality Map. This research explored multiple theoretical domains, and integrated the insights in multiple conceptual models. An overview of 21 determinants which influence the vitality of knowledge workers is presented in the Vitality Map. Moreover, this research contributes to societal challenges, such as the increase of burnouts and associated societal costs, through providing guidelines for the development of human resource management systems within firms which have the potential to slow down, or ultimately, decrease the amount of burnouts within and without the Netherlands with positive effects for the health of individual knowledge workers. Moreover, the tools developed in this Thesis Research contribute to the societal challenges for two reasons. First, a decrease in burnouts results in a decrease of costs of both firms and society and, as a result, individual inhabitants. Second, adopting the guidelines for human resource management systems design, creates the opportunity for more knowledge workers to be supported and coached, and not only knowledge workers employed by “Zuid-As” (Interviewee 1) offices.
Moreover, the findings of this Thesis Research provide managerial contributions. First, this research bundled the insights collected within the five theoretical domains and integrated these insights in practical design objectives for managers and policy developers within firms. Secondly, two practical models — the Vitality Map and the Conceptual Framework — are presented which provide an easy-to-use overview on the relevant elements and determinants in performance management and human resource management systems. Third, concrete guidelines are provided on how human resource management systems should facilitate the collection, analyzing, distribution of data amongst stakeholders within and outside the firm are presented. As a result, this Thesis Research contributes to the extension of the toolkit of managers and policy developers which they can use to unlock the full potential of their human resources.

Further research is required due to the broad scope of the topic of this Thesis Research. This Thesis Research provides a validated framework for research to deepen the knowledge on the functioning of human resource systems build on the guidelines of this Thesis Research. Therefore, further research should incorporate two dimensions. First, current human resource management systems should be assessed based on the Conceptual Framework for further validation and performance analysis. Second, the prototype should be realized and tested among knowledge workers for further development. Further research should incorporate longitudinal testing amongst different groups of knowledge workers, in which at least one group is using a tool which is build on the guidelines provided in the conceptual framework. Through measuring key performance indicators, such as engagement, job satisfaction, productivity and burnout-rate for a longer period of time the results of the implementation of the artefact are, hypothetically, measured. Moreover, specifically in relation to the development of the machine-learning algorithm, the Vitality Map should be filled with data. If data amongst knowledge workers is structurally and systematically collected the accuracy of the Vitality Map can be validated and the interdependencies of determinants can be calculated. Moreover, the potential of forecasting burnout’s can be measured through forecasting key performance indicators (as mentioned above) in the future and comparing the actual results to the forecast.
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Interviewee 1

Researcher

Nice to see you!

Interviewee 1

It's exciting, I'm going to behave.

Researcher

I'm sure you'll behave, but I'm curious first. You are obviously quite a lot in coaching. There is of course a whole palette of different types of coaches in the vitality landscape, and then you are mainly, I believe, on sustainable performance. How would you describe that?

Interviewee 1

Yes, I do a lot of performance coaching. Indeed. Vitality. Of course the goal, yes, that is of course very broad. I meant not only physical vitality, but also emotional and mental.

Researcher

Yes.

Interviewee 1

Is just what comes on the table from the coachee.

Researcher

Yes, and how did you get there? How did you get involved in that?

Interviewee 1

I am originally cardiac technologist and worked in a preventive medical centre for cardiovascular disease, and I was interested from that point of view, actually in the preventive part of it. I thought: you have to make sure that you are with the people before they end up with the cardiologist and from that point of view I went on to study coaching and ended up at (...).

Researcher

Oh, how nice, well, at least that's what resulted in this conversation. Because I knew that you were of course with (...) and I liked that, but I didn't know what else was in front of that trajectory.

Interviewee 1

Look, nice!

Researcher

Look, I do have some big news. I'm going now, three years later than your son, finally to graduate. At least it seems that way. I started at the beginning of February, so I'll have my green light in two months and then, if all goes well, my final presentation in August if everything goes as I want. Yes, it is challenging, combining it with my other activities, but also a lot of fun. And of course COVID hasn't helped either.

Interviewee 1

No I can imagine. Of course I see a lot in my work. You couldn't be who you were, and couldn't do what you wanted. Things stagnated, and of course the world is just closed and we were kind of in our own ourselves. And that eats up energy and very little positive energy comes back, doesn't it.

Researcher

True. What I would like to do with you is to take you through the different steps of my research. I actually used four phases, with four deliverables as output. Ultimately, where I started is of course in elite sport, and what they do in elite sport is measure every day how everyone in the team is doing. So when you look at me, am also the idea for this study came from the athlete coach, Jeroen Otter. I don't know if you know him?

Interviewee 1

I do.

Researcher

He is the one who has done that, who has explained to me how to measure that. Every day he asks his people in the morning: how did you sleep? How much energy you have today? How motivated are you? And then you have muscle pain on a scale, from one to ten? All information that you can use and that says something about the output. And of course he knows the input. That is the training program he presents to his athletes.
Oh yeah, interesting. We do work with question lists, but of course we don't monitor them that intensively.

Researcher
So the question to the people you have some kind of input - allows output balance. Thus, as a people after a heavy workout did not feel right if wishing to go a little further, only to them that day, the schedule of that person is adopted. He will therefore follow a different program than the group. Well, that's actually very interesting if you can see how the sport works. Because, in business is simple: everybody invests 40 hours plus in a week and they ask very limited what you are doing, let alone still create a personal program depending on how you are doing in the short term. So I thought, I'm just going to see how we can use that approach in business, because they use different tricks for that too. I'm just going to see how we, the business community, can use that too. My study is Management or Technology and that is about the interface between man and technology within companies. So what I've done is start with a lot of literature research. And of course, I looked from different disciplines from vitality and healthy look, but also from human resources and performance management, but also from the systems which are already within organizations. (...) naturally also has numerous tools that you can use in organizations. Then I distilled here what a solution must incorporate. I then made a model, or rather an overview, of which things and which determinants ultimately influence whether someone ends up in a risk. So what things can influence a burnout, both positively and negatively. And then, what should such a solution actually look like? So I also made a kind of prototype. We will click through it later and then discuss those criteria, those design objectives, will eventually come back in the solution. And so I did and I talked to all kinds of interesting people about it.

Interviewee 1
What kind of people then?

Researcher
People from an occupational health service, for example. And those people all have good tips and adjustments, so that's great too. And it's also nice that they all encourage me to continue with this. So that's cool too. Anyway: I'm happy to take you along, I'm curious about your ideas.

Interviewee 1
I wrote down three questions from Jeroen Otter. How did you sleep, how motivated are you? And do you have muscle pain but was that other question?

Researcher
How motivated are you? Are you motivated?

Interviewee 1
Yes, I have it there. Look, how did you sleep, how motivated are you and then you have muscle pain.

Researcher
How much energy do you have?

Interviewee 1
Ok, I did miss that one.

Researcher
So well that, first of all I was just asking some general things. What do you see happening to your customers now? It is mainly young knowledge workers that you coach, right?

Interviewee 1
In fact, a lot of social poverty. Which is of course coming back a bit now. And yes, really just a little withdrawn, lonely behaviour. Because a lot of people will come across that they have been alone a lot, few social contacts, could do few things, could only sit inside, and could do few things to refuel. Sports naturally helps with that. In fact, no one really got on well.

Researcher
Yes, I believe so. So these kinds of vitality issues, that is the domain where you are. Because what are the biggest issues in that? That's really the sleep instance? Is that a personal development? I have such an association with performance coaching. We work a lot with top sports, coaches we talk about performance, behaviour, what behaviour must have to deliver performance, what choices must make? Where do you sit?

Interviewee 1
Right now it's more like you talk a lot about a structure that someone has, that he or she has to get in a day, if you just walk from bed to your desk in your room. And all day live in your office, and that same space is like where you sleep. To what extent do you keep an eye on your work - private life, balance? That you really say at the end of the day: I close the day, my laptop is
at the office, I close it and throw it in the bag in the corner, so that I can no longer touch my work
has to think. I'll make sure I go outside. Vitality is really about balancing.

Researcher
Yes, and what about personal development? In your, in your vision, in your opinion?

Interviewee 1
Currently just really worried about that people keep the battery charged to keep motivated
themselves, sufficient in their work to sit, to be productive and fall back into a kind of overload and
do not go towards isolation to burnout. And people who go to the office have more to do with it,
hey, you go to the canteen together and you have a chat in between, but now everything is
actually continuously online. You have meetings, but equally of: how is it going? It is
no longer about a piece of mental attention, emotional attention. Real attention.

Researcher
Yes, exactly. Which model do you use with (...) for this: physical, mental and spirit is of course a
model that is used regularly.

Interviewee 1
We use emotionally, physically and mentally and spiritually.

Researcher
Yes, exactly, and spiritually is then also: What is your mission? And what drives you? Not just about
religion.

Interviewee 1
Yes, because it is your inspiration, yes. A broader understanding.

Researcher
And then you say: especially the mental and emotional. That is where the biggest energy drain is at
the moment.

Interviewee 1
Right now, yes exactly.

Researcher
Is more overtime still a problem?

Interviewee 1
Certainly. I also see that you hardly have that dividing line between private and work.

Researcher
Yes.

Interviewee 1
Yes that is difficult. Then you have obviously the people have who are single or live in a dorm. But
of course you also have the families, people who had their children over during corona all the
time. Hey, how do you make sure that all those kids who keep running in and calling mom and
dad, also find some peace of mind to make sure that you can also, well, even then
charge. And you're not continue with your work, with your family, but also relaxation at its
moments.

Researcher
Yes, exactly so there is use of you (...). I am also curious: What do you really use in practice in terms
of software, systems, IT solutions to support you in your work or that of others? Your customers,
say?

Interviewee 1
We have of course a library through a knowledge base content through where I can get my
information from. So that's very convenient, because then I can just look up a few things and
occasionally recommend a few apps. That is of course the easiest to build in for people. Also,
a Business Work Out app or a fitness or a mindful app. Head Space is used a lot. I don't know if you
know that.

Researcher
I know that for sure

Interviewee 1
That's the most appealing, because it's short-lived and easy to hand, eh, so it shouldn't be
complicated and too big and too long. And it just has to be handy to build into your daily patterns.

Researcher
You say your coachees come to you when the red lights come on. How does that work? Are your
services offered by the organizations?
It is offered by the organization. And it varies: sometimes a red light, and sometimes people who just want to spar. But usually something is already wrong. It's really through the organization and then people can sign up voluntarily.

**Researcher**
Yes, exactly, so it doesn’t depend on a kind of personal budget. So it's just if you have your needs, sign up and then you can make use of it. And your customers, what kind of customers are they?

**Interviewee 1**
Customers with money. That's really what it comes down to. It is quite an expensive exercise.

**Researcher**
So actually do you mainly have “Orange” people in your trajectory? People who do take action, but actually just too late?

**Interviewee 1**
You don't just get red and orange people, because they often dive. They run from the problem. So the people who are green, they want confirmation that they are doing a good job. You get those kinds of profiles in the first instance, often at the beginning of such a trajectory. If the program is rolled out and people hear from colleagues "that's just a fun project, and you get a nice conversation rather than a woman who only with her finger is pointing, they feel that they have something to do with it. And then dare anyone actually make an appointment again much earlier than they say yes, what gets the organization it hear? What does that mean for their career? Afraid for their career, yes , but also for an image of course.

**Researcher**
How do you do that now? Do you have some kind of no disclosure ? Or how does that work?

**Interviewee 1**
Everything is anonymous.

**Researcher**
Everything is anonymous.

**Interviewee 1**
Yes, absolutely anonymous. It is fed back to the organization at company and group level, but never individually. That's not allowed.

**Researcher**
No, exactly , because you have a kind of professional secrecy, just like a doctor or a company doctor does.

**Interviewee 1**
Yes Yes. Exactly that.

**Researcher**
Do you also have, say the organizations where there is less money. I mean: the large Zuidas offices will have enough money, they can knock on your door. But there are also organizations where this is not possible. How do they solve that?

**Interviewee 1**
I think they are more likely to turn to occupational health and safety services . That’s a whole different business. I used to work in occupational health services, is not it, that offer also checks, which are then consist of periodic medical examinations and I think that financially much less impactful than what we offer. I find it very difficult to say: look at the Zuidas financial services , the consultants, yes, they have plenty of money. And other companies too. I have been to a large waste processing company but that happens a lot less . But I think there's a lot of money there as well. But in the end: where is it going? And that results if absenteeism does not become too great, so that applies to every organization. And then the question is: what will it bring us and how will absenteeism rates go down?

**Researcher**
And then only the absenteeism KPI is looked at, which is of course not possible. People will also perform better. Probably, that's the top. The positive side of the spectrum.

**Interviewee 1**
Certainly. But difficult to measure, which is why we look at the bottom. And it is measurable, but of course less impactful. You do that with questionnaires.

**Researcher**
But if you have a questionnaire, do you use it to show a development?

**Interviewee 1**
Yes. I'll see if I can pull one up. So, for example, we use a Quick Scan, and questionnaires for mental resilience, mental energy, experienced stress. That's what you're working on right now,
so you get a bit of a picture of a participant. So in consultation with customers, it is already being asked: which questionnaire do you want to use and where do we get the most it?

**Researcher**

And where do you put that in? Is that also to see who you should contact in the organization? Like a diagnosis? Or does it work that if someone reports to you, you send them a questionnaire, so that you are better prepared for a conversation.

**Interviewee 1**

Everyone who receives, who has signed up, will automatically receive a letter from: do you want to fill in the questionnaire?

**Researcher**

Yes, exactly so it is for preparation and not for diagnosis.

**Interviewee 1**

No. I think it was indeed deployed the moment someone reports to continue the conversation. Yes, exactly.

**Researcher**

Okay, interesting. Fun. Then I'm going to share my screen. Does this work?

**Interviewee 1**

Yes.

**Researcher**

I have read a lot of literature about the knowledge worker. They also agree that if there is one thing they have in common, it is high ambition.

**Interviewee 1**

Recognizable.

**Researcher**

This they want very much, maximum that you want to get your day.

**Interviewee 1**

And keep going to achieve it.

**Researcher**

Because you have that ambition of realizing it and, on the other hand, you have a high need for autonomy, so you want to figure it out yourself. I think that's exciting too, isn't it?

**Interviewee 1**

Well, yes, I definitely recognize that, I don't know if it's a side track, but it, the corona crisis has actually also ensured that people actually got a kind of peace, because they no longer have that feeling of fear of missing out. So a lot of people between 25, 35 thought that corona crisis was actually clear like, I don't miss anything, I don't need anything. All I have to do is listen to myself and work well, no matter how small that world was, but it also gave me an enormous peace of mind. If that would be over, then I would have to do everything again.

**Researcher**

Yes.

**Interviewee 1**

So then it must provide outside your work that you're there, you have enough friends, you all concerts not miss, do not miss the festivals. That was actually stressful. In the end, that also creates a lot of pressure and I am very curious how people will deal with this in the future.

**Researcher**

Yes, I can also imagine that this has even more influence on people with specific personality traits. So introverted people for example.

**Interviewee 1**

That kind of differentiation certainly exists, yes. Because the introverted people naturally also try to keep up with everything without listening to themselves what they need in their free time. They must learn to say what they need. So: I'd rather read a book tonight instead of going to the pub with some guys. That is of course difficult and that is an energy leak for introverts and an energy boost for extroverts.

**Researcher**

Yeah, that's really fascinating how that works. How something can be enormously energizing for one person and a huge source of stress for another person.

**Interviewee 1**

Complete.

**Researcher**

One may be talking about the exact same thing, but have completely different perception.
Indeed it is.

Researcher
Going back to what you just said: to me you were still talking about the emotional battery. Can you tell us more about that? Can you explain?

Interviewee 1
Well, I think that was always a difficult thing to say, mentally and emotionally. What exactly are the differences? Yes, how would that be? Look! Emotional is more the feeling you have inside, so just come to that feeling when you're heartbroken, then you can get over it very rationally. It's not the right person for me and I have to keep going and there are so many girls left in the world that I can have a relationship with. In the meantime you have sadness inside, so that's just for a moment, maybe it can be explained a bit well.

Researcher
Yes, exactly. So you can rationalize the other three dimensions and make a plan out of it. You are going to do a different project or work for another client, or you will find out what you like. Body you will sleep better, but emotionally it is a bit more difficult. That is really much deeper.

Interviewee 1
Ultimately it is deeper. Are there things that pass by in your life and that you have to deal with and sit, yes, I can already see it myself, so more real in your body, the feeling you have with it, which you very often tumble over.

Researcher
Yes, exactly, interesting. But what I have done is read a lot and look at which factors influence the burnout. What do the scientific researchers agree on that has an influence on that battery? So what you are saying nicely is that you have discharging and charging of energy. I have mapped out and worked out all these factors. And the interesting thing is, all factors work both ways. So if you exercise a lot, it has a positive effect. If you don't exercise much, it can have a negative effect. So I've kind of tried to visualize that so you actually have your general energy level and you have three levels of determinants that affect that. I have them categorized as organic, psychologic, environmental and personal - so your environment, say. There is a difference between the professional working environment and your private working environment and then again, that also seems to have an influence, and they are of course still a bit outside. But there is also the annotation that all those things are in contact with each other. So the way you experience work pressure depends on how much sleep you've had, and it depends on your personality, and it depends on your age. The researchers also agree on the influence of gender. So it's kind of a web of all different determinants that influence each other.

