Diginomics Working Paper

Research Group Diginomics
Digitalization - Economy - Society

Human Resource Management in a Digital Environment

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February 2022 No. 0008

Universität Bremen

Impressum:

Diginomics Working Paper

ISSN: 2701-6307

Published by:
Universität Bremen, Diginomics Research Group, Max-von-Laue-Straße 1, 28359 Bremen, Germany

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https://www.uni-bremen.de/graduiertengruppe-diginomics/forschung/diginomics-working-paper

This working paper will appear in L. Hornuf (Ed.), *Diginomics Research Perspectives: The Role of Digitalization in Business and Society*. Cham: Springer International Publishing.

Human Resource Management in a Digital Environment

Vera Hagemann and Katharina Klug

Abstract

This chapter provides an overview of important topics in human resource management (HRM) that are affected by digitalization and automation. It is outlined how work in HRM is changing in areas such as mental health at work, work design, leadership and personnel development. The last section shifts focus and introduces a new way of working in HRM, known as HR analytics or people analytics. The fact that the various topics are not independent of each other and indeed intersect with each other is illuminated in the individual sections.

3.1 Introduction

Human resource management (HRM) concerns the functions and processes in organizations that focus on personnel and aim to attract, deploy, motivate, and optimize this resource (Rowold, 2015). These functions include such areas as HR marketing, personnel selection, personnel deployment planning, people development, leadership, management behavior, and workplace design, to name the most important. The responsibilities of HRM are therefore not new, but what has changed significantly over time are the implementations of these functions in organizations, given that the tasks, the ways of working, the requirements, and the relationships among employees and with managers have changed due to digitalization and automation. Digitalization in this context means the introduction of digital technologies into organizations in the sense of the digital transformation process (Petry, 2019). If, by contrast, individual functions or entire human activities are transferred to a system, the terms “automation” and “automatization” are used, often interchangeably. However, the term automatization refers to the process, while automation describes the result of this shift (Hauß & Timpe, 2000). A modern HRM must respond to these changes and adapt accordingly (Petry & Jäger, 2018).

The present chapter addresses current topics in HRM, such as mental health (3.2) and how this can be assessed by HR. Factors influencing mental health include work design (3.3) and leadership (3.4). However, these topics are themselves also strongly influenced by digital transformation. Due to ongoing changes in demands on employees, the topic of people development (3.5) is important to discuss. Similarly important, though still relatively in its infancy, is the field known as human resource analytics (3.6), which is also reviewed this chapter. Figure 3.1 provides a conceptual overview of the key aspects and implications of digitalization for HRM at different levels in an organization.

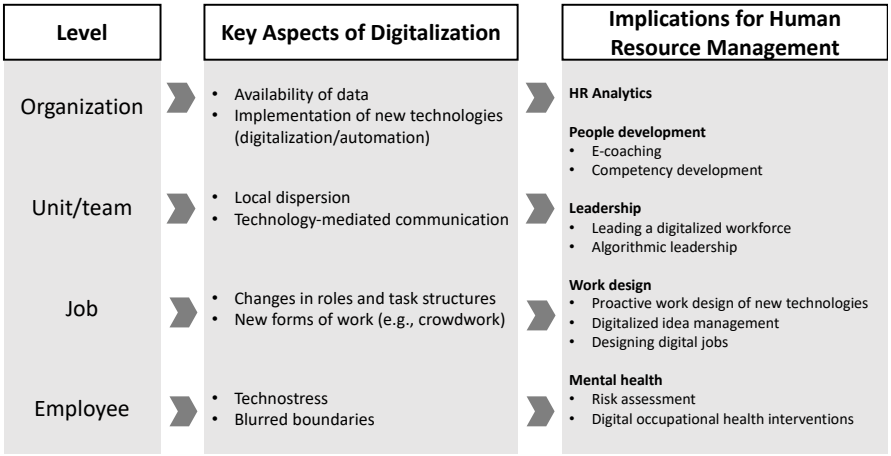

Fig 3.1 Conceptual overview of key implications of digital transformation for human resource management at different levels of the organization

3.2 Mental Health at Work

The digital transformation has brought employees' mental health to the forefront. Manual jobs have declined in favor of an expanding service and knowledge economy, while automation in the Fourth Industrial Revolution (known as "Industry 4.0") has also changed the cognitive demands placed on industrial workers interacting with smart technologies. As a result, stress and health at work pertain to psychosocial rather than physical issues for many workers today (de Jonge & Dormann, 2017).