Interviewee 1
Nice overview! Very, bright.

Researcher
Also you can conclude the vitality programs that only involve sport, that that bluntly is, because there is much more in vitality.

Interviewee 100:28:39
No, it's a little too small to read everything, but that's the story in itself. It is focused on performance. What stands out for me is the resilience that someone has. That's the foundation for me. Nutrition, rest, meaning, so all those things, they are added. You can exercise very well, you can sit comfortably in your work, but if you well, there I go again with my heartbreak if you have that, you can do your very best. But that emotional part, you have to process that, it has to run through. So the resilience someone has, influences all of those factors. Weather is very interesting

Researcher
Yes, that one is very funny.

Interviewee 1
I never hear, but of course it applies. Which I can also more often used. Will use that in the advice to get people out.

Researcher
Sun just seems to be a thing. Of course really, because you have a very interesting research. That was done at Harvard. There used all the information obtained through cell phones to measure a person's mood. And sun had a significant influence on that, they concluded.

Interviewee 1
Haha, wow. Bizarrely fun. It's beautiful. I think it's a nice picture. Well, yes, everything is in there.

Researcher
And another interviewee said it was not intrinsic and eccentric, but adjustable and non-adjustable. On one category you consciously do something, say. Think about your skills, your perception of your skills you to coach, etc. But, gender, age, that sort of things you cannot do anything. So we thought that would be a better name. How do you view that?

**Interviewee 1**
I sit and think for a moment: yes, that is the inner circle. What have you added the cardiovascular is in the system. That is of course also a good one, because you can of course do a lot with it, so why is it in the inner circle?

**Researcher**
Yes, that is the question: can you influence it?

**Interviewee 1**
You can influence that.

**Researcher**
Yes, my thoughts were more biological, because you just got it that way 26 years ago, so you can't just do that, but then you can do something about it.

**Interviewee 1**
You can do something about that.

**Researcher**
Yes, that is a certain biological basis, but you can still do something about it during your life.

**Interviewee 1**
Could have given another term. That is more in your DNA or family burden. It is better that you say: you can of course do a lot about the immune system.

**Researcher**
And what would you think of nature/nurture? The further out of the middle, the more nurture it becomes? That doesn't say anything about the inviolability of the family tax. thanks. Do you have any other additions? Determinants I'm Missing? Design adjustments?

**Interviewee 1**
I think I can relate to that. No, I think the overview is correct.

**Researcher**
So those scientists which that concept invented itself effectively effectiveness, saying that one place the greatest impact of this energy, or even burnout is because there is one mismatch or imbalance is between the degree to which someone assessed own skills in relation to the challenges that person faces within the organization. Anyway, my simple thought was, well, if that is as true is that factors affects the burnout most, why should we separate personal development from vitality? What vitality is about the development of those skills and vitality, management, sleep, nutrition and private life?

**Interviewee 1**
Yes, sure. Being well balanced as a person naturally gave you self-confidence and with self-confidence you have more energy. If you have justifiable confidence in your own skills and in future prospects, the moment your battery is properly charged, you take on the challenge of stepping out
of your comfort zone, in your assignments. New assignment and can then fulfill you much more powerfully than when you have a relapse and are not comfortable in your own skin.

Researcher
Certainly. I do find it interesting to put different perspectives on each other. So interesting, thanks. Another interviewee unwittingly separated the two from each other, but she found out for no good reason.

Interviewee 1
Interesting.

Researcher
While actually they interlock, because what you say: it's about self-confidence.

Interviewee 1
Yes, yes, then I can agree. With the thought behind it, just the moment you coach someone on his positive qualities, so that he starts to believe in himself more or just see how do I get to those qualities that I need for the next step?

Researcher
Yes. Interviewee 1
How do I get there? That you can grow and that you also know how to take those steps to get somewhere.

Researcher
Do you also do that for people, for you? Coaches yes, exactly, so there is also a piece, sometimes a piece of competence skills, development is there, or at least help to make a plan for that.

Interviewee 1
Yes, exactly.

Researcher
Yes, exactly right, that's the performance component of your function as a performance coach, so to speak. I understand him.

Interviewee 1
If you see that someone gets stuck and is actually not on the right track at all, you will of course never say that you are not in the place where you should be.

Researcher
Yes. Interviewee 1
But you are going to look at how can you get to the place where your quality lies and where you can actually deform yourself much better.

Researcher
Yes, exactly yes, I agree with that, I think, nice! And how do you view reactive action in vitality management? I also hear you say that in general people only come to you when they come into the "Orange"? What I got from people who really got back was that it is often acted reactively, so not preventively, which may be a little better for you, because there is a bit more budget. As a rule, I get the idea that at an Occupational Health and Safety Service, there is only a response if someone really aims at dropping out. You actually want to be able to see in time where the risk profiles are, so to speak, and help the managers in their observations. Because it turns out that they aren't always able to see that either.

Interviewee 1
Would you actually already at the beginning, the moment new people come in, huh, that people are starting a new job, that you tackle that right away and guide it at the moment that someone does not only know what their tasks are? , but also simply: how do you view the organizations, so that you are already inside and involved with those people from the start? I agree with that. And then you can also identify things more easily during the process.

Researcher
Yes. Interviewee 1
The moment someone starts at extension, that you immediately start a kind of guidance process to say we also expect a lot from you. At night and that will result in little sleep. How are you going to handle that? And we're going to guide that?

Researcher
Yes, and how do you view the autonomy of your coachees? To what extent do you have to provide a certain structure for this? Or if you say no, we will make sure that the goals are clear and you can
start moving yourself. You indicate what you need, so to speak. That you really put all the responsibility on the individual.

**Interviewee 1**

Well, I certainly think that when you go from student to working, for example you need quite a bit of coaching to learn how to deal with a company, with work, with how to organize your hours, with learning what is expected of you. It is often set very high. People are hard form themselves. When you get out of college, you've always done it too. Yeah, I guess it kind of feels like you've always been at the top and then you come into a company like that. And are there all colleague's all on the top. And there are only a few places where the promotions fall. And then suddenly you're not that fantastic student anymore. That colleague of yours is the great student as well formed, so you get equal an enormous drive to ensure you o to which also are good enough to get promoted that process must be your good guidance from well, yes, you have already started this for a month. How are you doing and how can we guide you further? To ensure that you are feeling well, but also productive you and the right side on the go with your career.

**Researcher**

Yes, and do you see that the management takes that role sufficiently? Or do you think that you still need some help with that, in addition to the managers?

**Interviewee 1**

I think that help is definitely needed, because they only want to satisfy the customers and ensure that the targets are met. And no, that emotional part, it is being facilitated more and more at the company, yes, but still far too little. Beautiful canteens, beautiful restaurants, I don't know how it is now, the corona is like a little closed, of course. So it is being facilitated more and more, but in addition, you always have to make sure that you work hours and it must all be ready at the end of the week. The worst thing is that the older population, say my generation, my generation and then ten years younger. They also come from the era when it was indeed just work, work, work. And you shouldn't whine, just keep going.

**Researcher**

Yes, interesting. So the generational differences between young and old also play a role.

**Interviewee 1**

The category thirties there behind come it does not work, perhaps because there are social with many r's going on. Perhaps our social life used to be much smaller. That one was perhaps less to miss, I think. We have had much less of a digital life, so also being continuously online with your friends and all the information you get. That has probably also ensured that this category of people in their thirties now burnout earlier than us, who used to only have a television screen, I'll name just a few. So the thirties now need breaks, who need relaxation areas, more demand for leisure, or relax anyway moments and elderly people, partners who are often nonsense, so they are not supported are from other partners. So there is a bit of a generation gap I think da n. So the generational conflict causes those partners to be like: dude, I never had that problem before. So there is little understanding, yes.

**Researcher**

Bright. On to the next. I made a schematic representation of what such a system should look like, say. So how a system can facilitate that the battery is not structurally discharged less than it is charged.

**Interviewee 1**

Okay.

**Researcher**

It looks like this: until a battery is charged by the determinants on the Vitality Map, from that comes the absolute energy level. From there you go to effort, that's what they call deploying your energy. Yes ultimately, the effort will result in performance. It's a bit of a technical story, but that's how performance is viewed in the literature. Okay, so you've got a task to deliver. Effort is therefore basically in the intermediate phase. Wen re very focused on knowledge workers, so the people you guide, to seek: what is now the biggest risk, in which Vitality web? So for example: a 32-year-old woman gives it just a child, or a man nowadays just as well in that age. Husband, wife of 32, just had a child. Then there is a greater risk that it's in a different determinant wrong web than a boy of 26, where it presumably much more is in the workload, so to speak. So by very smart technology to look at what kind of profile we hav, we aimed to informed consent, we would be able to collect the data. And that's nothing more. Then you see a dashboard in front of you with all kinds of figures that are all yellow, red or green. And where you come to a certain risk that you as a vitality coach, who therefore sees all those individual profiles, can intervene.

**Interviewee 1**
I understand.

**Researcher**

And if they do not have the budget to approach you directly with even small questions and personally, then you are in a position to do something preventive, so to speak. So act preventively, even if, say, the answer to the questions thinks: well, I’m just going to check how things are with that person. Not because something is wrong, but just for a moment to check how someone is feeling. This is of course all anonymized then for the organization. But they do receive feedback at the organizational level. That way they know how people are doing and whether they should do other things with them at an organizational level. How do you view this model?

**Researcher**

I certainly recognize it. I think there is a lot to gain from using data. And the holistic in particular appeals to me enormously. It is so fragmented what is offered. Also from our organization. If you can streamline that, and also ensure that you can start a conversation with the person in question earlier.

**Researcher**

We know that we have to look for our interventions in that area, so that you can tailor your tasks to that at some sort of policy level, for people who have a high risk for certain determinants, so many, many women and men with children aged 32. And there’s another one, those people I still find interesting myself, from whom we share. And also an important question: why should people share data? Because it is quite personal of course, and you have to fill in questionnaires every time. I based this on the need for autonomy and the ambition of the knowledge worker. What would you like to add or adapt to this design?

**Interviewee 1**

Well, hard to say. I think that is broadly correct. The most important thing is that all information flows come together, and that you really have a complete picture of someone’s health and functioning. And it is also important that we do not exaggerate the autonomy. Because that responsibility can sometimes also lead to uncertainty, and that’s exactly what we don’t want to achieve.

**Researcher**

Yes, I will immediately make concrete, because I have made a prototype. That’s how it could be. I’ll just explain: You’ve obviously just your WhatsApp but there is actually your personal self-management system in. Which you always have access to. And WhatsApp is a very intuitive front interface because everyone knows what it is. You can respond to people yourself or not, you are completely in the lead. People know that from the real Whatsapp. So the Tessa, the business coach that you can be, for example. At some point, the app can request targeted questions based on an algorithm. Thus a general questionnaire which is generated on the basis of previous input. If you’re already a week earlier says: Well my energy that is back, you might run anything more specific questionnaire will receive, we’ll go anything more in that corner of the Vitality Map. And based on that, there is also a personal development plan: based on that diagnosis or those small questionnaires, for example: I’ve been sleeping badly for a week, you may also receive an e-learning advice on sleep earlier, for example.

**Interviewee 1**

Because you sleep badly, so. A plan to improve your own performance, and ultimately it all comes together in your own personal health dashboard. Your performance-dashboard where you have control over yourself, so you control it, you manage that you are responsible for and you decide who you communicate to. I’m really glad you’re committed to that. So this is about food and exercise, social sleep. Of course, all these things sometimes come back within companies. And it’s nice that they have to appreciate that too. So if you judge yourself on leadershi, is that sufficient or more than sufficient, to determine if e-learning is required.

**Interviewee 1**

Super fun, I think it’s really super fun, because I think that the younger target group has a huge need for digital tooling. Which you always have available yourself if you want. I think this generation that we’re talking about actually likes these kinds of tools to monitor themselves a bit and to see the short lines: what do I need for this? One caveat that I do want to make, and I think it’s really important, is the pressure they can put on themselves again to get everything green. Those are of course the ones who set the bar very high, because ultimately they are the group of people I think of. The people who want to be good at everything, so the moment they are a bit in the red, they think: damn it, I have to get myself into the green. I have to make sure they get enough out there in the green.

**Researcher**
Good point. I hadn't thought about that yet. Then we achieve the exact opposite of what we want to achieve.

**Interviewee 1**
But that sidenote aside, this is the hub that the market needs. I really believe in that. It must just be really outcome of their own. And I understand that.

**Researcher**
Yes, you have to be very careful with that. Indeed, the pressure that people put on themselves is a risk. It is a known phenomenon that you do when you are sleeping, and you sleep measures that kind of puts pressure on making you sleep worse. That really seems to be happening. So yes, those kinds of things, those kinds of negative side effects, we have to avoid at all costs.

**Interviewee 1**
How would you are? Yes, that's still a challenge. But the first thing that comes to my mind is not to work with red, green or orange. Not such confrontational numbers, so to speak.

**Researcher**
What could also be done is that you can simply indicate how you should deal with it. Or explain by means of e-learning how to deal with information and data. It might be a good idea to turn the feature off. That you don't see your own information, but that you only know that someone is watching you at the back. That it is a kind of guarantee, a kind of safety net.

**Interviewee 1**
I just happened to be off a check last week at a new organization I hadn't heard of before. They had very beautiful equipment, all of us again the best of the best and that. Well, then you can do a check. And in the end we are at the back as a coach, because they do not yet have the right coach in-house to guide people. So a kind of partnership with live contact. They do have a WhatsApp coach for these people. So they do have a digital solution, but then you don't have good contact with people, because you saw someone once and then everything goes via WhatsApp and I don't know whether I have Laurens here or Mark on the phone. That's not a nice feeling either. On the other hand, I also find it restless, because people are so busy with that phone and via WhatsApp you will also get a lot of information. So the call goes on and on with information. So that's something to think about as well. Whether we do not overload them with information with such an application.

**Researcher**
Yes, agree. Would be stupid if we know the information on the phone is a big stressor, we just magnify that stressor. I'm thinking: maybe it's an idea that you decide when you react. So I'm also thinking that you can turn off the push notifications.

**Interviewee 1**
That's actually not so good that I just monitor it once a week, eh, that's the overview of people, monitor once a week to see where your needs lie, that you experienced that week. Or I think that is a lot quieter, because you can say: yes, you are in the lead yourself to what they naturally do on your own and it is, but it often doesn't work like that, people are of course constantly stimulated by everything that lights up and what information comes in so yes, that is also a challenge. Hey, how do you really ensure that people get a little more rest in that, maybe for your new graduation project.

**Researcher**
Yes, exactly.

**Interviewee 1**
But yes, and not being able to monitor all day long, but just offering it, once a day, once a week, something like that. The availability of information can contribute to the process of burn-out.

**Researcher**
Some will thrive but some will very much feel that they just can say with a setting: Well. Thursday, between one and two, then I just get a list of all my action points that I need to do. And then again a week later you just get your notifications. Then you save it. Not a bad idea at all, if I do say so myself.

**Interviewee 1**
Perhaps. Look, at myself, I am very enthusiastic about the Bugs huh. You know that investing.

**Researcher**
Nice, yes. I know it.

**Interviewee 1**
If you see how addicted I am to that, I am constantly looking at the stock prices. So I can also imagine people who are interested in this and really want to make sure that they get everything in green, that they constantly monitor that and see how they are doing the best, I think you'll get a lot of pressure again I think. And those short lines with a coach, that sounds great to me, maybe once a
month you just walk through with your coach like well, how did you lead this month: how did you
sleep, what was expected of you, did you feel it? That's great isn’t it?

Researcher
Yes, I think so too. That can be a nice product. Nice though. Thanks for your input.

Interviewee 1
Yes Nice. Very nice to think about.

Researcher
Definitely, I'm really going to look, because I have really nice reactions, also on this prototype. So
I'm going to really see if we did not have real business of making to after the summer.

Interviewee 1
Awesome.

Researcher
That would be really nice.

Interviewee 1
So hey I'm curious, keep me posted.

Researcher
Six and we'll talk again soon.

Interviewee 1
Is good , take good care of yourself.

Researcher
It'll be all right. I'm going on vacation, Monday: two weeks.

Interviewee 1
Ah will be all right, hey, I'll see you again. Thank you, I see.

Interviewee 2

Researcher
Anyway, thanks for taking the time. I started in February, and it took me a month to get into the
subject. And then I continued with that. Yes, and then for today. I interviewed ten people in two
rounds. What I have in done in the period after February, I'm going to take you through that
today. First I did a literature search. Based on the literature research I made Design
Objectives. This starts with a literature study, and in phase two it is examined which requirements
the solution must meet. Phase three is developing the solution, four is evaluating the solution and
five is showing the solution to the interviewees.

Interviewee 2
And do you also include feedback from this round in the optimization of the model?

Researcher
Yes, yes, you say that right. I did the design and evaluation phase in two steps. So first I did a
literature search in 5 domains: Vitality & Health, Performance Management, Artificial Intelligence,
Human Resource Management Systems and Knowledge Workers. For companies I first made a picture
of: how should that be done? What elements are included and how should that be done? And we
discussed that in outline last time. I have incorporated that image into a conceptual framework and
then in the next phase we will make the conceptual framework completely visual: how can that
really look on your phone. We'll look at that next time.

Interviewee 2
And then you're going to talk to me and actually make an evaluation of your design? Then make a
two point zero version of this conceptual framework? And next time is about the practical
application?

Researcher
Yes please. True indeed. I'm curious what you will think of it. By the way and so that's one, because
you said yes last time, actually vitality is influenced by a lot of different determinants that
ultimately determine whether someone has an increased risk of burnout. I fully researched that and
made a conceptual framework of how it all works together.

Interviewee 2
All right, all right!

Researcher
Yes, I only record and then I leave it at that. No, that's right, from those interviews it comes out,
for example: this must be added. This needs to be changed or this needs to be removed. So you're
going to say things. Then I write that down and that will be included in the last round. So is that
included? Indeed.
Interviewee 2
And it is included, so you still adjust it to a two point zero version.

Researcher
Sure.

Interviewee 2
Great.

Interviewee 2
Then I don't do it for nothing.

Researcher
Then you don't do anything for nothing. Indeed, and the best thing is of course that if those conversations show that: well boy, what you have come up with, is actually not that crazy of course. But we'll see for ourselves.

Interviewee 2
But Max will be driving soon, so I really want to see that. So we have until 2:00 PM.

Researcher
I want to watch too. It'll be fine.

Interviewee 2
Fun! Let me first show you this picture: this is an overview of all determinants that influence a burnout. Both positive and negative. So charge and discharge. Can you see well?

Interviewee 2
This looks really great.

Researcher
Yes, I was still colouring it to make it more understandable. But good to hear.

Interviewee 2
I also think sleep is a bit intrinsic, isn't it? That's a combo. Actually, that line of intrinsic and eccentric is sleeping outside. Physical activity is a kind of middle variant. In gray you get that? So you have three things: you have intrinsic, you have eccentric and a combination or something.

Researcher
Yes, because I am indeed looking for the right word, because I also have personal there. But that's not quite it either, because ultimately the dimensions are psychological, biological, psychological and environmental, those are the well-known dimensions that you often see coming back.

Interviewee 2
Actually, there it is, if I may help here, you have the physical side, the biological side. Ethnicity is actually a remarkable factor in here, but it may not belong there. But then you should actually say: basic, is that something you can use?

Researcher
Yes, I agree.

Interviewee 2
What is the difference between those stress determinants in those levels? Of course I wondered that. It's a part of the predisposition that you can't do anything about, psychological is also largely predisposition, and the aftermath of certain traumas, and the factors after that are either within your circle of influence or outside it. Yes, exactly, because at least that's what I meant by this. Because sleep is something that is also something intrinsic, but you can do something about that, so to speak. That's why I categorized it that way.

Interviewee 2
But then I'm still not satisfied with intense and eccentric. What do you call determinants that you can influence? Well, you can think of a term for that, because I think the setup is very nice as said. But those names are not correct from the point of view of research and science. Both personal things that you can influence, as well as work and social things that you can influence. There's another name for that.

Researcher
It's more basic or something like that, something you get and you can't help it, you just experienced that.

Interviewee 2
True, but what do you call the eccentric levels?

Researcher
Good question. I'm thinking about that too.

Interviewee 2
Because we can adapt at those levels.
Isn’t that it? I think that’s a beautiful one. You know, what I like here about what I just want to say is that I’ve always believed that the human mind is actually something for “Delfterikken”. You have to think very simply and analytically.

Researcher

Is that true?

Interviewee 2

I’m really still looking for the formula.

Researcher

Is it nice that you mention that formula, we’ll get to that in a moment. But I’m really happy with this, so we can leave it at that. This is really very good. I think adjustable and non-adjustable is the right categorization.

Interviewee 2

Nice, yes, I get it.

Researcher

And I’m still trying to see if I don’t put very thin lines between all those blocks, between everything. Is that ultimately what do you think?

Interviewee 2

But you can also say that, it’s just all interrelated you know, then you don’t have to draw all the lines.

Researcher

Clear, noted.

Interviewee 2

Yeah, but it’s being recorded, so you don’t have to change right away.

Researcher

Exactly, but quite right. And then the thought, just like with the lines, is that how you receive the workload depends on how calm you are, how well you slept and of course your psychological characteristics.

Interviewee 2

And then there’s the youth and the values you’ve been given, isn’t it? That’s very hip, isn’t it, and your current context is: you have a context from the past and you have a context from now.

Researcher

Yes, is that where they put it?

Interviewee 2

I think that context, which belongs to the all outer. But those values, so what value do you have in your life and what value do you find important? For example: we think it is important to be kind to everyone. Or do I know, you have value in your head and I can see that that is becoming more and more important, because we lose those in religion, so then the new value will take its place. You can also put it at spirit, somewhere else, if that’s still allowed, or if you want to do that.

Researcher

Then the question is, whether you really got it, it’s not psychological of course. Then it really is nurture. But then it would still be possible in psychological, just like the life events.

Interviewee 2

The value of now, what value do you trade? Look? I do act and behave out of value that I learned from my youth, but I do create new value every week and I also have a value that you, well, I name it, do not cheat at my University where I work.

Researcher

Okay, clear.

Interviewee 2

In the beginning I said: I will not cooperate in fraud. And if you have a very strong value, that you always have to take care of others, for example, and then that can also help you to get stressed. Because a value means that you literally attach a lot of value somewhere and therefore probably spend a lot of time on it.

Researcher

Look, value is not in your character, that is really something different than character traits.

Interviewee 2

Well, that’s not in your character and I find the character difficult anyway, you know. But do you have such personal qualities that you can keep there. And I really believe in my own personal qualities. Look, one person does have a predisposition, but you can’t approach your brain in a plastic way, so you can change. I can also really make sure that I am better organised.
Totally agree and I think I put it in psychological or in the environment. I also have to check the literature on that. But many thanks for this suggestion, very valuable.

**Interviewee 2**
And where is your social life?

**Researcher**
Social life, yes, it may indeed be something more explicit. It falls under relational connectivity. Relationships with others.

**Interviewee 2**
I understand it.

**Researcher**
Ok great, thanks again. Then we move on to the next part. So I looked at five theoretical domains. These are knowledge workers specifically, performance management, so as part of human resource management, vitality and health and human resource management systems, which is more about the IT system and the approaches that are available for it. I've read a lot about all of that.

**Interviewee 2**
Those slides don't colour well together, but that's something else.

**Researcher**
This template is from TU Delft. Of course, certain challenges or conclusions also emerge from the research and interviews, which I have translated into the Design Objectives. And sometimes different conclusions come together to form one Design Objective.

**Interviewee 2**
Fun! Let me take a closer look. No, I think that's really great, you must have done well enough. I have had my say on the subjects of which I really know something.

**Researcher**
Well, yes, then I guess. I do have one more question. I also spoke to a medical director of an occupational health and safety service and I also got back from those people that this is really very good. So that's actually very nice to hear that you haven't had very stupid things in recent months, so to speak.

**Interviewee 2**
Awesome.

**Researcher**
And that they are even there, because I asked one of them on a given, from that lady that was the sales account management director: how do you view the vitality programs and how do companies do that? You know, those programs are often about sports and exercise? And ultimately, when you look at where burnout comes from, it's often about the perception and appreciation of your own skills in relation to the challenge in the assignments your manager has to do. You can get a lot of stress with very few assignments, but with a large mismatch between your own skills and the assignment you have to do. So given that skills or lack thereof is one of the main reasons for stressors, why are vitality programs and personal development programs two different departments within companies? And she went along with that.

**Interviewee 2**
I don't quite understand what you're saying. It's basically people's perception of their skills, and it's not just the absolute skills, it's those people's perceptions. And those beliefs they have about their skills must match the assignment they are given. So you can have someone who's really smart, but they don't think they're smart, you can give them a smart command, and then they get all stressed out. But you can have someone who is stupid, but who thinks very well of himself, but is given a difficult assignment, he has less stress from that assignment. That's interesting. You should actually apply a formula to that, which calculates whether someone can tackle a task.

**Researcher**
That vitality within companies is often about people and sustainable employability, and that this in turn is often about exercise, healthy food and sleep.

**Interviewee 2**
So the formula actually consists of those urges. That you say, it's perception, it's the skills and vitality, and then that together determines the workload that can be absorbed.

**Researcher**
Yes, it is. But actually, to take up the Vitality Map again and go back to the previous picture, that all these factors are a formula. So it's ultimately a sum of all these factors.

**Interviewee 2**
My parents, which is so nice, isn't it, because you have a picture back. You know what's so fun about it? I am also involved in palliative care, the care for children who die and I notice this there too. I'm
on a program right now and you just notice combining body-mind-spirit is so incredibly important. Awesome. And you do that with battery drawings. Yes, that's enlightening too.

Researcher
Yes, come on in a minute, then you can understand where it comes from. But first I want to go to this picture. This is the Conceptual Framework I was talking about. In the bottom layer you can see the process from charging energy to completing certain tasks that are defined by the organization. The intermediate steps are effort and tasks. Above you can see the sharing of information from this process, which ultimately results in the dashboards that show the information. This information is divided into two target groups: external consultants who see data on an individual level, and on a team or organizational level, where managers get general information about the company and how people are doing. And what I also added in there is that people are rewarded for sharing information, as this information enables the organization to act. The more you share, the higher the reward.

Interviewee 2
Super nice. And why is it called effort? That's a hard word for me to understand.

Researcher
Effort is a kind of phase between and energy and which is used for applying energy. This is also referred to in the literature. If effort is then also used for something productive, then we are talking about fulfilling tasks. If not, it's just an effort.

Interviewee 2
Look, I understand batteries, goes to energy, with that next step I think it goes very quickly.

Researcher
Bright. That's a good suggestion. Then I thought about how the system should work. And the picture I showed at the beginning, that's actually the basis. From there you have to share information with a central point. This central point processes the data into information. This produces an individual profile with all those factors and an organization profile of how the entire organization scores on all those factors. This individual profile can only be seen by people who are entitled to it. So just say the company doctor or the vitality coach. At least not with your manager, because otherwise people will not share information.

Interviewee 2
I totally get it. It's really super fun, doesn't need any better.

Researcher
And let's talk a little bit about those rewards. How can you encourage people or knowledge workers to share information with us? And my hypothesis is that, let's say based on this principle: according to the literature, knowledge workers have a high personal ambition and a great need for personal growth. And you can feed that by saying: if you share information with us to a certain extent, that your reward is in a personal development budget in that direction. This motivates you on the basis of intrinsic motivations.

Interviewee 2
Yes, and that's nice and, and, but then you could draw a line between rewards and sharing the information.

Researcher
It's already in the middle, look. That line runs in between, because it is indeed the case that the two are linked.

Interviewee 2
OK, then I get it. And you know what's really funny. So I pay attention, when I look very much at task and performance and I also pay attention to whether it fits the person, but I am not at all concerned with the profiles of the people behind it. So actually I already have a lot of steps to take in my work.

Researcher
Well, exactly. And the system must then also give you as a manager an overall picture of how these profiles are doing.

Interviewee 2
And I also pay attention to whether it suits the person, but I am not concerned with the personal other needs of people at all.

Researcher
Okay, well, yeah, exactly. What I would also like to discuss with you is the development of the formula, as you already mentioned nicely. It is a formula, based on different types of people with certain characteristics. Let's take you as an example: you are a woman of er, after your late 40s and you are the manager of one of a large team. Then there is inherent in your group of people, namely
middle-aged women with a certain job profile, there are certain increased risks of being in a certain area of that Vitality Map. So you will probably no longer burn out because of your children because you are no longer in that phase. That's more of a 35-year-old thing. So the formula-based system won't send you any questions about that.

Interviewee 2
35. Huh?
Researcher
Well, I just happened to read some studies that it's really only women who are overloaded by pregnancy and the accompanying responsibility. Is that right?

Interviewee 2
That's really biased literature, because at the time it was mainly women who did that. But in your generation, men are going to do just as much as women in parenting.

Researcher
Yes that is true.

Interviewee 2
Really, I can already see that men are also going to get those same types of overload.

Researcher
Yes is that so?

Interviewee 2
Possibly even more, because they also get into an identity crisis, because women have had to emancipate much more and therefore become much stronger, and men therefore think: what is life left? What is our role in that?

Researcher
Yes, interesting.

Interviewee 2
Don't think it's just women who care. But which is also nice. In medicine you have had the concept of positive health for a while.

Researcher
Yes.

Interviewee 2
Do you know that?

Researcher
No, but I can imagine it.

Interviewee 2
And what you see with that is a kind of spider web that people can score on and then you can do very well, so it's more the end product. How are you going to show that web to people?

Researcher
Yeah, I'll get up in a minute, okay?

Interviewee 2
All right, I'm listening.

Researcher
What you don't want is burdening people with questionnaires all day long. So what you actually want is a maximum of once or twice a week that there is an action per week and maybe even only on Friday afternoon or only on Monday morning, and that you actually tailor the questionnaire for that person by using very specific questions. To set. Of course in combination with some standard questions from the organization, some standard questions from the HR manager, but also from the specific age or department where the person concerned is located.

Interviewee 2
But why do you ask motivation, energy and sleep at daily three? Why do you have those three?

Researcher
I'm curious what you think about that one. Yes, those three questions. I'm still trying to figure out exactly what these should be and what the frequency should be. But my thoughts are as follows: you have those three batteries. Body, mind and Spirit. You can fully expose them according to that Vitality Map. But then you're going to overload people, and that's exactly what we didn't want. So my thought is to work with questions that represent absolute value, without being able to diagnose where that comes from. That way, the system knows what to include in the next questionnaire.

Interviewee 2
Body and energy are then 2, but then it is nice that exactly the three batteries that correspond to them are added.

Researcher
Yes, so yes. Energy is indeed the subjective measure for body. And sleep is extra interesting, because it is both a gauge for body and an indicator for a real burnout. The sleep always decreases in quality before people get a burnout. So that has sort of double value.

**Interviewee 2**
Yes, but then maybe I wouldn't take it wider. Maybe you should just ask about stress.

**Researcher**
Yes, that's a good one.

**Interviewee 2**
Still difficult. I'd stick with the three batteries anyway to keep it purely diagnostic. That way, if there is a trend on one of those questions, you know that the system has to deepen that battery.

**Researcher**
Yes, good. And how often? Just, for example, you could only do it once a week on Monday. I think one a day is a lot. Or all at once or maybe on Wednesday, because then you are not too close to the weekend.

**Interviewee 2**
You can do your best three times a week. Monday, Wednesday and Friday? I don't think people would mind that at all, but it depends. You can, you only have to do that body and stress once, but how you feel, you can do it three times a week. For example, I did this recently, because I was not happy at all. Then I started coding all my meetings, so then I started to say to others: when I was done, and I thought my team had inspired me, I gave the meeting a five. And if the opposite was the case, and they hadn't inspired me, I gave a 1. Fortunately, that hardly happened. But that gave me a lot of insight into what and with whom I liked it.

**Researcher**
Funny say. And then also created an app, to be able to make it concrete.

**Interviewee 2**
But you made it, really, or?

**Researcher**
Not downloadable yet, but I've made it all visual, so you can click through it and we'll do it next time. So say: according to the Design Objectives, it should be an app that is about the autonomy of the knowledge worker and that can be used intuitively.

**Interviewee 2**
You haven't done industrial design, have you?

**Researcher**
No, exactly, public administration. But I did enjoy working out something to make it really concrete. Such a conceptual model is nice, but of course it also remains quite abstract. That, while it is precisely the practical application that makes people understand it. Because it is of course a fairly complex web of factors, processes and components. That's why it wants to show in a simple way. I can tell you briefly what I've been working on, so you know that for next time. I want to use a WhatsApp format as a base in the design. That is recognizable. Everyone knows that. And so if you stay very close to those basic functionalities, it makes it easy for people to adopt the app. So for example: the personal profile contains the dashboards of that person. In fact, the personal Whatsapp profile has only been expanded. And your contacts contain all the consultants and helplines that you can use for your personal development.

**Interviewee 2**
This is great fun. What I'm thinking about right now, and what you should be looking at, is a really nice app. Of course not a WhatsApp but very nice. It's called it every two weeks for free and that's a weight loss app. And for me that was very nice, because I just want to lose a few more kilos and what they did very well, which I really like about them. You should just create an account because it's all free and they've designed it so nicely. Look, this is really great, so I can see here. I don't know if you can see.

**Researcher**
Yes.

**Interviewee 2**
Then I can see how many calories I can still have. So I keep more calories in this, but I also teach you at the same time. I have my today scores and if I can get rid of it and check it off, I'm very happy with that. I suffered this morning, and then I can fill it in and then the system automatically puts it in. It is the first app that actually combines the physical with the mental and also a behavioural change. They asked me: what kind of person are you, what do you want to learn in particular? It seems very bad, but that is really the future.