The rapid expansion and accelerating development of information and communication technologies (ICTs), as well as digitalization of processes at work, create both opportunities and risks for employees' mental health. Among other advantages, ICTs allow for more flexibility in work hours and location to support employees in balancing their work and non-work roles and reduce stress (see telework, 3.3). But increased flexibility and constant connectivity also carry the risk of work intensification, blurred boundaries between work and private life, and specific stressors related to technology use (Demerouti et al., 2014). Modern HRM needs to respond to these challenges to protect employees' mental health at work through risk assessments and (digital) occupational health promotion.

3.2.1 Challenges: Technostress and Blurred Boundaries

Extensive use of technology on and off the clock can create a particular kind of stress experience known as "technostress" (La Torre et al., 2019; Riedl, 2013). Most definitions of technostress include physiological, psychological and/or behavioral strain reactions to stressors related to the use and anticipated use of technology

(Salanova et al., 2013). In line with the traditional job stress literature (de Jonge & Dormann, 2017), techno*stressors* (i.e., events and conditions eliciting stress reactions) can be distinguished from techno*strain*, which denotes an individual's response to the stressors. Technostrain includes experiences of anxiety, fatigue, skepticism and inefficacy in relation to technology use at work (Salanova et al., 2013).

Several studies have linked technostress to physiological stress reactions, self-reported stress, exhaustion and decreased job satisfaction (see La Torre et al., 2019 for a systematic review). The causes of technostress broadly relate to the two categories of information overload (i.e., having to process large amounts of information from multiple sources) and constant connectivity (i.e., accessing work and being accessible potentially everywhere and anytime; La Torre et al., 2019). Acute technostressors such as computer crashes can further be distinguished from chronic stressors such as availability expectations, requirements for continuous learning or employee surveillance, although frequently occurring acute stressors can transform into chronic stressors (Riedl, 2013). A particular kind of technostress related to the unique challenges of nonverbal communication in videoconferencing ("Zoom fatigue") has gained media attention during the Covid-19 pandemic, although empirical research on the nature and relevance of this phenomenon is still in its infancy (see Fauville et al., 2021a, 2021b; Shockley et al., 2021).

The framework of ICT demands introduced by Day et al. (2012) builds on the job demands–resources model (Demerouti & Bakker, 2011, see 3.2.2) and provides a validated, systematic operationalization of technostressors comprising eight categories: (1) hassles, meaning ICT malfunctions such as system crashes, freezes or data loss; (2) response expectations, or the pressure to respond quickly to work-related messages; (3) availability expectations, such as accessibility beyond regular hours or outside the office; (4) increased workload; (5) lack of control over technology; (6) ineffective communication, particularly misunderstandings in digital communication; (7) learning requirements to keep up with technological advancement; and (8) being monitored through technology. Collectively, ICT demands have been shown to relate to employee burnout and strain above and beyond classic job demands (Day et al., 2012).

ICT use can also blur the boundaries between work and non-work life. Availability expectations and work-related smartphone use after work have been shown to increase work–family conflict, obstruct recovery and impede well-being (Derks & Bakker, 2014; Dettmers et al., 2016). At the same time, employers may fear that cyberloafing (i.e., private browsing at work) and smartphone use impede employees' productivity and motivation. Empirical evidence in this area is ambiguous. For example, although employees who use social media during work more often than others report generally lower work engagement, a short social media break when energy levels are low can replenish engagement later on in the workday (Syrek et al., 2018). Another study suggests that cyberloafing may have simultaneous positive and negative effects on mental health through psychological detachment and fatigue, respectively (Wu et al., 2020). Interestingly, a profile analysis of employee groups with different patterns of smartphone use suggests that private smartphone

use at work goes hand-in-hand with work-related smartphone use at home, indicating a general preference for more or less segmentation between life domains. Frequent smartphone use in both domains was associated with lower psychological detachment from work, a core element of recovery (Dora et al., 2019). The pervasiveness of ICT thus affects employees' mental health in various ways which are not yet fully understood. Nevertheless, existing research suggests specific risk factors for mental health that HRM needs to detect and address.

3.2.2 Assessment of Mental Stress and Strain at (Digitalized) Work

Digitalization changes not only the methods (see 3.2.3 and 3.6), but also the content of risk assessments. With respect to content, risk assessments ought to include specific characteristics of the digital working environment pertinent to mental health. The opportunities and challenges presented by digitalization of workplaces and processes make work easier and improve well-being, but they can also lead to increased mental stress and strain. Digitalized work has practical advantages for the workforce, such as relieving people of inhumane requirements through automation, but it can also lead to an increased mental workload due to changed job demands (Diebig et al., 2020; Hartwig et al., 2020). Technologies can help to simplify cognitive and physical actions through better planning and self-determined, flexible work design (Kraus et al., 2021; Schwarzmüller et al., 2018), but might also lead to more work in the same amount of time, as well as the need to react flexibly to changes in work processes, resulting in higher mental workload (Atanasoff et al., 2017; Hartwig et al., 2020; Klumpp et al., 2020; Turel & Gaudioso, 2018). Changes in mental workload often lead to an increase in experienced mental stress and strain, with widespread consequences such as emotional exhaustion, job dissatisfaction, burnout symptoms, and fatigue (Fischer et al., 2021; Hartwig et al., 2020).