**Researcher**
Nice though. It should be like that.

**Interviewee 2**
If you have a lot of this stuff in a WhatsApp, but you might also become very volatile. And it would be so nice and good if you could integrate everything into one app. Very valuable, also due to the combination of data.

**Researcher**
Yes.

**Interviewee 2**
And then also make it very visible: look at what they do, so that you also make progress tangible.

**Researcher**
Just make your success visual, so to speak. When people take responsibility for their own personal development, in their own health. That would be so nice. So in the end everything you have entered in questionnaires will be returned to the dashboard. And based on an algorithm, personal interventions are created based on that information.

**Interviewee 2**
It's really nice, I'm really curious how it will look like. Nice, Laurens, I would like to introduce you to a number of people within the medical world. I really believe in this. I will next time you show me the app. Now it's time to watch Max.

**Researcher**
That's what we're going to do. Many thanks again for your time on the free Sunday afternoon. Very happy with it.

**Interviewee 2**
Well, I think you did well. A nine I would say. Until next time.

**Researcher**
Thanks for advising. They will see this advice to the assessment committee in the transcript. Thank you!

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**Interviewee 3**

**Researcher**
Good morning, thank you for taking the time to do my research. During this interview I would like to go through the following steps. First of all, I will give you some background on my research and we will discuss your background and affinity with the subject. Then I will share the design objectives of the solution with you to discuss whether you have additions to them. Next, we discuss the Vitality Map, an overview of determinants that affect the human battery. I developed this model myself. Then I would like to share a Conceptual Framework in which I show how the solution works from a conceptual approach. Is that clear?

**Interviewee 3**
Completely clear. And fun to work with you.

**Researcher**
What I've done, what I've researched, is the following. Of course I studied at the Technical University of Delft and there I did the Master's degree in Management of Technology at the Faculty of Public Administration. So that is not the most technical study, but a study that also teaches the more Alpha side, for example management and human and administrative processes. But that is ultimately also about: how can you use innovation in companies, in order to create a positive effect on people, companies and society. As you know, I have my own company in top sports coaching, and this is what really triggered me from the sport. For example, I was inspired by an example of Jeroen Otter, the short track national coach. He has an app in which he has contact with his team members, asking the skaters daily: how did you sleep? How is your energy? Just on a usual scale of one to ten. Motivation is also another question that arises, I believe. By asking those four questions at the same time every day and comparing the training program on the other side in the same way, it can compare the input -energy, sleep and charging- and output -using energy for training- and with each other. And then I thought, after seeing a few companies from the inside, that this way of looking at human performance is not yet embraced by business at all. Then I thought: I think it is an interesting topic to discuss this within business. A way of looking at performance and energy, and exploring what that could bring to business. Because there is a big problem in business. The newspaper even recently reported that one in six employees has developed burnout-related complaints. Yes, of course there is still profit to be made. Besides the costs for society of course. I started with the ideas from the United States, and with the question of how we can do this type of
analysis with data from your phone. In America they call that the Quantified-Self. Do you know that term?

Interviewee 3
That has to do with measurements of heart rate, movement and things like that, right?

Researcher
True indeed. In essence, the Quantified-Self is approaching man as a machine. What do you think about that?

Interviewee 3
Yes, I do find it very interesting and I just see the importance of a different approach when I see what we are doing around us. The direct feedback about how you are doing is often ignored, with the result that we keep walking with it endlessly and eventually even end up in a burnout. We now know that your heart rate, your Hearth-Rate-Variability and your heart rate under stress compared to when you don’t work, already provide a lot of information about how you are doing. So yeah, I definitely think that’s an interesting approach.

Researcher
Your expectation is that that information can be valuable in preventing burnouts, if I understand correctly? You specialize in burnout processes, right? Are these preventive or curative processes, or of course both?

Interviewee 3
That’s for sure. People who are not in it yet are the easiest to help to stay outside that burnout. Yes, they have already developed a number of phenomena, and what you want to prevent is that they really fall out. But the majority of the people I supervise are burned out. So they really came home sick.

Researcher
And yes, you guide them back to the workplace in their own way. Where would you see the application of all this all this data that we just discussed, like the data from the smart watch, the Hearth-Rate-Variability, and whatever they have available? Is that both preventive and curative?

Interviewee 3
Absolutely yes, so preventively certainly, but there is also a lot about awareness beforehand. How can I consciously influence my vitality? Because people are also looking for what is good for them, and also looking to stay within the limits of this. What you want from a biological perspective is that all kinds of stress hormones and the ability, their adrenaline, hormones that at least in case this has gone up also decreases again. And when you first start working with people who have certain complaints, the first thing we do is work is focus on their lifestyle and work. And then you see that some people are really looking for parameters that help them to know and understand their own limits, before they learn those limits in a different way.

Researcher
Yes.

Interviewee 3
You can steer a bit on these data and hard parameters and you need that, and can help me as a source of information for customization.

Researcher
For example, what I understand from my sister, who of course plays in the Dutch Hockey Team, with everything they have to measure, is that she is someone who likes that very much, because she is and she also says that herself, who has that feeling, the emotion, finds it very difficult to feel what her own limits are. While other athletes are perfectly aware of that. If you answer a question like: were you fit, were you good, she says: “I don’t really know”. She is unable to determine that. She really needs other sources of data, so to speak. But I also supervised an athlete myself and she says, the moment I have to measure my sleep, it becomes a Self-Fulfilling Prophecy. So at a time when I’m sleeping badly, or the app actually says so, I get nervous about that measurement and then I sleep badly because of it, giving me a bad sleep rating, and then I’m tired the next day. Do you recognize that?

Interviewee 3
Yes, I definitely recognize that. Some people really want this because unfortunately they really like such a number, but others don’t. I therefore really look at which approach I choose on a case-by-case basis. Some people just give something to hold on so I definitely think these kinds of techniques. They can really can work. And yes, you simply have more and more access to these kinds of techniques.

Researcher
Yes, exactly. So, you are actually very contextually driven on your coachees if I understand correctly. Some benefit from it, others don’t. So really respond to individual needs.

Interviewee 3
Sure. No person is the same. That method certainly works for those people. But I am also convinced that it is good for everyone to put the proverbial thermometer in how you are doing now and then. Your body does not lie.

Researcher
Clear, I can imagine.

Interviewee 3
That makes it complicated, doesn’t it?

Researcher
No, it is. But also an interesting challenge. And there are already examples where this works quite well. For example, I know an app that looks at the heart rate and the Heart-Rate-Variability by means of a smart-watch. Based on the results from your smart-watch, you will receive tailor-made e-learning and you will be helped with personal information relevant to your process.

Interviewee 3
Cool! I like that.

Researcher
Definitely it is. Yes, this is being developed at TNO. But that’s interesting. Jeroen Otter who says it’s yours so you have to measure this on an almost daily basis. But there are also researchers who say, to which you just referred, that they are accused of literally seeing man as a machine, and therefore as a device with all cogs that are all connected to each other, and that by removing all those cogs measuring your ability to measure human functioning is going too far. They also say that it is a complaint that the measurement data is never completely accurate, because there are many human, psychological dimensions in a person that you cannot quantify all of them.

Interviewee 3
You know, of course it is. It is, of course, a tool to apply. There are fanatic people who are very much involved with health, fitness, sports, et cetera, but I think it would be good for a large part of those people to monitor and work with those parameters for their own health, in such a way that suits you, but which does provide information, provides immediate feedback about the functioning of your body. And thus also the impact of chronic stress. And how do you recognize that in yourself, huh? What do you need? And when do you get into that stress? What challenges can I handle? All complicated questions. And questions that start, as far as I’m concerned, with awareness.

Researcher
Are you also referring to the concept of self-efficacy? What I really liked about my own research is that I got to read a lot of that psychological research. And self-efficacy or personal effectiveness that Albert Bandura is the founder of. Are you referring to that challenge?

Interviewee 3
Yes, that’s right.

Researcher
Your own skills in relation to the tasks you have to do, so to speak, and the balance between them. And that imbalance is the biggest source of stress. Is that right?

Interviewee 3
And also that you should constantly check that with yourself. What do I need? What are my stressors?

Researcher
Nice. What I have tried to do is to develop a technical or technological solution that contributes to the prevention of burnout. Ultimately, it is an app that should facilitate that the knowledge worker receives maximum support in his or her performance, and to which people like you and the coaches are connected. The knowledge worker must be supported in self-management, awareness, own performance improvement and personal development. And the knowledge worker requires an interesting approach: because if you look at the literature, it is always said that knowledge workers are very ambitious, are have a high need for autonomy. But ambition is also a characteristic feature. And for the realization of ambition, physical and mental fitness is a must you would say.

Interviewee 3
However, overshooting the management requirement to be able to realize that ambition is a risk. It’s kind of custom. What now wants to accelerate and speed up, or recover. That is something everyone should constantly ask themselves.

Researcher
Yes, there is a kind of extreme need for cognitive and intellectual challenge and ambition to get the most out of it. In which the physical element often remains underexposed or completely ignored.

Interviewee 3

Or indeed not happening at all, to adjust and what we say, to slow down again for a while.

Researcher

Interesting!

Interviewee 3

I often talk about optimizing. Optimizing instead of maximizing allows you to maintain that performance for a much longer period of time.

Researcher

Yes, that’s a nice one, Indeed. I actually recognize myself in that.

Interviewee 3

I think so.

Researcher

Yes, and then I’m really going to continue. You should also check the time.

Interviewee 3

I want to add one more thing. I recently went to a major international conference, and scientists in the field of positive psychology and emotions also agree. Your personal characteristics determine how you react to your environment.

Researcher

Interesting, and fortunately also a conclusion that I also made in this research. What I would like to do now is take you through a number of steps in the development process. The aim of this research was to find a solution that supports the knowledge worker in, what you say nicely, optimizing performance and creating a holistic approach, in which everything around the knowledge worker comes together. How I've done this is by reading many different studies on psychology. That was also just a lot of fun to do. Based on this literature review, I drew up design objectives that the solution had to meet. From there I made a visual picture in which I visualize the various factors that could or could influence the energy of the knowledge worker. And then I made a visual example of what the solution should look like.

Interviewee 3

Completely clear. Fun.

Researcher

I’ll take you through. This has of course been discussed a bit, burnouts is a problem, we have discussed and what I have done in my research. A lot has of course been written about all different factors, about all the factors that influence the burn out. I actually tried to visualize that in this picture. I introduced four levels, the first level being about gender, your age, your ethnicity, and the real biological elements. Just say, determinants on what you have little influence on. The second level deals with the psychological determinants. For example, childhood and adolescence are the most important phases from research. And your mental development and personality traits are also at that level. Then the personal things you can influence. So not your biological characteristics, but your sleep, for example, or your physical activity. Perceived Skills are also included. These are the buttons that you can turn, because you can influence these determinants, while the first two levels describe determinants that you cannot influence. And then there is also an Environmental dimension, which concerns, for example, the autonomy you get from the organization you work for. And other things that really come from within the company or are caused by it. And then of course the personal environment, such as whether you are faithful or not, whether you have children at home. My conclusion is the same as yours; this is a web of all determinants that all influence each other. You could draw lines between all the determinants. All those things influence each other. So what fascinates me is that it's often about just that within vitality programs it's just about physical activity. What do you think of the Vitality Map? Do you recognize that?

Interviewee 3

I totally agree with the complexity. The visualization with the lines is therefore also accurate. I think it’s a very nice visualization, which for me also gives a nice overview of all determinants. The only thing I would like to add is the social support you need in your area. That is at least as essential as the focus on nutrition and physical fitness, but which is much less emphasized because much less research has been done on them.

Researcher

And why do you think that is?

Interviewee 3
It sells less easily. Yes, that may sound strange, but it may quickly become vague when we start talking about social action support with all of us. And it is therefore less easy to refer to scientifically.

**Researcher**
Yes, yes, interesting, because physical fitness is of course also easier to develop an intervention. Could it also have something to do with that?

**Interviewee 3**
I think so. That is it. It is less inconvenience for the organization or something. Social support has a higher status than we thought. Starting the conversation about the difficult topics, and feeling that people support you. And how do you ensure that this happens in an organization?

**Researcher**
Nice, yes, I think so too. That was also one of the conclusions from another interview I already did. That person, medical director at a health and safety service, pointed out to me that most of the burnouts they have to solve come from the fourth level. So the professional environment. So too much work, managers who are incapable and unable to lead, lack of psychological safety, those kinds of themes. Do you recognize that?

**Interviewee 3**
It really is in the combination of those external influences and the personal characteristics of the individual. I always administer a questionnaire to people for a coaching trajectory with which I correctly map out those psychological characteristics. For example, if you're a huge perfectionist, you're much more prone to limited psychological safety, because you'll only drive yourself crazy for doing better if you don't get confirmation. So again a confirmation that the Vitality Map is a nice representation of those connections between different determinants.

**Researcher**
Yes Nice. So to determine the influence of environmental characteristics on the individual, you take such a questionnaire. My main conclusion from this model is therefore that it is such a complex web of factors that you should not want to capture it in a single questionnaire or in just approaching the physical activities. Because it's not all black or white. IT systems can support this, but precisely because it is such a complicated web of factors, it does not make it any easier. But hey, that's just really fun to think about. In this picture you see an overview of the five theoretical domains that I have incorporated in this research. So, based on the information from these five areas of research, I've formulated the requirements of the solution.

**Interviewee 3**
Great, you can see you've read well.

**Researcher**
Here you see the design objectives. We've already discussed some things of course. So, for example, that the solution must be context-driven. I also thought that was very nice. A solution should address personal needs rather than the needs of the organization to create a dashboard and make everything controllable.

**Interviewee 3**
It is very essential that you take people as your starting point and not so much the organization. Because it is true: if the person is well supported, the organization will benefit from it. I must say that I have no further additions to the design objectives. As far as I know of course.

**Researcher**
Yes, and that's complicated for businesses. Because that also means that you cannot standardize that as an HR Manager you cannot have the same questionnaire sent out to everyone every month. And of course companies find that complicated. But that yes, that person I interviewed literally called it “Human thinking” instead of “Dashboard thinking”. I thought that was a very nice description.

**Interviewee 3**
Very well. I also agree.

**Researcher**
And the second I found very interesting as well. I have already discussed this with the other interviewees from the occupational health and safety service. You would emphasize that. But what they said was. what I always thought to establish, that personal development and vitality programs often co-exist within the organization. But I could also say what you just said: about that personal development, your skills in relation to your challenge that you have, that that is one of the biggest stressors. Or at least a potential source of it. So then the question we have to ask is. Are those two similar programs? Or, looking at the overlap confirmed by the literature, is it actually one program?
It is about which resources are available and which resources you can activate to ensure that you can at least optimize the energy of the knowledge worker. Personal development for sure. So it should indeed be part of one approach, possibly involving specialists on specific themes.

**Researcher**

Beautiful. Do you have any additions to the design objectives?

**Interviewee 3**

Let me take another good look.

**Researcher**

But if there are still things that you think of: if I have to use a system at an organization, what requirements must it really meet?

**Interviewee 3**

I can’t read it well enough. At least, the fine print. I don’t know if you can make anything bigger. No, I couldn’t think of anything like one, two, three.

**Researcher**

Top, good to hear. Then we move on to the next part.

**Interviewee 3**

But really nice. And keep me posted. This is a theme that I deal with every day. And we, as a society and as a business community, simply have to deal with this in a different way. This also includes awareness that prevention is better. And also cheaper.

**Researcher**

Nice, then I’ll continue. Ultimately what we want to do is collect personal data. But data, which we talked about, is only really valuable if it provides insight for managers and policy developers. So what I want to do, say on the data collection side that we use the information that is available on your phone by default, so just for example your physical activity. There are a lot of things that are automatically tracked by Samsung and Apple. In addition, we add Jeroen Otter’s three questions, the questions about motivation, energy and sleep. The third source of information is simply the information the organization needs. With this we also prevent that there are all different information systems within the organization, but that the tool also allows the organizations to retrieve information. Based on this data, the system - or you as a consultant - can request personal information. Think, for example, of sending a request to monitor your heart rate in a certain week. This way you can do individual cases based on the total picture, which is then responded to. And then what does that mean? Well, for the organization and the consultants it helps to apply interventions based on factual substantiation. So managers can then view information at team level, but not at individual level, of course. You, as an external consultant, must be given access on an individual level. One gets a dashboard in which they just see what the trends are within the organization, there is a number of standard minimums. You do a questionnaire once or twice a week: one standard question and questions that are automatically generated by the algorithm, based on the individual answers from the previous questions. The results for the knowledge workers can be found in a special dashboard for you, that you get an overview of the individual figures, so really just an overview of the individual vitality profiles. All information contained therein is of course only intended for you and is strictly confidential. People know: An external consultant is watching, and that is no longer a manager, and I and a word are being watched so that nothing happens to me. Nothing will happen to it unless people think it’s good for me, so to speak.

**Interviewee 3**

I think that’s really great, because I often run into this with people. But data and privacy will remain a concern.