Conducting mental health risk assessments is not only mandatory for companies in Germany (§§ 5, 6 ArbSchG),[1] but also supported by the numbers. The number of sick days due to mental illness has increased by 64.2%, since 2008. In 2018, the average annual duration of a mental illness was 26.3 days per case, which is more than two times the average of 11.8 days per case for other illnesses (Meyer et al., 2019).

Organizations and human resource management departments seeking to digitalize workplaces are thus faced with the various challenges of analyzing, evaluating, and mitigating a potential increase in mental workload for employees and leaders. In making digitalization a success from the employer and employee perspective, the first step must be assessment of work factors leading to mental stress and strain. After that, measures can be planned and implemented to counteract the stressful working conditions. Mitigation measures can be at the individual level and relate, for example, to personnel development programs (see 3.5), or at the organizational level, possibly relating to the design of workplaces and work processes (see 3.3).

[1] https://www.gesetze-im-internet.de/arbschg/

In order to assess factors causing stress and strain and to analyze resources as potential starting points for remedial measures, it is helpful to have a theoretical model that can be used as a basis for orientation. One such model is the job demands–resources (JD–R) model, which provides a framework for understanding the relationships between demands and available resources at work (Demerouti & Bakker, 2011). The JD-R model states that each job may have specific risk factors associated with work-related stress (Bakker & Demerouti, 2007). The model emphasizes two essential underlying psychological processes causing the progression of either job-related stress or motivation. First, the model assumes that workplace demands, such as problems with new technologies or working with more and different technological devices, increase stress, affect employee health and deplete employee energy. Second, the model assumes that work resources, such as time savings for certain tasks or technical support, offer motivational potential and thus lead to greater work engagement and higher performance. The model also postulates an interaction effect between work demands and resources, by which resources such as task variety, technical support, or work relief may buffer such negative consequences as work overload and problems with technical equipment (Demerouti & Bakker, 2011). The JD-R model provides a well-tuned framework for relating job demands to job resources and assessing impacts on employee mental stress and strain. Figure 3.2 provides an overview of the model as it has been empirically used in the measurement of mental stress and strain.

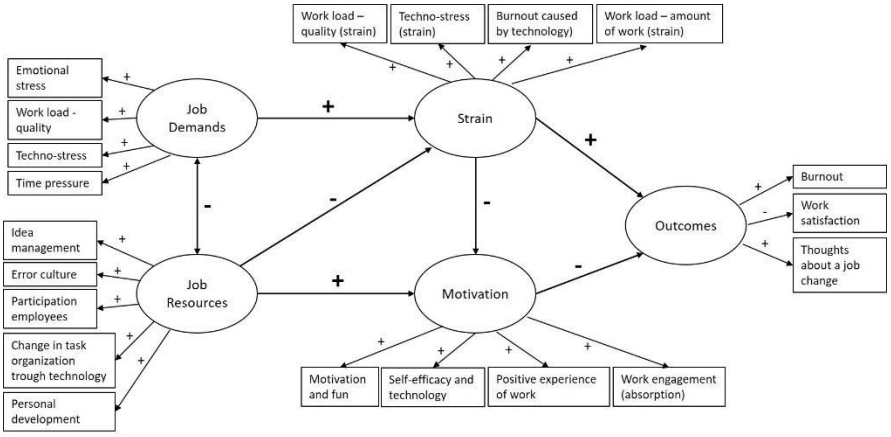

Fig. 3.2 The JD-R Model Assessing Mental Stress and Strain (cf. Hagemann et al., 2021)

A large number of instruments for measuring mental stress and procedures for mental risk assessment are available (see GDA Psyche, 2017 or Kauffeld, 2019 for comprehensive overviews). One example is Sandrock‘s (2017) Kompaktverfahren Psychische Belastung (KPB), which is a suitable instrument for measuring psychological stress in small and medium-sized companies, although it does not take psychological strain into account. The KPB can be used to restructure a critical work

environment, but it reaches its limits when it comes to deriving measures for personnel development, since no information is collected about the employees. Contemporary aspects such as the digitalization and automation of work processes and the participation of employees are also not considered. A more recently developed screening tool is the digital stressors scale (Fischer et al., 2021), which captures possible negative effects of digitalization in the workplace, but is limited exclusively to these and does not allow a holistic assessment of mental stress and strain at work. This scale can nevertheless be used as a supplement to an already established instrument. A risk assessment screening instrument that is not only free of charge, but is applicable both online and offline, usable by HR specialists and non-professionals, and which is all-purpose and considers individual strain and digital aspects of work is the mental stress and strain assessment tool for employees and leaders (MESTAT) (Hagemann et al., 2021). Balancing the advantages and disadvantages of each method is essential to the validity of the first step in risk assessment, which is to measure mental stress and strain. A next step would be to identify and initiate appropriate mitigation measures.

3.2.3 Opportunities: Innovation in Occupational Health Promotion through Online and Smartphone-based Interventions

Digital technologies also offer opportunities to improve employees' mental health. The advantages of telework, for example, are discussed below in the context of work design (3.3). The present section focuses on the potential of ICTs in implementing occupational health promotion (OHP) interventions. The wide range of intervention methods for improving employee well-being can be broadly categorized along two dimensions: (a) the level, that is, whether the intervention targets organizational structures or culture versus individual behavior; and (b) the focus, that is, whether the aim is to reduce negative experiences (e.g., stress management) or to enhance positive experiences (e.g., resource-oriented and positive psychology interventions) – although these distinctions are not always clear-cut in practice (Beehr, 2019; Hülsheger et al., 2020). The literature suggests that interventions should combine both stress management and resource enhancement, and that multimodal interventions targeting different levels are the most effective (for systematic reviews of OHP intervention research, see LaMontagne et al., 2007; Tetrick & Winslow, 2015).

Digitalized intervention programs utilize a wide range of methods and technologies such as web-based trainings, mobile applications, social media, serious games, virtual reality, videoconferencing and instant messaging, each of which may be used alone or in combination with traditional face-to-face methods (Lehr & Boß, 2019; see also e-coaching in 3.5.1). A recurring problem in OHP programs is low participation, especially given the paradox that the most strained employees in need of intervention are the least likely to participate (Krick et al., 2019). Digital technologies may tackle this problem by making interventions more accessible and

engaging. For example, online interventions reduce constraints regarding time, location and number of participants and provide anonymity, reducing potential stigma associated with seeking support (Ryan et al., 2017). Elements of gamification may incentivize participation, while virtual reality and simulations create a safe space to try out new behaviors. Smartphones or wearables can keep participants engaged through the use of alarms and reminders, as well as by providing automated feedback based on data collected in real time. Collecting such data also offers a convenient and reliable method for monitoring employee participation and well-being for process and outcome evaluations (Lehr & Boß, 2019; Stepanovic, 2020 see also HR analytics in 3.6).

Although research on organizational-level online programs remains limited (Ryan et al., 2017), emerging empirical evidence points to the effectiveness of individual-level online interventions. For example, a systematic review of online mental health trainings for teachers documents their effectiveness with regard to depressive symptoms, sleep quality and sickness absence (Lehr & Boß, 2019). According to a meta-analysis, online mindfulness interventions are just as effective as their face-to-face counterparts (Bartlett et al., 2019). Shann et al. (2019) evaluated an online training for leaders' mental health competencies in a randomized control trial and report that participants' depression-related stigma was significantly reduced six months later. Although this type of intervention can be categorized as individual-focused, training leaders is thought to also benefit their employees and thus have a wider organizational impact (see Kelloway & Barling, 2010). However, factors related to the work environment, organizational readiness, and support from HR were found to influence the leaders' transfer of training (Shann et al., 2019), which underlines the importance of addressing structural conditions to achieve sustainable change with digital interventions.

3.3 Work Design

Work design, defined as the content and organization of tasks, activities, responsibilities and relationships, is fundamentally linked to employee performance, motivation and well-being (Parker, 2014). Whether digitalization and automation have positive or negative effects on key work design characteristics (e.g., job autonomy, skill use and variety, feedback, and social relationships) depends in large part on how technologies are implemented (Parker & Grote, 2020). Work design has thus emerged as a crucial HRM field with regard to (a) ensuring that automation leads to improved job quality instead of decline, and (b) the prevention and management of technology-specific demands such as technostressors or blurred boundaries (see 3.2). The present section discusses the role of prospective work design in the automation of tasks, digitalized idea management as a means to increase employee participation, and the management of demands and resources in telework and crowdwork.