**Researcher**

Yes indeed, I often hear that. And that is a challenge, because people are going to share it because in the end, you often cannot and should not oblige. Because then you’re in that autonomy of the people, and that’s exactly what they didn’t like. But my thought is, and what my hypothesis was, that if you look at the personal ambitions and motives and motivation of the knowledge worker that a reward should work. And not the rewards such as money or other external motivation sources, but rewards that stimulate an internal motivation source. And that is of course the ambition of the knowledge worker. But as that stimulus, an internal motivation that facilitates and motivates you to get the most out of yourself. That could work. So I’m thinking about rewarding the knowledge worker when they share information. This indicates: I want to get the most out of myself and I also take it and I invest time in it. I share information so that people can help me. And that based on the time the knowledge worker has put into it or the number of check boxes that I have completed, that a personal development budget is built up for and by the knowledge worker. A kind of “If you invest in yourself, we also invest in you” principle, so to speak.
Interviewee 3
A great way to get people involved and make that data available. I can well imagine that this will work.

Researcher
Yes, exactly. When I look at other organizations, it often concerns the sharing of mandatory, standard questionnaires, where the question is often what happens with them. That doesn't motivate. So if it's made personal and there's some kind of reward system that fuels that internal motivation, that could work quite well.

Interviewee 3
Yes indeed. And that budget then becomes available to the knowledge worker himself? So that they can then decide for themselves what happens with that budget for their personal development?

Researcher
As a knowledge worker, you are in the lead yourself. Indeed, well exactly that, so you can decide for yourself what you do and don't do, and everyone thinks that's fine. Of course you just have your assessment somewhere or reflection at the end of the year all. But the moment you provide handles and grab them, they are also provided more. What I've done next is let's say this is plotted in a conceptual framework. This is what it looks like. Given the time, because you've had until a quarter to one, we're going to talk about that now. The solution is of course still all theoretical, but what we have done is we first put those design objectives into a kind of ordinary conceptual model. Of how the ecosystem should be structured and how it should interact with each other. This gives an overview of the processes, so to speak. We have that in a concrete visualization conversation is kind of the dummy. Do you have any additions to this?

Interviewee 3
This gives a nice overview of how it might work. Completely clear I think. An important point I would like to point out is that usage is really very important. I've seen so many systems, but none of them made it because it just wasn't convenient enough. This solution has the potential to offer much more, but it can really fail in the adoption of knowledge workers. What is really good about this is that it is an integration of various systems, and that different approaches come together. So that both online and offline come together. And that the reflection and assessment interviews are therefore also incorporated in this. That's very strong. Which design are you thinking of?

Researcher
According to one of the Design Objectives, it should be intuitive and easy to use. And that's why I'm thinking of the following. You have an app on your phone, you can use WhatsApp just like the web. You can then log in online. And then that inherent in the structure of Whatsapp, you can decide for yourself what you respond to, because people are also familiar with that. You will then receive your own profile in which there is both a Health and a Performance variant, which shows the results of the questionnaires completed by the knowledge worker. If you're 24 and just started working, you don't get questions about you, about your kids. You probably know, so it's kind of built that way.

Interviewee 3
Very well.

Researcher
And then you can arrange it yourself from the app, with a contact from Leonie, the company doctor, just make it up. Interventions that you can do yourself to improve your own profile. What do you think when you hear this?

Interviewee 3
It sounds very complete. Nobody can do this anymore. The first overview showed he can fill in different questionnaires and depending on how much you can do in them and what information you can get out of it.

Researcher
So you have two dashboards. That is a summary of the information and the system must be designed so that the dashboard acts on the basis of your personal needs. That you get information based on that.

Interviewee 3
On the basis of performance and your own vitality, health you can see from okay, I'm doing well. If I know where to act.

Researcher
Exactly and you see that as a company doctor and as a vitality coach too. People decide for themselves which theme they want to work on, with the budget they have built up. Whether you, as an external consultant, see this person in the dashboard of well, I just call to be sure with the side
note of: “Maybe there is nothing wrong, but I just want to check with you how you are doing.”. So it works both ways.

**Interviewee 3**
If people really start working on this, yes, that would already make them aware of it. On the one hand, it is exciting that information is available. On the other hand, this allows us to have a much more focused and much earlier conversation about well: what do I have? Namely, what about that? And now I think we miss that opportunity too often.

**Researcher**
Indeed, exactly. There can also be other HR applications behind this, but simply bring them back to one intuitive, recognizable place, because in the end everything is communication. In the end it becomes a very understandable whole, so to speak, and which comes together in one place, namely your own profile, for which you are responsible yourself.

**Interviewee 3**
Make exactly all the information available to take good care of yourself. Cool, you did this really well.

**Researcher**
Well nice to hear. I look at the time, you must move on.

**Interviewee 3**
Yes.

**Researcher**
Thank you so much for your time if anything else comes to mind that you're thinking well, I'd really like to, just want to see if that, I'd like to add that. Let me know, also know about it, but I get that, I get, say, a whole theoretical story.

**Interviewee 3**
Yep, I'm definitely a fan of this. I now know to look from where. Let me know when the app is ready, because I want to get started with this.

**Researcher**
Thank you for your enthusiasm and thinking along. I'll get back to you on this soon.

**Interviewee 4**

**Researcher**
Good day, good to talk to you again. Glad you want to make time for this.

**Interviewee 4**
Very nice. I am curious what steps you have taken.

**Researcher**
Well, doing a lot of interview. And great insights. I look forward to your sharp analysis.

**Interviewee 4**
What are the responses you get back?

**Researcher**
Well, well. And the good thing is that I can do some pitches after the summer, when it's finished so to speak. I'm happy with that too. Soon it will become real.

**Interviewee 4**
It is nice if they already see that there is potential in it, eventually you need a launching customer. Perhaps the smartest thing to do is to organize some kind of co-creation session. Invite them to your side of the table, or vice versa. Then you achieve the most in my experience.

**Researcher**
Yes, good suggestion, thanks.

**Interviewee 4**
That they can then deploy their own program and thus make a difference. Yes, those are nice conversations. But take me with you, what have you done.

**Researcher**
Well, as you know a lot of literature research.

**Interviewee 4**
Yes I can imagine. How did you handle that?

**Researcher**
I researched five domains. You can see that picture here. And based on these domains, I have drawn up design criteria that the solution must meet. It's also nice that the other interviewees recognized...
it. So the basic conclusion is that you could say that, as a kind of design validation for new systems. Whether all these guidelines have been incorporated.

**Interviewee 4**

Exactly. I recognize this one too. But that contextual, that's really the most important thing as far as I'm concerned. I already mentioned that last time.

**Researcher**

Yes, that's why it's there. Can you tell me again what you mean by that?

**Interviewee 4**

Well, in companies we want to make everything controllable. So, to put everything in dashboards. If a number comes out then we understand it and we can do something with it. But this is where we're going all over the place, ignoring the real value of that number and more importantly, that everyone is different and has different needs. So we should not collect our analyses around the dashboard, but collect our tools around the knowledge worker and make it as matchable as possible for that person. Do you understand what I mean?

**Researcher**

Yes, completely clear. Have a look at this; as mentioned, I have mapped out all the determinants that influence the energy level of knowledge workers. I also spoke about this with a professor, who called it determination. You have to look at determinants in medicine: what influences what? So that in my head I read a lot; what exactly has the burnout or about an increased risk of the burnout. Because that also determines how someone's energy can be improved. So we finally arrived at this. All of these things are all weather scientifically of course, and in fact the conclusion is: your workload interact with how rested you are, that interacts again with peace of mind, that interacts back with your gender and so it is a very complex web of all things that relate to each other. And it would be nice if you could develop an algorithm that understands this web. Thus, if you so are a woman, you're 35, you sleep badly and you know you are in phase that you probably have a child, that the algorithm then focusses on that determinant, instead of generic burnout questionnaires which are not specific enough or take too long.

**Interviewee 4**

Beautiful, I like that.

**Researcher**

That then the questionnaire or the system will look more in that corner, say. So you will collect information in a targeted manner and then develop appropriate interventions. The moment something deviates, you can recognize it and the sooner you can detect it, the faster you can do something about it. And sometimes, once you observe a pattern, it's figuring out which of these determinants underlies and correlates that pattern. Then you have to and you can monitor that determinant.

**Interviewee 4**

Quite honestly, I don’t expect computers to be able to do this either, because they can't perceive everything at the same time. They can do all kinds of things, observe the things which already occurred in the past, not what is still developing. So you will always need people who, for example, see a person like: hey, something is wrong with you, you need help.

**Researcher**

Do you think? Isn't it true that Facebook's algorithms can also predict whether someone is pregnant before someone even realizes it?

**Interviewee 4**

That is also true, but it will really need a lot of data to be able to do that, I suspect. The most important thing in the first phase is that there are parts on the program that read out your daily affairs so that we know whether this is going in the right direction or not.

**Researcher**

Yes. And then an interesting one indeed is to see how the hypothesis that algorithms can’t do that, or that it's correct.

**Interviewee 4**

I am very busy with this question. Here I can show you an example of altos. A long-time back a research was looking at couples, and they looked on the basis of video materials, if they could predict whether there problems later in the relationship would occur or not. And in the end, a gigantic bucket of better data has been released on it. And they got to a certain reliability, but at one point they looked at that a little bit better at those couples with ordinary, human experts, and I believe they had a higher reliability then the system within a minute and a half. Because of the fact that human experts saw, that you can't really put into words where it went wrong. And then that
computer came up at the same level, with much less data but that. So that indicates that people look at the situation in a different way, and you cannot see that in all big data.

**Researcher**

Interesting, I was not aware of that study.

**Interviewee 4**

In research is only one step further when perceives humans and pattern and do something with it. Computers do not think like that, who does not yet say in my knowledge and experience: the computers never cope well with this, because they do not have all the forms of perception that we do have. They are never going to get that, I believe. I also have an interesting one. If you are told in this way, you can indicate the technology strengthens the human being with certain capabilities, by perceiving or enlarging on certain dimensions, easier, so that it does not get in the way. And then people don't feel attacked. So you actually only use the technology as a toolbox. When you will use an algorithm to do everything at the same time to observe and to replace humans, then it's not going well. Because we also know that people simply need physical contact.

**Researcher**

No, actually the system should always be a Decision Support System, and never take the seat of the coach.

**Interviewee 4**

Agree, yes, indeed. And then the question: How do you find the datasets?

**Researcher**

Yes, especially in the beginning. Another research states that machine learning can supplement data, to an accuracy of 90%. They called it Multi Kernel Machine Learning. Really interesting.

**Interviewee 4**

Somehow you can use some smart technology. And this is a nice added value. You have to put it in the right place, then it can be interesting. Can you share that model you just showed?

**Researcher**

Sure, I called it the Vitality Map. Basically a summary of all determinants, but then structured in a logical way.

**Researcher**

Yes, in fact you see those three batteries again. If you don't charge one properly, you know where to look for it.

**Interviewee 4**

You can do something about the influence of those batteries. Only the impact of sleep depends on all other factors.

**Researcher**

Indeed says: view also includes environment, which is divided into a lot in a personal and professional. The second is the work environment.

**Interviewee 4**

Business and, yes, so that's your private. And then again, that also seems to be another thing. That's just out there I see.

**Researcher**

True indeed.

**Interviewee 4**

I’d put here one more time on the dividing line, that’s a big cloud. Everything we don’t know, but belongs to the environment.

**Researcher**

Nice, read about it, but didn't record it. We call that “The Unknown”.

**Interviewee 4**

And the reason for that is only going to the pub. These are the things in your environment that you are not consciously involved with, but that have a huge effect on you. Singing people on the terrace for example.

**Researcher**

A very good one, I hadn't thought of it that way. Otherwise, an algorithm must assign everything to one of the other determinants, but there is of course a part that is uncertain. That's that factor.

**Interviewee 4**

Can play a big cloud, a lot of influences that we don't know, and we will never know, but they are there.

**Researcher**

Yes.
And it sits too. That is also on the side, because there are also unclear factors on the side and a lot of people are disappointed. We can never make a model that captures everything. And then I also say: it's not about making a model. It's about making visible what we're talking about, I like it when we often eat different things, for example. Everyone differs in that. Same with the desired input. And yes, one knowledge worker finds it fun to work every day with such a program. The other doesn't like it at all, and sees it as an obligation. And what does it look like then? If it's all pre-programmed, the day, the time. And my advice is: work with nudges. This way you can work with micro elements in the program at different times. I also presented this to people who also have a didactic background on this way to approach your development. So no big chunks of information, but small chunks. Once again: nudges.

**Researcher**

So if we can work that out with those coaches, it must always be with the agreement that we want to facilitate that for them and that we create a kind of framework that includes this nudging. The best thing is to develop programs that can also be used for the larger community. That is completely impactful.

**Interviewee 4**

But, even better is that there are companies behind the screen itself and develop questionnaire themselves, and may select questions, possibly with the help of the algorithm. Ultimately, that feature has to come. Questionnaires that can be developed by the coaches and companies themselves. The way I see it is: 80 percent of people can buy something standard. With a standard program and some of them will be developed. Do you have a whole box of questionnaires available to everyone. There is of course even more possible when it comes to customization.

**Researcher**

Exactly. Although I do think that the algorithm has an important role in those questionnaires and intervention development. That should not be manual work in the main.

**Interviewee 4**

Once. You have several people at the back, which one employee e-learning from signs. Or you put buttons algorithm, which says: are you going to propose anything for that person. And that algorithm button has to be added at a later stage, because you first have to push thousands of people through it before your algorithm is able to give well-founded advice.

**Researcher**

Totally agree, I think too.

**Interviewee 4**

If the catalogue behind exists, you call the continuous toolkit, from e-learning till the questionnaire. Then that is a very user-friendly way to get the information to those people, yes, that's fantastic.

**Researcher**

It would be nice to see if a firm can do a test, to be able to work this out with them in a session. Difficult to estimate and determine where to start in companies, you know. How would you do that?

**Interviewee 4**

You can go to companies in different ways. You can aim on the risks: you can start measuring risks, and you see a lot of companies that have business with that. So map burnouts so to speak. Those companies say: we have validated questionnaires, which we can put with your staff and on the basis of your validated questionnaire we can make a proposal what you should do with your company. So that's a very straightforward. If I hear the reactions of the parties where you are, I think they finally more interested in feedback, you have to say that feedback is only created when they also put energy into it.

**Researcher**

Yes. And then we have a first program, which we don't have to develop ourselves, but we do that with them. Then we just have to set up the workshops properly, so that that content is generated, and I think that in itself is also a product that you can sell. Yes. Great first phase.

**Interviewee 4**

Yes Yes.

**Researcher**

That could be the intermediate product after that first creative session. And in the end where to go with this solution, I just don't know. I think you will create content together with the client. The Design Objectives really show that the contextual part is so important, I see that everywhere. Then I don't think you can avoid the fact that companies have to be able to design it themselves.
Interviewee 4
Yes, but what I just suggested is step one. And then step two is, that they can eventually make it themselves.

Researcher
Anyway, interesting. Did you have any other customizations besides the “Unknown Clouds”?

Interviewee 4
No, continue. Again, I'd love to receive the visual. Such an overview is also useful in my work. Challenging trajectory that you are working on. Also the question of customization and standardization.

Researcher
You a solution develops dynamical and offers flexibility, I think is really a precondition. Just like that holistic approach, which is characterized by the Vitality Map. All components are an integral part of burnout prevention. And companies still have to get used to that, I notice.

Interviewee 4
And so do I in my daily work. It's more than measuring whether you sleep well, isn't it. That's kind of the classic approach to the Quantified Self, which I've heard you talk about.

Researcher
Hey, and back to those Design Objectives; did you have any additions to that? You've worked quite a lot with those kinds of systems, of course. Say from literature nine design criteria drawing is beautiful, but of course I am wondering if it really works as well in practice.

Interviewee 4
Yes, I think you're fine. Covers the whole picture. But those six Design Objective, so how intuitive the app is and how well the solution, which is really very important to the eventual adoption of the end-user.

Researcher
Yes, there are still challenges in the implementation, the degree of autonomy, the design, the algorithm. Those are the limitations of course. In any case, the research offers a clear direction that the solution must meet.

Interviewee 4
Yes.

Researcher
And then I put that here in a Conceptual Framework. So what the solution should look like. Not yet the design, of course, but all connections and flows within the ecosystem.

Interviewee 4
As a basis you can use it naturally.

Researcher
Yes and I was also thinking, I will work in the design with personifications of the robots. To contribute to the intuitive design, so to speak. So Olivier Organization support are the questionnaire and of the organization . And Tessa Vitality Support does the automated questionnaires based on the analyses of the Vitality Map.

Interviewee 4
Bright. Think that works. And will you still use my research that you have to work with a text-message based design?

Researcher
Yes, my apologies, I didn't state that clearly enough. I am certainly going to do that. Would you explain on-the-record your reasoning behind that?

Interviewee 4
Certainly! The main reason is that a text-based design can be recognized by the user. Because use that almost every hour. In addition, this basic function actually offers everything you need for a coach and analysis app. So file building is included, contact with coaches, a personal profile. And again, people know it. So it's an extension of what they already know.

Researcher
Clear, thanks for the explanation. Again.

Interviewee 4
Do you have it like this?

Researcher
Certainly.

Interviewee 4
And I get really good responses to this view. You, on the basis of interpersonal communication, an environment created where you can all set up and can plan and can do. And the dashboard
integrates and analyses all that information. I just told you a little bit how complex it is for a computer to be able to analyse that, but because everything is codified via text, that can be done well.