3.3.1 Prospective Work Design in the Implementation of New Technologies

Despite widespread concern about artificial intelligence replacing people and jobs, in reality, it is usually tasks within broader job roles that are automated. Automation thus intensifies the interaction between humans and technology in organizations, affecting task structures and job characteristics of the employees working with technology – that is, their work design (Parker & Grote, 2020). Classic models of work design focus on motivational characteristics of jobs and tasks. The job characteristics model (JCM; Hackman & Oldham, 1976) identifies five essential job characteristics for employee motivation: autonomy (the degree of freedom over how to do one's job, often synonymous with job control); skill variety (the degree to which employees get to use different skills); task significance (the degree to which the job has an impact on other people); task identity (the degree to which a task is complete); and feedback (receiving information about one's performance). These characteristics motivate employees by creating experiences of meaningfulness, ownership and knowledge of the results of one's work. Although work design research has expanded the list of job characteristics (e.g., social relations), mediating mechanisms, moderators and relevant outcomes over the years, the validity of the core job characteristics for employee motivation, performance and well-being still holds up (Humphrey et al., 2007; Parker, 2014). The JCM's job characteristics can be subsumed as resources in the job demands–resources model (Demerouti & Bakker, 2011), which additionally includes the potentially stressful aspects of work in terms of demands (see 3.2.2).

There is ongoing debate as to whether automation leads to an increase in job quality (e.g., more autonomy and flexibility, fewer tedious routine tasks) or a deterioration (e.g., being limited to monitoring technological systems and increased monotony). The skill-biased technological change perspective, for example, suggests a dichotomy between employees in high-skilled jobs with non-routine tasks reaping the benefits of automation, and those whose lower-skilled, routine jobs will change for the worse (Autor et al., 2003). Throughout this chapter, we reiterate how the digital transformation can both improve or worsen different aspects of people's jobs (see 3.2). For example, automating leadership tasks (3.3.2) has the potential to relieve managers of administrative tasks, enabling them to focus on what is viewed as the more meaningful aspects of leadership that require human judgement or social skills (Kolbjørnsrud et al., 2016). But if managers leave administrative decisions (e.g., regarding shift schedules or task allocation) to algorithms, these may become impossible for employees to control (Kellogg et al., 2020), reducing their autonomy in turn.

The impact of automation on employees' job characteristics is extensive and more complex than we can discuss in detail here; instead we refer the reader to the comprehensive review by Parker and Grote (2020). Their main message, which we seek to emphasize as well, is that the outcome of automation on work design is not unambiguously positive or negative, and not deterministic either. Whether

automation results in more versus less autonomy, active skill use versus a reduction to passive monitoring, or a relief from excessive demands versus increased workload, depends in large part on how the technology is designed and implemented. The choice and implementation of a specific technology involves decisions on different organizational levels about the distribution and coordination of tasks among humans and machines, which calls for involving work design experts in these processes early on. HRM therefore needs to assume a proactive role, not just in training employees to adapt (3.5.2), but in ensuring that the technology above all serves human needs, in the sense of a prospective work design strategy (Parker & Grote, 2020).

3.3.2 Employee Participation through Digitalized Idea Management

Acceptance of new technologies in the workplace is greater – and working with them less problematic – if employees participate in the change process and if the challenges of transformation are supported and shaped by all stakeholders in a partnership (Rogers, 2003) This can also promote identification with one's own work (Hackman & Oldham, 1976). Such engagement can be supported by idea management, which includes the collection, sorting, evaluation and utilization of suggestions for improvement (Kunert, 2014). The suggestion of new ideas and thus the direct participation of employees is promoted, thereby enabling specific knowledge about work processes, opportunities and weaknesses to flow in.

The sort of participation discussed here is more meaningful than simple co-determination, such that a non-institutionalized and informal participation is possible and opportunities arise to further develop the organization. This form of participation is similar to prosuming. Prosuming, a joint activity between consumer and producer, has gained particular importance in digital contexts (Ritzer & Jurgenson, 2010), with consumers of a product taking over individual sub-activities in the context of product creation. This is comparatively easy to achieve and has been successfully used in digital service contexts, especially with regard to the provision of data in online communication and advertising networks (Beer & Burrows, 2010). This concept is also suitable for considering employees in organizations because it can illustrate how they can participate in shaping their working conditions.

Participation can take place within the framework of a continuous improvement process (CIP) or in the company suggestion scheme (BVW) in the organization. The concept of a CIP is understood as an instrument of quality management and developed in the context of lean management considerations. The PDCA cycle (plan, do, check, act) is understood as the core element, which, as a form of implementation in quality circles, is intended to ensure that ideas for improvements are continuously taken up, evaluated and, if possible, implemented (Prashar, 2017). Employees play a central role in this, but methods such as the creation of quality teams and quality circles consisting of several employees are also used specifically to point beyond the perspective of individual employees (Blaga & Jozsef, 2014).