Researcher
I follow it. That's cool. I'm going to go with that, I think.

Interviewee 4
And it ties in nicely with that autonomy. The knowledge worker can take control of things himself. Or not, of course. Equally good friends.

Researcher
And in principle it contains all the tools for the knowledge worker. He can think for himself: okay, how much time does it take and things like that to be able to do?

Interviewee 4
Certainly.

Researcher
Well thanks again for your time, I will undoubtedly give you a call to spar over a few things. Anyway, many thanks so far. And I was allowed to include this in my Thesis Report, right?

Interviewee 4
Certainly no problem. I'll gladly do it for you.

Researcher
Until next time!

Interviewee 5
Researcher
I'm curious at first. I met you on the website. Medical director, got that right?

Interviewee 5
Oh, it said in English.

Researcher
Yes I think so.

Interviewee 5
Okay. That's cool, I'll keep that in there. Yes medical director. I am trained as a company doctor. And within the hard core of (...), of which (...) is a part and (...) is in charge, I am the only doctor. So it quickly makes sense to make me the medical director of (...) where every label in our company has a medical director. What does that mean? Well I have more roles, you know. So what (...) just told you about what she does, I do a lot of that too. Relationship management, sales, product development. But as a medical director, I actually try to create good conditions for our doctors to do their job well. It is from the very hard side, for example, to ensure that the laptop has the right applications up to and including the very soft side, I spar a lot with doctors about case histories, I organize training sessions for them a few times a year, I still teach to interns at the VU, legal challenges, the complaints procedure. I had just, let me knock it, not often, a complaint had now been filed about a company doctor. Well, I will contact that gentleman, because that's how it is in the complaints procedure, and I try to handle it properly. So everything is coming my way in that sense.

Researcher
It sounds like a nice dynamic job.

Interviewee 5
Really great. It is the nicest job I can think of at also the nicest company with the nicest boss.

Researcher
Yes, right? She says that herself, too. But good if that is widely embraced, by the people themselves.

Interviewee 5
Yeah, she knows that too. We are very happy with each other, but also thanks to (...). 'Cause I know you don't live far from each other. She already told me that.

Researcher
That's my colleague/partner, (...).

Interviewee 5
Oh, I thought you lived across from her.

Researcher
No, that's my partner, they live very close to each other.

Interviewee 5
That is broadly what my job entails.
Researcher
Are you also a practicing occupational physician?

Interviewee 5
No, I haven't been in the consulting room for a long time. But because I still do all those other things, I still know a lot about the content. That's how it can go. In college I always thought that I wanted to become a company doctor, it has also been a very good choice for me personally. I ended up in management quite early on and at a certain point I no longer wanted to combine that with the execution, really wanted to bet on 1 horse and that's fine.

Researcher
Yes, medical director, let's just use the English term, of a large organization, that's nice. Sure, it is. It's going very well. I also thought it was good to hear from (…), the boss, that in the context of practice what you preach, a nice work culture and the few hard rules and based on the own strength of the people that they themselves acts upon. (…) just said that, that is one of the preconditions of psychological well-being, so to speak. That this is also addressed internally.

Interviewee 5
Yes it is. (…) couldn't help it either. And that also applies. A certain monoculture arises in a company, in other words, the people who end up in her team think about work in roughly the same way. So we're all good at it and we thrive on it. And that also translates into very satisfied employees and very satisfied customers.

Researcher
Nice. I have already heard about a number of customers and they are of course large customers. For today, thanks again for taking the time to do this, it's now time for our company to work with (…). Today (…) and (…) are recording podcasts with managers and experts and coaches from top sport. It's nice that it got off the ground. The reason why we are here today is because we are both 26 and are also doing a study, and this is because we have been working on (…) for 4 years now, so I'll put it that way. I am now in the final phase of my studies, which is Technical Public Administration in Delft and it is about how you can use technology in business. In that context, I am now working on my thesis and that comes very close to performance management, but that is on the very negative side burnouts at a given moment if that does not go well for a longer period of time. And that's great fun, because at (…) we really only deal with performance management, of course: how do you deal with your own personal development and with your own performance and with your energy level. And that's why it's nice to see how we can bring that to business. So what I really want to do with you today, so as a suggestion for the agenda, is that I first ask some general questions about the business you are in, the burnout, where the risks lie, where the problem lies. within organizations in your view. To then look at what could be a solution from the perspective of IT and ICT and that is what I eventually did research into. I have therefore drawn up a number of design criteria that a solution must meet and I have also already developed a kind of concept solution with an online design. So I'd really like to take a look at that with you, if that's okay with you.

Interviewee 5
Fine.

Researcher
Did I understand correctly that you are involved in these kinds of projects, in the innovations?

Interviewee 5
Yes.

Researcher
What trends do you see right now? Where is (…) now aiming his arrows?

Interviewee 5
In general terms, data-driven working. In concrete terms, this means that we try to collect information in a smart way from our clients (we say clients instead of patients) at the front of the process. With which we can efficiently deploy the right expertise to come up with the right solution for that problem that the client has. That's 1. And 2, if you do collect data, use it to provide the customer organization with insight into what's going on there. This can be about medical problems, burn-outs, but it can also be about, we think in domains, you may have noticed that by now, there can also be bottlenecks in private, work or motivation domains and by collecting data smartly and consistently, you can provide insight into where the problem is and, hopefully, we can also help bring the solutions closer.
I can imagine that at a certain point in the process someone will end up in a burnout, in which phase could you already do something about prevention or premature diagnosis with this kind of technology?

**Interviewee 5**

Actually in the metaphor, the burnout then something already flows from that tap, then you start mopping if someone is already in the consultation room with our company doctor with a burnout. And you have to turn off that tap. The sectors that influence the development of a burnout that are primarily with the employee himself, a certain character makes you susceptible to a burnout. But if that character is in a certain context, in a certain work environment that gives rise to it, then a burnout can easily develop. So you want, if you want to turn off that tap, you want to end up with those factors at work that promote burnout and you quickly talk about managers. Their ability, through giving trust and offering a safe environment, to have the right conversation with that employee, even at an early stage or actually continuously. In plain Dutch: that the manager can deal with people somewhat normally and is just interested and asks: How are you? And when you notice... you also have those people in your area, they are more often ladies than gentlemen, between the ages of 20 and 30 who have a lot to do with their bicycle. They row here, they study there, they are still on a board and they have to organize everything if it is someone's birthday... Well, then you say to such a daughter, in this case, you have to watch out because you are also at risk. In the setting of a company or organization you need a manager who is able to discuss this.

**Researcher**

Is it always the supervisor who has the ball, basically?

**Interviewee 5**

Yes, primarily in terms of ultimate responsibility. But if you as a manager create that environment, and that's no trick, that's actually the bad news, you either have that or you don't as a manager. That is very difficult for people to learn. But if you create that environment, that atmosphere, then it can be colleagues who, together, on time, say hey dude, are things going well, or wouldn't you be careful that...

**Researcher**

Because it's about that conversation and that doesn't sound very complicated does it?

**Interviewee 5**

No. For example, within an organization such as (…), in which I believe that safety exists, you can expect people to have that conversation with people on time, so that they are presented with a mirror. And that is no guarantee, because it could just as well happen that someone goes off the rails.

**Researcher**

I understand what happens in the workplace, through structured conversations or scheduled conversations, or keeping your eyes and ears open and checking how people are doing, but what role does this type of system play? Do they make it easier for a manager or do they waive their responsibility? That will keep an eye on it.

**Interviewee 5**

The latter is a risk. Hence my reference that one must naturally have those qualifications or those skills. Systems can only be supportive, they cannot take over.

**Researcher**

And are systems already able to retrieve information from people in addition to the information, I know the surveys with I am doing well, I am not doing well, are the systems also able to put their finger on the sore spot?

**Interviewee 5**

Yes, I think so. You can use valid questionnaires that identify early whether something is wrong with someone.

**Researcher**

And how do you deploy that within organizations? I can also imagine that people have other things on their mind or think they don't need it. Or find that there is no problem yet and then find out for yourself later.

**Interviewee 5**

Yes, that's too easy of course. In any case, we want to use these questionnaires if someone has called in sick. But then you already have it, then you're pretty late in the process.

**Researcher**

Then you're already mopping.

**Interviewee 5**
Yes exactly. And actually, I am allergic to structurally scheduled conversations, you would do this for this purpose, because that is far too instrumental. Of course, as a safety net it is good to schedule something every now and then, but what matters here is authentic attention and interest in people. And you don't replace that with a series of performance or appraisal interviews and those kinds of situations and conversations. But you could work periodically with questionnaires for the maintenance of the well-being of your employees, provided you dress it well. Namely with the explanation, this is not intended instead of us just being able to share things in confidence with each other in complete safety, but as an extra lock on the door.

Indeed, I can imagine that. Vitality and personal development are often seen as 2 trajectories in organizations. So we do something about health, exercise, healthy food and that framework. And on the other hand, we do something about training, personal development and the conversations about it. Are they two separate paths?

No. As far as I'm concerned, but that's not a scientific basis, but that's my personal view, it's much more holistic, and it's about that these aren't two separate paths. That personally, if you take good care of yourself, mentally and physically, you can also handle all challenges much better, you can grow much better personally. And I also think that if you look at leadership, if a manager also approaches people in this way, that it also has a much easier effect, sorts in trying to achieve personal growth. I have seen in practice, and my vision has also developed from that, that departments or companies where there is such safety and mutual trust, people also take responsibility much more easily for their own employability in the short or long term. So it is also about physical strain, also preventing obesity, not smoking, eating healthy and getting enough exercise. You do that much faster if you are at work in a nice dynamic atmosphere.

That's all intertwined. In my research I regularly see vitality programs that are fairly 1-dimensional, for example such as ASR Vitality: move more and you will get your fit-bit sponsored by us. This kind of tooling is a global multi-billion dollar business.

You have to be intrinsically motivated. And I always find the paradox that you cultivate intrinsic motivation by simply trusting people, here it comes again, facilitating them well in their work, being there for them and then, consciously or unconsciously, they start taking better care of themselves and they also want to stay healthy and fit.

I see very little sport on the (...) website compared to other vitality organization and vitality program websites. And that will be a choice, I think.

That's not very conscious. I have been looking for a long time, and it is not easy, for proven effective interventions. And if I ask in the network what proven effective interventions are available on those lifestyle themes, exercise, smoking, nutrition, etc., then you quickly end up in sports medicine. At Tom Brandon, who is chairman of the Association for Dutch Sports Medicine and who then talks about customer cases where the Board of Directors also sports fanatic and thus makes people enthusiastic to do the same. But that's about it. It is also very difficult to put together a whole palette for this in your offer to customers, because there are not many good examples.

I can well imagine that. It will contribute something for everyone, but it still remains fairly 1-dimensional?

Yeah, it's pretty one-dimensional and a dangerous parallel: How come highly educated people take better care of themselves than less educated people? Because they understand better what it does to you to live a healthy life or not, but they also have a much greater interest in and are rewarded more for that healthy behaviour.

And what form does that reward come in?

Live longer and live longer healthy.

And in the short term, what are the rewards of being able to function better at work?
Sure. And just very black and white and that’s why the comparison is also dangerous because you can't tell it in black and white, but someone who already has a shitty job and a shitty wife and shitty kids at home and who lives in a shitty house, why should who then stop to role his shaggie on Saturday?

Researcher
So you think that this kind of online tooling and methods can play an important role in diagnosis and prevention, but never instead of that kind of conversation, but complementary to it.

Interviewee 5
Exactly.

Researcher
Thus facilitating the off-line contacts and preferably the informal off-line contacts and not the formal quarterly meetings.

Interviewee 5
Exactly.

Researcher
Obviously. What I really want to do: I have made a list of design criteria that a solution must meet and I would like to go through it with you. Not all of them anymore, because we've already had a few, and then we look at the solution we came up with and I'm very curious what you think about it. What I've heard back from a lot of people is that they also say that the need of companies, which is to create dashboards that you can respond to immediately and that you can use in reporting, so creating systems that are more common than that. That it is looked at where is there a need for instead of putting that in rigid systems. Do you recognize that?

Interviewee 5
Yes.

Researcher
The big companies like to work with ROIs and still want to see all those dashboards. But can you achieve that personal approach sufficiently in the services you offer?

Interviewee 5
That’s hard, because you'd really like to objectify and quantify it. So what does this mean in terms of production improvement, for example? Such an (...) case, I don't know whether (...) shared this with you, you do see an effect there, but there are a lot of confounders in it. It is now corona time, so perhaps that is why the frequent absenteeism has decreased. So it's really, really hard to get your finger on that. I really wish someone could do that.

Researcher
You don’t have a vision of how to do that either?

Interviewee 5
No. It's a very well-trodden path. A study was done 100 years ago which showed that investing 1 euro and yielding 3 returns. Maybe it was still 1 guilder investing yields 3 guilders, it is that long ago. And you keep falling back on that study. So no, that's it.

Researcher
And what do you think of all the things you can measure with your phone? You can even measure your heart rate for liability with your camera. And I have already come across an app from TNO with which you can predict your chance of a burnout by taking a daily measurement by placing your finger on the lens. How do you view those kinds of technological solutions, often on your phone or on your fit bid that are said to have great values?

Interviewee 5
Yes, I look at that positively. Provided, of course, that it measures what it measures, so it is valid. And provided that it is not easily used by everyone. In other words, and perhaps a little too black and white, it must also be a generational thing. That is not entirely true. But you also gradually see that it is gaining the upper hand. And I am convinced that it is also the future. And I actually hope, and that is part of the diagnosis, the inventory of what is wrong with people, that it will be digitized. That may well be one of the benefits of this crisis. That there is an acceleration in making a good distinction between what really needs to be done physically, for example in an outpatient clinic, and what can also be done digitally remotely.

Researcher
What tools do you already use from Mensley for this? Are there things you can do on your phone? A questionnaire is of course a well-known tool for retrieving information, but are there already such smart technological things? I often think they are a bit overrated.

Interviewee 5
The requirement that it is valid, so that you measure what you want to measure. But no, so far we have not progressed beyond a questionnaire that we use after a sick report to see which intervention should take place, to offer it over the telephone.

**Researcher**

And that's a video call for example?

**Interviewee 5**

No, that's a questionnaire. With questions like do you have a pain in your head? or do you sleep well?

**Researcher**

And based on the results of that questionnaire, a next step, for example a video conversation or a personal conversation, is determined?

**Interviewee 5**

Yes. And you then decide on the basis of that decision tree slash algorithm whether you should continue with a company doctor or a psychologist, or the manager.

**Researcher**

The integration, that holistic approach, I think that in Human Resource management is called more performance management, so developing the skills and competences of your people, and on the other hand vitality, do you think that is 1 path or 1 method, 1 approach asks?

**Interviewee 5**

Yes, I think so.

**Researcher**

And from what background do you think that?

**Interviewee 5**

That's just part of my personal experience and what I find myself that is good for me. But also placed in the experience I have in recent decades with good and bad examples within organizations. Where there is an atmosphere and a culture that you would wish for, people will do their best again, not only for qualifications that are necessary to be able to do the work, but also for parameters that are good for their health. That goes hand-in-hand.

**Researcher**

And then again, if the perception of your own skills in relation to the work you have to do is one of the biggest if not the biggest causes of psychological tension and thus stress. You can approach it separately and throw on healthy food and exercise. But if you already determine that the stress of being able to do something or not is one of the biggest causes of psychological tension, then it is implicitly one of the most important parts of a vitality program?

**Interviewee 5**

Well, sure. You explain again what I just mean, which brings us to the same page.

**Researcher**

From TE we have seen that in the worst case someone has a bi-la per quarter and we also have a sports program running. 2 totally completely different paths. So I find it fascinating that it works that way.

**Interviewee 5**

Yeah, I don't understand that very well either. And well here he comes again, how we work with people and how we treat each other, those bilas that will be, they will be in the agendas somewhere, but we just talk to each other if necessary. And the question of what do you need to be able to do your job is asked often enough in one form or another. But of course you are also expected to let us know what you need before that question comes up. That goes both ways. And there can also be vitality things in between. I have already agreed with (..) before corona that I will indeed do something for myself that I can use to give something that happened in the personal sphere about 6 years ago. And anything can fit. In my case, it would be very appropriate for that to be a combination of physical and mental as well. And (..) then comes back to that herself: Joh, you don't forget that we agreed on that, do you? Look, now little is possible because of corona, but that just remains on the agenda.

**Researcher**

So you could have agreed, so to speak, to do something about competencies, but now it's more about the physical/mental aspect? That brings the informal conversations in the workplace to the fore.

**Interviewee 5**

Yes. And so we also instruct people who are new to us. Please indicate what you need, but don't wait for us to ask that question either. Just come with it.

**Researcher**
Yes, and if there is that space, and that psychological safety. What (...) indicated is that it is often possible to measure certain things, but what is not yet successful is to convert it into a specific change in people's behaviour. So actually move healthier, deal better with your personal development, etc. Do you think there is a role for ICT in this or do you think it will ultimately really be diagnosis and prevention?

**Interviewee 5**

You need to help me with what you're looking for.

**Researcher**

What (...) meant is that creating a nice dashboard and getting information is step 1, but do you want people to do something different in the direction of what's good for them. You have then passed the awareness phase, but then you have to get moving. How you make behavioural change possible through applications is still a big black box. Do you recognize that?

**Interviewee 5**

Yes, I recognize that and that's what I meant, if I understand you correctly now, when I was just talking about the search for proven effective interventions. Because you can't get there with the croquettes from the canteen or score points with the fit-bit or what's that called these days, I can see that too. That intrinsic motivation, how are you going to cultivate it? What do you have to do for that? So I think it really helps to just have that good conversation normally. There's a lot of fuss about it and the good conversation is even capitalized in the literature, but I think if you're given as a manager to deal with people a bit normally then you don't have to institutionalize that, then you do it naturally yes. And if someone can demonstrate that what you really feel on your clogs has an effect on that people in that department take good care of themselves, slash, even better, if you can demonstrate, also to keep it very businesslike. what increase in production you will achieve in terms of employability of people, then we are the best of luck. So if you can sort that out...

**Researcher**

I'll write it down for my to do list for the next conversation. I understand that the involvement or engagement of people in these kinds of solutions, concretely, we send a questionnaire that they have to fill out. Also preventive, so if there is no problem yet. That there is a challenge. Would it help in your view if - I have called it reward structures - there is some form of bonus structure, perhaps not monetary but in the atmosphere of ASR Vitality? So basically where ASR Vitality is you move and you get a fit bid and it could be here you share how you are doing in different ways and you act on that too and you are rewarded with similar things eg a personal development budget, just to name a few?

**Interviewee 5**

Yeah, I don't think so.

**Researcher**

Doesn't it work like that?

**Interviewee 5**

You want people to fill out that questionnaire or whatever it is because they find out that they have to start exhibiting a certain behaviour. I don't really see the link between that reward, so that cinema ticket, and that they then start taking better care of themselves because they have completed that questionnaire. I find it too instrumental, if you ask me. That's purely intuitive, my answer.

**Researcher**

And an external motivational source? I think that basically doesn't work, but my thought was that knowledge workers, I focused on that for a moment, are ambitious, have a need for autonomous work and attach great importance to personal development. Well, if you add up personal development and ambition and you reward them for getting started with a tooling or a personal development budget with which you give in to that need, so to speak. So maybe not in the atmosphere of cinema vouchers, but fill in the questionnaires and the online interventions that we think are good for you and on that basis you will receive 50 or 100 euros per month in personal development budget, which is also in the mutual interest. So more in that sphere of rewards?

**Interviewee 5**

I think those people don't need these kinds of rewards when you're in the game like that you don't need that reward at all to want to do this. You are already motivated enough to want to work on it.

**Researcher**

So those few percent that are swinging just on the edge of just about, could give you a nudge. I understand you, it is an external source of motivation that in principle should not be necessary. Bright! Would you have any adaptions in relation to the design objectives?
No, I think this works. And please prove me wrong on the reward systems.

**Researcher**

Then I'm going to show you what we came up with, a kind of framework that helps human resource managers to develop human resource management systems. My idea is that it will run on WhatsApp. It creates a kind of intuitive environment for people to communicate with their personal resources, say. I'll show you what that looks like and then I'm very curious how you look at it from your experience. Let's start with What do we want to collect? My idea is to collect a very short questionnaire every day in which you ask questions every day. In athletes sport you literally have daily questions about: How did you sleep? How is your energy? How is your motivation? Because those are the main drivers, your most important energy sources. By having those three questions every day, you kind of have absolute values of how someone is doing. The moment your sleep decreases, your energy decreases, your perceived energy level, and that has been going on for a long time, then you know that you have to do something about it.

**Interviewee 5**

Is that evidence-based? Has it been proven that it works that way?

**Researcher**

In any case, what has been proven is that - they call it RPE, the perceived experience - that it is one of the most accurate sources of knowing how people are doing. So, for example, there was a study on the accuracy of sleepcycle and just asking people how did you sleep? And when it appeared the second *really* accurate forecast. So that's been proven and researched. The value of a daily measurement, in top sport that is somewhat the standard that that happens, in business not yet in my opinion. So has that been proven? I wouldn't know. Third is the information that the companies themselves want to collect. There is a whole set of information that companies want to collect themselves, either about the corporate culture, or about leadership, just the employee satisfaction surveys. And the last one is personalized questionnaires that focus on the personal profile of the employees. So what I've done is in my research, among other things, what the potential chargers of the energy level are, but also what the potential dischargers of energy are at the same time. You recognize all factors known to you, from occupational stress to social activities, the presence or absence thereof, learning, the sleep-physical activities, but also whether someone has a child, they call it the second shift I believe, so that you have peace when you come home. What we actually mean by this is that, based on your personal profile, you will look very specifically with an algorithm at, for example, this 29-year-old woman in a consultancy job who has a higher risk that the risks of burnout are in a certain angle, so in that corner we're going to get information. So not like many companies I work with, where everyone gets the same questionnaire, you have fifteen minutes with that and that's it. But really with minimal effort and very much on the basis of the personal profile and the risks that are based on the available data, very specific retrieval of information. What will happen next for organizations? A decision support system, so it does not replace decision-making or policymaking, but it supports decision-making. So if it turns out that this same 29-year-old woman, if a lot of stress is caused by things outside of work, at least you know that you don't have to look for it in leadership or in exercise. But at least you know where the problem lies. And it offers an integral performance management system. For knowledge workers, this results in a kind of risk profile, i.e. low, medium and high risk, and a tool in which the individual needs are really central, which in turn is context thinking instead of systems thinking, so really based on the individual needs of the individual. employee. Then then, once we all have this data, what can we do with it? That means organizations can intervene more effectively where it is needed. And prevention of burnout, so hopefully before we have to mop up we already do interventions for that, very targeted, so not another standard wellness program, but very focused on where the problem lies. And for employees, that means balancing online and offline interventions. I can really see that the quarterly meetings that this indeed comes together with the use of e-learning bites, but also the use of nudging, for example, through small messages that are devised from those conversations, and the use of other tools, but really based of that personal need. What we did was look at what is the most recognizable and intuitive environment of people within a company? We could all start developing separate apps, questionnaires and the like, but people are already overwhelmed with things like that, so how nice would it be if you could use the user environment of What's app, so not What's app, but an environment that strongly supports it? makes one think, using that as a starting point for organizing that personal learning environment, or ultimately that personal performance environment. In this you will see a number of things come back, that can just be your doctor, so to speak, your business coach, your e-learnings are prepared in a program, which then concerns training 2, which is then simply added to the app for you. ready, the business updates, so it can function as a communication tool for the company and the result is an environment in which you as
an individual both have your own medical file, can organize your own interventions, so we don't want you to do this but ask yourself where you need help. And a dashboard based on your own questionnaire that is made specifically for the person. A dashboard that helps to provide insight into how you are doing, so to speak. The 2nd dimension is then performance, which is not ready yet, but you can then represent the same figure, but then based on your competencies, i.e. leadership, communication, and so on. But in the end everything is organized in such a way that it is up to the individual, who you yourself, in line with how people know What's app, decide for yourself whether you respond or not, can approach people yourself or not, but really put the control in the hands of the individual. How do you see this?

Interviewee 5

That's cool. Of course, the condition is that culture, that environment at work, that makes it possible for people to take good care of themselves, that safety, that trust, but if there is, it is a beautiful mirror. Perhaps (...) also mentioned this just now, our leadership platform to executives in fact offer this. Make an inventory of their strengths and weaknesses and then support them in, intrinsically motivated, to achieve possible improvements in your performance as leaders. You then offer something similar for the individual employee.

Researcher

Exactly. And some won't use it. I can imagine that a distinction is still made between a number of obligatory things because you work somewhere and just have to do that, and a number of things that are optional but which are strongly encouraged and from which you also reap the benefits if you then also uses. I can just imagine that you have the feeling that everything is organized around you, that you just can't react and that's fine, but that you are at the helm.

Interviewee 5

Exactly and that is the condition. Because that meets my conviction that people must be intrinsically motivated to want to do this and, as we just talked about, that it doesn't make much sense to formulate it very playfully, to provoke it with a cinema ticket.

Researcher

So we also thought, to create an intuitive communication interface of human and robot. So think of, with a wink, Vera Vitality support and Olivier organizational support, those are the algorithms that talk to you. But based on the information you share there, you get your personal advice based on that, which then becomes more and more accurate and then you may or may not be able to do something with it.

Interviewee 5

Nice.

Researcher

What do you miss? What is really a missing link that you think really needs to be added to make it land?

Interviewee 5

Of course you still need an entrance, but you probably don't ask for that. This only works in a context in which you also understand what preconditions are needed to allow people to take good care of themselves. And that is very much related to the highest management layer in an organization. I have examples privately and in the client portfolio, but the moment a corporate gets a new chairman of the Executive Board who understands that, you immediately see that it changes. And that won't all be arranged next week or the week after, but then you will get the right preconditions. That is also an organization where people can work themselves completely over the top, but then you get an environment in which people are well taken care of and people are also appreciated if they take good care of themselves, including that they dare to ask for the right preconditions.

Researcher

Exactly and that's why I think, it should never be at the expense again. It is not the case that you can approach all kinds of specialists via the app and perhaps a little more at a corporate because there is more budget there than at a smaller company, so I no longer pay attention to you as a manager, it should never be. But I may also have an extension somewhere that it is a kind of integration of the offline and online conversations. Okay, you have those objectives for the coming period, what do you need from us, let's create a learning line with some support from our system and then you can get started yourself.

Interviewee 5

Yeah, that's really cool. This therefore meets the insight and desire that we take steps in this direction. With a parallel to the hospital environment where specialists were used to ordering everyone back to the outpatient clinic and inserting a thermometer or a stethoscope. Naturally, this
was also encouraged by the financing in the Netherlands. But I hear friends of mine who are medical specialists who say we will do this permanently differently after corona. Do some more remotely. I can see that parallel with what you offer here. And if you ask what are you missing, I can't judge that at the level of what you just show, but I can turn it around: What do you need to make this work properly, then that is the context of a customer organization in which the highest management echelon offers the absolute, all-digital, 1 or 0, condition to make this a success.

Researcher
Thanks for your time. I found the conversation inspiring.

Interviewee 5
Me too.

Researcher
Which I agreed with (...). I will soon be back for a follow-up meeting. See you then.

Interviewee 6

What we are now very busy with is that the current system with sickness report is the gatekeeper with the company doctor and immediately the whole circus that that no longer fits the current times. So we also try to come up with innovations within the field, within psychological absenteeism and sick leave, so we are busy with that.

Researcher
I heard that you guys are developing some of those apps and applications and things like that yourself. Are you also responsible for it?

Interviewee 6
Nice! Yes correct.

Researcher
Nice, what's your background? I saw Nyenrode in any case.

Interviewee 6
You I have done a business class there and I actually studied tourism studies four years later, all the way and I have not done anything with it, without coming into contact world. So having to choose a psychological background within occupational health and safety services is not really a logical one, but it is a business focused occupation within psychological absenteeism and at the same time also playing a role in customer service, because I always like to deal with customers. I have been active for 7 years now, because it is still fun at this organization.

Researcher
And those kinds of customers are large corporates, for example, did I understand that recently?

Interviewee 6
So we have the entire organization of those guys, but also the casino, healthcare institutions that are somewhat larger, municipalities, so youth care institutions. So that.

Researcher
Cool and how do these people relate to a classic occupational health and safety service?

Interviewee 6
Yes, so we have two sisters who are occupational health and safety services. But I have, and those are the classic services, they are of course also innovating, but they take sick reports off the hands of organizations. They do have to innovate. Certainly, some smaller companies that, they are just not good at it and they find it difficult to arrange all those things. It costs them a lot of money, so you would rather have outsourced it to a service. But many people, which is what I say, those are the big companies that do everything virtually everything themselves, who have the knowledge and expertise in house, have a professional department, which sometimes have some consultants which have everything from knowing, so they see us as a sparring partner and hiring professionals to take you one step further. I think that sets us apart from the occupational health and safety service.

Researcher
And is it then that which is the search of those subsidiaries, that it should become less expensive, but that at some point you will have to deal with a sick report, or someone who encounters burnout symptoms, or someone who is against certain problems, he reports to the manager or to the internal doctor or the person who handles the intern. This makes the diagnosis and then an external process is started.

Interviewee 6
Well, by an external process do you mean the Arbodienst circus? Exactly, that's what happens.
Researcher
Yes, that is a real circus indeed. I've heard that before.

Interviewee 6
Okay, circus, actually it is, so as soon as they have a flu tomorrow and you're thinking, well, I can't work. Then you actually call your supervisor and then, as those who think of, “I accept”. The manager then presses, figuratively, a button and then 90 percent of us get to see the particular cases. But you are not recovered within a few days, then all sorts of things can happen. What we find and see that this is the case with psychological complaints, you read more and more about it in the newspapers. So you happen to have had an argument with your manager, you are intensely sad and actually you are more inclined to call them. Like, I'm just not here for a while. I can't, that's the wrong reason, you see. So then it is clear that you are ill, and can rest and then you will continue to be paid and you do not have to work, but that is a company doctor, who cannot help you with the grieving process or with an argument with your manager. So that's the wrong professional, as these professionals and not the sales officer. And yet that you should stay away from those sick reports as much as possible. Solve it together with your employer, try, with common sense, to look at what went wrong. So you just do not completely or just not to work. Sometimes the difficult conversation is just part of it.

Researcher
No, I can well imagine. So before going to forget: is it okay if I also can record this interview, so that later it can still pick out a few things? And include the transcription in my Thesis?

Interviewee 6
Yes, that's fine.

Researcher
Perfect, thanks. But interestingly, because if I have seen one thing in reading all this research, that such leadership and internal culture is a determining factor for whether or not burnouts are developed.

Interviewee 6
But it is also the hardest button to turn.

Researcher
Yes, that fascinates me. Sport touches on vitality and I now have a few companies that we do things for. But a vitality program within this companies, in essence, means that a sports program. It's more outward marketing. We do something with vitality, they say. Because sport is one super simple parameter that you can control.

Interviewee 6
No, that's right, that's very bad. It is tied to the organizational culture that starts with the manager first. Seeing something happen is a bit of looking down from your twenty-fifth or sixty-fifth floor and analyzing what's going wrong there. While the things go, most often, wrong at the top. Also, sometimes something happens. So maybe something with children, we said: maybe you will have to deal with informal care, or someone close to you will die. And it is the task to an organization to develop a culture in which those people can discuss that kind of things. When you see how employers work with their employees. And what is agreed upon. An agreement with all kinds of weird articles. There are so many hours of work, you get so many vacation days, you may or may not get a company car. I would much rather want a social contract to make, even if the agreement even fails. And what do we offer? That you just live life and occasionally deliver a little less. That is not a bad thing.

Researcher
And then you work with large organizations that want to control everything, which is all KPI's and structure. That is also a reasonable hierarchal with management, management, and even more management layers. Where do you start?

Interviewee 6
That also applies to many of our clients indeed. This creates a kind of group with an extreme micromanagement culture. Such a big broadcaster for example, many ladies are all in the rush of life. Hey, it's also a bit of the time. They have recently started having children and they still get a lot of stress at home. And then the stress of work can really turn things around.

Researcher
And then it can also be work pressure, right? It doesn't have to be just culture?

Interviewee 6
You have the workload, but that is often a distortion. We see this reflected in our own figures. Look, if that someone is too busy, but often it is not quite so. Then the diagnosis is actually somewhere else. A colleague with less fun in his work experiences this because of less energy and
resilience. But normally people can do quite a bit. But if I'm not doing well at home or you haven't arranged other things well for yourself, then that workload is an important part. But other things also apply: if you keep storming the pub at the weekend, you will function less during the week. Then you should take better care of yourself. Those kinds of factors, that's why workload is a dangerous thing, because that's such a standard thing that the organization gets on their plate. But that is often not the solution. Indeed together with the leadership of co-workers keep talking about what you need from each other to function properly. It really is thereby a matter culture and leadership. That's a really important one.

Researcher
And are those the interventions that you do with you colleagues? So really on leadership, culture development. And what you say can also start with the individual. I can also fully imagine that our generation, who are ambitious and hard-working, but also just want to fully enjoy the weekend. That you break up at some point.

Interviewee 6
It's his two tracks, so it's ownership and it's leadership. And indeed our interventions we now have on that platform that we have developed.

Researcher
Cool.

Interviewee 6
Exactly and there are also inspiring articles on this theme. So we want to inspire managers to deal with people in the workplace, and how to get the best out of them. That has to do with leadership and ownership. So you also have to work with someone who is having a hard time and perhaps also someone who is indeed in that grieving process. And then it is difficult to start the conversation, to start talking about when, when you can expect that person back. That is very sensitive, at the same time. Yes, you also have a business agreement. And the employee who is in a grieving process is, of course, terrible form him. So there are two sides. But you really have to work it out together. And then there is the task of improvement, which is the main source of prevention. You want to prevent as much as possible and cure as little as possible. This kind of interviews, you can decorate organizations as collective fewer burnouts allow to occur. But there are always instances where it comes up. How do you then help to call in help early and intervene in time?