The BVW is a participative instrument for optimizing processes or products and pursues the goal of utilizing the ideas and innovation potential of employees. The suggestions for improvement are typically developed outside of actual working hours and can concern both smaller and larger changes. In contrast to CIP, the suggestions for improvement do not relate to the immediate tasks and duties of the employees submitting them (Crespo et al., 2009). The suggestions for improvement submitted by the employees are reviewed by superiors and/or experts, and the works council is also involved. If the suggestion is implemented, employees receive a portion of the resulting savings as a bonus under certain conditions. Due to the rather complex processes of a BVW, it tends to be perceived as sluggish and can have long reaction and processing times from the submission of a suggestion to its implementation (Crespo et al., 2009). In the long term, the lack of feedback or the long delays in providing feedback to employees on the proposals submitted leads to demotivation and to the fact that the BVW is often not practiced.

Digital idea management can and should be used to counteract this problematic circumstance. The development of digital idea management can be based on the two established concepts CIP and BVW, but seeking to combine their advantages and reduce the disadvantages. Ruiner and colleagues (2020) devised a comprehensive model of digital idea management, clearly presenting the progression from idea through processing, decision-making, and implementation to awarding. This method of idea management was developed as a responsive web app, enabling automatic adaptation of the application to the platform used (e.g., desktop PC or mobile device).

In practice, such digital idea management offers the opportunity for increased individualization, traceability, and transparency. For example, users of the app can see an overview of their own submitted proposals and also follow the review process live. This, in turn, can increase the motivation for further idea submissions from the prior experience of the transparent, fast and appreciative review of previously submitted ideas, potentially leading to an overall and long-term increase in the number of ideas submitted. This can open up new innovation and value creation potential for the organizations.

3.3.1 Work Design in Different Forms of Digital Work

The expansion of ICTs has also changed the traditional structures in which people work. First, telework has afforded employees in traditional organizational structures more flexibility over when and where they work (Contreras et al., 2020; Gajendran & Harrison, 2007). Second, the gig economy has created new forms of work (e.g., crowdwork) that challenge the boundaries of employment relationships and traditional HRM practices (Duggan et al., 2020).

Telework (also known as telecommuting, remote work or working from home) refers to “an alternative work arrangement in which employees perform tasks elsewhere [in most cases from home] that are normally done in a primary or central workplace, for at least some portion of their work schedule, using electronic media

to interact with others inside and outside the organization" (Gajendran & Harrison, 2007, p. 1525). Telework is by no means new, but it is seeing a resurgence of interest by both researchers and practitioners in the wake of the Covid-19 pandemic, as organizations worldwide have had to move large parts of their workforces to remote work (Contreras et al., 2020; Rieth & Hagemann, 2021).

Like most other aspects of digitalization, telework can have ambiguous effects on employee work design and well-being, many of which reflect different sides of the same coin (referred to as the "telework paradox"; Gajendran & Harrison, 2007). For example, working remotely increases employees' autonomy over where and when they work and saves commuting time, and can thereby facilitate integrating family demands into the workday. However, blurred boundaries can also lead to family interfering with work (with telework increasing the amount of household responsibilities assumed by the remote employee) and work interfering with family when constant connectivity and response expectations (see 3.2.1) lead to stress and extended working hours (Allen et al., 2015; Rieth & Hagemann, 2021). As another example, employees tend to enjoy more autonomy, fewer interruptions and higher productivity when working from home compared to the office (Anderson et al., 2015; Müller & Niessen, 2019; Tavares, 2017). However, working alone and uninterrupted also reduces contact with colleagues and supervisors, which can lead to social isolation and concerns about career prospects (Cooper & Kurland, 2002; Gajendran & Harrison, 2007; Golden et al., 2008). Research has suggested part-time telework as a desirable compromise, as benefits seem to attenuate and risks to aggravate when employees work more than about 2.5 days per week from home (Backhaus et al., 2020; Gajendran & Harrison, 2007). From an HRM perspective, establishing policies and guidelines with regard to communication, availability and response expectations, as well as training leaders in effectively managing remote employees (see 3.4.1), emerge as viable instruments to ensure good work design in telework.

New forms of digital work, such as crowdwork or platform-based work are often subsumed under the "gig economy," which denotes short-term project-based or piece-rate work mediated by digital platforms (Duggan et al., 2020). This includes a range of heterogenous working arrangements and task types. Here, we focus on crowdwork, which refers to tasks that are offered by an individual or organization to an undefined group of workers and can be completed online. Crowdwork can be distinguished from app-work, where digital platforms match workers to clients for services that are carried out offline (e.g., transport and delivery; De Stefano, 2016; Duggan et al., 2020). Crowdwork in itself is heterogenous too: It includes contest-based models, where many workers complete the task but only one result is used and compensated, as well as "micro-tasking," where a large number of workers complete very small subtasks for low rates. Accordingly, work design in crowdwork can range from highly skilled, complex and complete tasks (e.g., designing a logo) to simplistic, repetitive partialized tasks (e.g., classifying images; Huws et al., 2016).

Even though crowdwork is not yet widespread and few workers rely on it as their main source of income (Huws et al., 2016), it warrants discussion in the context of work design for two reasons. First, the historic origins of work design are rooted in criticism of the scientific management principles that characterized early industrial jobs (Parker, 2014). In micro-tasking, the partialized tayloristic job seems to reappear, as workers complete simplified, repetitive tasks at low rates (Parker & Grote, 2020; Peinl & Bildat, 2017). Algorithmic management in general has been termed "scientific management 2.0" in this context (Schildt, 2017, p. 25). Platforms are often designed such that people work their way up; that is, a track record of good performance offers access to more interesting and better paying tasks. Against this background, a recent study across different platforms found that intrinsic task qualities such as task identity, variety or feedback (Hackman & Oldham, 1976; see 3.3.1) relate more strongly to satisfaction among higher-paid crowdworkers than among those with lower pay, such that financial compensation seems to be a hygiene factor (Durward et al., 2020).

Second, crowdwork is portrayed as offering workers autonomy and flexibility because they are freelancers and not employees. But their true degree of autonomy may be questioned, for example when the rates for microtasks are so low that people end up working constantly to earn enough, or when the platforms exert "soft controls" to nudge workers toward accepting tasks (Parker & Grote, 2020; see also algorithmic management in 3.4.2). The problem from an HRM perspective is that crowdworkers as "free agents" risk slipping through the cracks. Organizations utilize crowdwork by either outsourcing simplified tasks (micro-tasking) or benefiting from unpaid labor (contest-based crowdwork) without assuming responsibility for the crowdworkers, who are not their employees. Meanwhile, the platform companies' HRM usually caters to their core staff of platform developers. In turn, the management of crowdworkers in terms of task allocation, performance management and in some cases compensation is left to algorithms created by the core staff (Duggan et al., 2020).

3.4 Leadership and Digitalization

Due to their crucial role in coordinating work activities, organizational leaders (especially immediate supervisors) influence their employees' performance, motivation and well-being (Judge & Piccolo, 2004; Schyns & Schilling, 2013). The two key challenges for leadership in digital transformation concern changes in competency requirements for leaders (see also 3.5.2) and the potential of automated leadership. First, organizational leaders operating in the context of rapid technological changes while supervising an increasingly autonomous and dispersed workforce need to be both technology- and people-oriented, pointing to technical and communication skills as important areas of leadership training and development (Cortellazzo et al., 2019). Second, some essential leadership tasks such as performance monitoring can be automated such that technology may complement but also potentially supplant the traditional job of an organizational leader.

3.4.1 Leadership Competencies in a Digital Environment

Leadership can be understood as "influencing and facilitating individual and collective efforts to accomplish shared objectives" (Yukl, 2012, p. 66). Although by this definition anyone can be a leader, the study of organizational leadership is usually concerned with the behavior and effectiveness of people in formal leadership roles (i.e., managers, supervisors; Kelloway & Barling, 2010). Accordingly, the focus of this section is on the impact of digitalization on leaders' behavior toward their employees rather than organizational management. A complete review of the various theories that have been proposed to explain leadership effectiveness is beyond the scope of this chapter (see Kelloway & Gilbert, 2017).

According to Yukl (2012), the range of leadership behaviors can be meta-categorized into task-oriented behavior (e.g., monitoring operations, problem solving), relations-oriented behavior (e.g., supporting, developing), change-oriented behavior (e.g., advocating and envisioning change, facilitating learning), and external behavior (e.g., external monitoring, representing). Numerous studies have documented how constructive leadership (i.e., facilitating task achievement, supporting and motivating employees) is conducive to improvement in both performance and mental health (Montano et al., 2017), whereas laissez-faire and destructive leader behavior are associated with negative employee outcomes (Schyns & Schilling, 2013). Due to leaders' influential role in coordinating work activities, a large share of training resources in HRM is allocated to leadership development (Riggio, 2017). Against this background, the question is: What characterizes effective leadership in the digital age?

One of the main challenges for leadership is that virtual collaboration and technology-mediated communication increase the distance between leaders and employees. Though the degree of virtual teamwork can vary from face-to-face to fully mediated online collaboration across multiple locations, most organizational teamwork today is at least partly virtual (Rudolph et al., 2021). In virtual settings, it becomes more difficult for leaders to be aware of their employees' stress levels, as overtime and signs of strain can go unnoticed (Efimov et al., 2020; Kordsmeyer et al., 2020). Virtual teamwork can also feel isolating, and technology-mediated communication is prone to misunderstandings, increasing the risk of conflicts as a source of stress (Day et al., 2012; Rudolph et al., 2021). This means that team leaders have to put more deliberate effort into things that grow more naturally in face-to-face settings to establish trust and a good team climate (e.g., by checking in with individual employees, creating opportunities for informal exchange or setting up communication rules; Hoch & Kozlowski, 2014; Kordsmeyer et al., 2020). As increased distance also entails less control for the leader, research has shown that facilitating self- and shared leadership among team members may be more beneficial for performance and satisfaction than "traditional," hierarchical leadership styles in virtual work settings (Eisenberg et al., 2019; Hoch & Kozlowski, 2014).