Researcher
I thought about that too, haha.

Interviewee 6
This also has to do with the previous one between the contact with the manager and the employee. That's what it comes down to again. Those are big words, because it's easier said than done. But that comes down to safety and trust. The employee also has to indicate to his supervisor if things are not going well, that it does not work out. For example, if he has less energy, so that the manager can say: hey, we are responding to that. Or, I will already send you to a fine expert who can help, then that person will be helped back in the saddle.

Researcher
Yes, exactly. So you need some of those kinds of experts around your organization to respond to those questions. On various themes you say which one then brings you close to an organization in the surrounding area.

Interviewee 6
We want to see that, yes, and with that you also prevent many gaps. So there may be several things happened to be in one's life and at some point it becomes Thomas, or Pete, or Sanne, just too much. If he has experienced stress at a high level for too long. Then at some point, it turns, to one to the other day.

Researcher
Is it really a switch? Does that work like that?

Interviewee 6
Yes really. They feel like, it's okay, and suddenly they wake up. And then, in one chat, completely burnout. Then you are of course too late. Well, then they go to well, to an intervention specialist such a specific intervention. Which would be more effective. Then there are often many different factors that play a role. Then it is often not only within the organization.

Researcher
Yes, I can imagine. And what is the role of those applications, those systems you are working with, in this approach?

Interviewee 6
There are very many different experts who can be of value. Those who have something from here and know that people can accompany. Debt counseling is another example. You can also suffer quite a bit psychologically. So those that those platforms are around to inspire. The chances are also that we have a whole training module to develop offered within the organization.

**Researcher**
Yes, exactly it really is, yes, in inspiration and a bit of education. Certain themes programs you'd web of possible factors that burnout cause of spots can thereby than prematurely to sit down to work. Do you mainly focus on awareness?

**Interviewee 6**
Exactly.

**Researcher**
And that prevents you from reaching the diagnosis. For example, I recently came across an app on, I get more often feel that it is all a bit opportunistic such apps . But with this app from TNO, which you could use your phone to measure that stress on a daily basis. And based on that you got an advice.

**Interviewee 6**
Interesting.

**Researcher**
It wasn't a questionnaire, so to speak, which I think is still a bit the status quo. But really putting your finger on the lens of your camera. Every day. The lens then saw the discoloration of your finger your heart, and conducted an analysis from it.

**Interviewee 6**
I heard yes. Opportunistic indeed, but what role and research are they already engaged in? And I think Philips is also working on certain mirrors. Something about your facial expression, so you can see whether you are doing well.

**Researcher**
That's good yes. Mirrors. Since you obviously get up every day.

**Interviewee 6**
Yes, exactly, so then you have enough data. I don't know, I think I honestly think we're going in that direction and that the more it goes in that direction of measurement, so that we can intervene faster. So I'm a fan of that kind of application at the base.

**Researcher**
In professional sports it also works like that, and I found that really interesting. My sister, who is also in a Dutch team, for example, receives a questionnaire every morning about your training sessions during the day. They measure all kind of factors, partly to determine to which you about your heart rate comes down. So they can determine an appropriate, reasonable structure for your training structure in this way. Every day you have to fill in three questions: how did you sleep, so your sleep quality, on a scale of one to ten, how much muscle pain do you have, on a scale of one to ten, and last, one question about the perception of your energy level. And then sometimes motivation. Those are the four questions, sometimes five. It takes you 35 seconds. But it provides the coach with the opportunity to compare input and output. That way they look or you so an individual training must start building. But of course there is still room for improvement . Your perceived energy level and your perceived sleep level, that's not really factual yet. It is still a perception, a quantified subjective measurement.

**Interviewee 6**
Kind of of course . Seems to be a really good approach though.

**Researcher**
Do things like this just happen to you within your organization? And if so, do you support it?

**Interviewee 6**
We are not doing much with it yet, but we intend to develop it. But things like that already exist. Organizations like us do have this intention. I just want to say, we have done something with monitoring of staff with an app which is accessible and surveys which are quickly done . That you just briefly indicate how you are doing. So that probably has to do with stress and things like that. In this way they can see a picture of the situation in the organization.

**Researcher**
Interesting, so you also provide feedback at organizational level ?

**Interviewee 6**
There was a period when a large proportion of the workforce indicated that they did not sleep well because they had sleeping problems. Then we gave them training, which was actually open to everyone. This information enabled us to act quickly. And then you also give people quite a gift,
Researcher

And is there a diagnosis in that? For example, to determine, if the energy is less, what’s the source? Sleep is also a symptom of course. Not only is that a way to recharge, but it’s also a symptom of burnout. You will sleep worse if you go in that direction. Do you also map this out with a kind of analysis, so that you know which button to turn, so to speak?

Interviewee 6

We don’t all do that ourselves, because you have a diagnosis, and we don’t really do that. Company doctors conduct the diagnosis. We are careful with that. The latter would actually rather be a clinical exercise, because that information is really too thin to really say anything.

Researcher

Yes, and what is the difference between those company doctors? Because you people are also quite well educated. Someone comes with a report, he comes here to the company doctor and then sits and then another person - the company doctor- comes across who makes the real diagnosis.

Interviewee 6 600:21:57

Well, that’s a company itself, but a company is required to really establish the relationship between a disease in combination with work. So they follow protocol. And a step in that protocol is that the company doctor is called in, and he can then say: you are burned out, take it easy. I think it’s wise that you don’t work for four weeks. I’m just saying.

Researcher

Yes.

Interviewee 6

Then that company can say to those employees: no, don’t do that, you just go to work two days a week, of course. But then an official advice has been given.

Researcher

Just right, clear And what things are you working on right now? In the context of data and applications?

Interviewee 6

With the continued development of that platform and also, if so, we could also think of things for organizations to help with, as much as possible in the direction of prevention.

Researcher

Exactly. I’m going to show you a few things. That’s one, an overview of all the different factors that determine whether someone say at an increased risk as of burnout. These factors determine whether the person has less energy or more natural. The burnout of course, is the most negative side of the spectrum. You just want to have a lot of energy and less energy is therefore not desired, so getting more energy is already a goal in itself. I found ASR Vitality really interesting. They are only on physical activities, say yes. I find that I find that quite complicated. That is such a big initiative, which is so extensive, and which is really internationally and widely supported. But of course the solution is only as one-dimensional as can be.

Interviewee 6 600:21:57

I agree with you. Sport is a very important part, even in times when things are not going well due to private circumstances, it is also important to take good care of yourself, to stay upright. And so to exercise. But it is certainly a one-dimensional picture of what an overall picture actually looks like.

Researcher

Yes, yes exactly so that I’m really fascinating. Would you add other determinants?

Interviewee 6

Do you know Machteld Huber? She is the positive health guru. I think it’s a general practitioner and is now retired. She has developed a model, which she attempts to lobby for worldwide. The World Health Organization definition of health according to the WHO is a very flat definition. So if you are completely healthy. Yes, who is that now? Everyone has something once in a while. So she has previously been ill herself. Health also has to live with learning about yourself, with knowing things about yourself, and know which factors are important are. So I know someone, and they’re pretty unhealthy. But when he says: the most important thing in my life is my health. But people don’t know either. You really have to help them in that process of awareness. They have such a huge blind spot.

Researcher
Yes, it is not absolute, the value health. Are you familiar with the phenomenon of self-efficacy or personal effectiveness? I know that concept of that psychologist, his name was Albert Bandura. It is also very well known in the psychological world. Obviously, it describes what determines whether people are effective in their work. It says it is about the perception of your own skills in relation to what to do. So say, the responsibilities that you get from the organization. And inherent perception is of course influenced by the absolute value of your own skills. The better you are, the greater the chance that you are convinced of this yourself, but of course your environment also influences this. If there is no psychological safety, and you feel that you are walking on eggshells, you’re your skills are not perceived how they really are. That has no positive effect on that. So what I consider was that model it is explained that the tension that arises when there is a kind of incongruity, so what you should do and what you think yourself that you can, what you are able to do. That that's one of the biggest stressors. Your physical fitness, Bandura may ignore that, but nowhere is it fully reflected in it. I find that remarkable.

**Interviewee 6**
It’s part of that concept, physical fitness. So it is really someone who is very overweight, who really suffers from that.

**Researcher**
Yes, exactly yes.

**Interviewee 6**
It really is the first question that should always be: you have no problem, we just want to check, and yes, you are not doing it to stigmatize.

**Researcher**
Interesting, okay, then I just want to take you through the following for a second. What I've done is this, it’s very much read and from there look: which requirements does a solution need? What requirements does it really have to meet? This resulted in nine design objectives. I'll walk you through them for a while. Are there any that you think I don't understand? Or who hears that?

**Interviewee 6**
The first is about system-driven and context-driven solutions. I assume you mean a personal approach with customization?

**Researcher**
That's right. Customized in the sense that, an approach which adapts to the personal situation of people, and those people say: what do you need? So do not pour everything into a dashboard, which is often the need of the organization. Organizations want to make everything as manageable as possible. But that is often not exactly organizing things around the knowledge worker.

**Interviewee 6**
Yes, recognizable.

**Researcher**
Yes, and how do you solve that? Because actually we want to pour everything into the dashboard and make it controllable. Do you have ideas for that?

**Interviewee 6**
Yes, think so. It starts with the people themselves. So the question is: if people are open for development and then you can continue with that, a dashboard can be quite useful for that person. But suppose you ask that within the organization in questionnaires and 70 percent say: well, as far as I'm concerned, I don't have a problem, I don't need help. Yes, then you have a nice puzzle to solve. Especially if it turns out that a certain need has to be met or there is a certain problem. And 70 percent says by now, I like it very much that you as an employer, or any other party, “I want to help with something”, then you have that group anyway in it. And then I think you can go into different topics and themes. So the first question should always be: are you open to help it all?

**Researcher**
Yes, exactly yes. I can imagine that half of the people lose weight as well.

**Interviewee 6**
Exactly. Or those who think: I'm not looking forward to that at all, certainly not from my employer. Also fine.

**Researcher**
But if it is known that it comes from outside, so that it does not come from the client. People than are willing to share more, don’t you think?

**Interviewee 6**
Yes, sure. But you have to explain that to them.

**Researcher**
Because that has to do with privacy? If you don’t want to share your personal information with your employer? Because you can see in the system that you, for example, are stressed for a presentation. Then you know that your employer sees that, and that you may not be allowed to do the presentation next time.

**Interviewee 6**

Usually yes, if you communicate well, then my expectation is that you should be fine with that explanation.

**Researcher**

And that bonus structure, so maybe not monetary, but in the form of a personal development budget. So that you can offer people additional options for personal development. I can imagine that if people don't have any problems, they think well, then I'll leave it alone. I can also imagine that people start to perform better, even if they don't have any problems, but that it just gets better. So that they optimize instead of maximize. And it doesn't have to be just repair work either.

**Interviewee 6**

Yes.

**Researcher**

But then in the form of a sort of "if you invest in yourself through it consciously to get started, we will invest in your, through a personal development budget". And with that, of course, also in your own organization.

**Interviewee 6**

Yes, I believe that too. That is more stimulating, I believe that too.

**Researcher**

Yes, I am also with the idea of: if you all of these questions and or small e - learning's on these topics, which will they not do because they do not see the need, but you also know that it's good for them. How do you get them moving?

**Interviewee 6**

Yes, that remains the challenge.

**Researcher**

Yes, well, this one, well, we've already discussed that a bit. It's not just about focusing on sports, but an integrated approach. Just say this. It is in that self-efficacy is also included. So one's own perception of the skills, in relation to the challenges. Do you think that vitality and personal development should be two separate trajectories?

**Interviewee 6**

I think it's a good question. My first inclination is to say: those are separate parts, but honestly I wonder that out loud. Of course you have agreed an agreement with each other and you have agreed that someone will deliver something. So also problems. Then I think, is going well and so long that someone the best they can get I do not know whether vitality should be there. Yes, I find that difficult. I do understand your reasoning though.

**Researcher**

Yeah, I don't know either. Because when you're in a burnout, it comes and you're going to then look at sport-like grounds, and often with their own perception of your abilities to do. Then it might not explicitly be vitality when someone arrives in an intervention for personal development. But there is a very clear overlap.

**Interviewee 6**

Precisely then, they would no longer have to do separate vitality programs.

**Researcher**

I did my research course specifically aimed at knowledge workers. This group has its own characteristics. Autonomy and personal development for example, and not too much required down. It is also somewhat in line with what you said at the beginning.

**Interviewee 6**

Even in our own scientific research we arrive at this: autonomy, development and social support. Those are the critical factors.

**Researcher**
And that social support is, say, just internal, in the social contact with each other. A sense of: Do not just do it on your own, say, but there are people who you can help.

**Interviewee 6**
Yes, and you are allowed to make mistakes and so you feel that freedom. Yes, that is social support. This can also be done from home, but preferably from the workplace.

**Researcher**
Check, okay, and I think the others have discussed, but in principle quite reasonable. Or do you have additions to the Design Objectives? Are you missing something, do you want to change something?

**Interviewee 6**
No, what I see now is good. I can imagine this is how it should work.

**Researcher**
I would like to show you what we came up with. And then, yes, let's see what I've made. First let's look at the concept of how to go from data to insight. We devised at least all the information gathering that is already collected with your phone, so through your Samsung or Apple Health. But without having to actively do things there. In addition, we also measure the absolute levels of the battery, so that is about motivation, energy and mental energy. If a negative trend can be seen in this, then the system must look more specifically for the cause of that trend. Just because an energy level goes down doesn't mean you know what's causing it. Do you understand what I mean?

**Interviewee 6**
Certainly. I think it's a very good approach in theory. I understand that this is what comes out of your research. But I'm curious if those questionnaires work like that.

**Researcher**
We have to find that out.

**Interviewee 6**
But how does that system work? You were going to explain that too, right?

**Researcher**
Yes, this is the Conceptual Framework. I have already explained that to you over the phone. Just take a look and see what you think.

**Interviewee 6**
Beautiful. And if you can do this in that intuitive environment, with a low threshold to make use of something. Those are all conditions, I think, for using such a tool. It would be nice if it could be done in a simple environment.

**Researcher**
Funny you say it. We work in a Whatsapp environment, because that is good for the people themselves, but if you are in an environment about which one to one does to WhatsApp, which you also can simply open online, but also just come back to your phone. And that you actually have your own performance environment in it, so basically all your conversations with your manager, but also your vitality coach, your business coach and possibly even your doctor.

**Interviewee 6**
Yes.

**Researcher**
But it is really important that all those systems are integrated in that communication environment. Otherwise it's just another system.

**Interviewee 6**
Good point.

**Researcher**
What do you think when you see that.

**Interviewee 6**
Yes, I think it's a good idea, I do recognize this conceptual framework from our own plans. At least, parts of it. We mainly focus now on the manager. But what we just concluded together is that ownership is also a very important one. And that such an environment can certainly help also the ownership part to stimulate. That people understand that they themselves are responsible. Because there is still a lot on the plate of the employers. I think that's good. And of course we aim more at the managers with our tool, but in this way you can include as much knowledge worker as the manager. Smart, you know.

**Researcher**
Yes, well, so that.

**Interviewee 6**
Yes, you know, of course I can't estimate what it will do, because such an environment appeals, but eventually people have to take over. So you have cleverly thought that that must be the environment in which everything comes back. Because then people have to use it too. Then it's not just extra, if you feel like it. Then you just have when you need the HR Manager. I think the medical file part is very smart, because we are still not there that it is personalize. That is always with the authorities, so it would be much better to keep it with the people themselves. But now my main “but”. What we also know from science, from work organization psychology, with an interesting fact. And that's you're dealing with employees, about 70 percent, and that's the followers. By that I mean: the people who come to that office in the morning. We are talking about employees who come to do their thing, and his afternoon go away again, and are mainly looking forward to the next holiday. And for those people this is something extra, you know. Are they really going to use it?  

**Researcher**  
Well, complicated. That's hard for me to say now. Interesting to know.  

**Interviewee 6**  
Yes. I wonder, but I have not the answer though. That's the beauty of theory. Nice on paper, but now it needs to be researched in practice.  

**Researcher**  
They say the knowledge workers are ambitious. That people are committed to their own development. But you say, that is often not the case.  

**Interviewee 6**  
That is a different story with top athletes. Too many people are around who are not so ambitious to and do come there for the money to live. On the contrary: It is not the right way when all people are very enthusiastic, and ambitious. The organizations also very often cherish those people who come and go. Because if the full organization has to do deal with that passionate and jumpy people, that would not work. I think that's very important to emphasize. Think about the target group, we can help gauge the interest in this application.  

**Researcher**  
Yes, exactly no, that that, I also have too little experience to conclude on that topic.  

**Interviewee 6**  
It looks really professional and good. Both the framework and the design. You've put a lot of thought into this, and you're on the right track. I see you've put a lot of work into it. Congratulations for that.  

**Researcher**  
Yes, thanks and many thanks for your time today!  

**Interviewee 6**  
Similarly. And thank you. We're talking!
APPENDIX B | VISUALIZATION OF DESIGN & DEVELOPMENT PHASE 2 - PROTOTYPE DESIGN