Technology-mediated leadership is also referred to as "e-leadership" (Contreras et al., 2020). Originally introduced as "a social influence process mediated by [advanced information technology] to produce a change in attitudes, feelings, thinking, behavior, and/or performance with individuals, groups, and/or organizations" (Avolio et al., 2001, p. 617), e-leadership does not seem all that different from traditional understandings of leadership. Hence, many competencies emphasized for successful "e-leadership" to meet the challenges of virtual work, such as effective communication or social and teambuilding skills, are not new compared to traditional leadership competencies (Contreras et al., 2020). What is new is that leadership is mediated by technology, which means that leaders need to be proficient in using (communication) technology to effectively exert influence and manage their teams (Newman et al., 2020). Accordingly, Cortellazzo et al. (2019) have observed a "renaissance" of technical competencies as an important additional field for leadership development.

3.4.2 Automating Leadership Functions

There is also the possibility of technology supplementing or even replacing organizational leaders. "Automated" or "algorithmic" leadership refers to algorithms assuming HR and managerial tasks such as hiring and compensation, performance appraisal, and the allocation of tasks (Duggan et al., 2020; Wesche & Sonderegger, 2019). For example, algorithmic management has been defined as "a system of control where self-learning algorithms are given the responsibility for making and executing decisions affecting labour, thereby limiting human involvement and oversight of the labour process" (Duggan et al., 2020, p. 119). Closer to Yukl's (2012) definition of leadership, Wesche and Sonderegger (2019) define automated leadership as "a process whereby purposeful influence is exerted by a computer agent over human agents to guide, structure, and facilitate activities and relationships in a group or organization" (Wesche & Sonderegger, 2019, p. 200), which illustrates that in contrast to e-leadership, technology is no longer the mediator but rather the leader itself in this scenario.

So far, the discussion of automated leadership in the literature has concentrated on theoretical reviews (e.g., Kellogg et al., 2020; Wesche & Sonderegger, 2019), while empirical measurement of repercussions for leaders, employees and HRM is still scarce. We can distinguish between platform-based gig work, where automated leadership is fully realized, and the introduction of automated leadership elements into traditional organizational structures with supervisors and employees. Platform- or app-based work has indeed eradicated human leaders and replaced them with algorithms: Although platforms like MTurk or Uber may be perceived as simply matching demand and supply, these systems also set incentives, allocate tasks, and reward, sanction and monitor workers' performance, thereby assuming HR- and leadership functions (Duggan et al., 2020; see also 3.3.2).

In more conventional organizational settings, leadership tasks can also be automated to assist in and complement the activities of human leaders. According to a

corporate survey of leaders at different organizational levels, a viable scenario is that artificial intelligence takes over administrative tasks (e.g., scheduling shifts, compiling reports), freeing up leaders' resources to concentrate on tasks that require judgement, creativity or social skills (Kolbjørnsrud et al., 2016). From the employee perspective, experimental evidence suggests that people perceive automated leadership agents as less benevolent and overall less trustworthy, but also more transparent than human leaders (Höddinghaus et al., 2021), underlining the importance of considering employee attitudes and acceptance in the implementation of automated leadership (see also Abraham et al., 2019; Lee, 2018). More research is needed to guide HRM in successfully aligning automated leadership – as algorithms need data – with an organizational strategy for HR analytics (3.6).

3.5 People Development

People development is central to HR maintaining the competitiveness of the company as well as the health and motivation of the staff. In this respect, digitalization has two effects on people development. First, it can take place in a different way, in a digital form. On the other hand, the digitalization of work processes and the introduction of automation in the workplace are changing what is demanded of employees (Rieth & Hagemann, 2021), and thus warrant changes in training and continuing education (Parker & Grote, 2020).

3.5.1 E-Coaching

Along with the proliferation of digital work, there is also a growing need on the side of employees for support that is flexible in terms of space and time, such as virtual or e-coaching. Just as information can now be quickly obtained, people want to receive personal feedback on their behavior or ideas directly, and to decide for themselves when to take the time for consultation (Kluge & Hagemann, 2016). Especially due to circumstances surrounding the Covid-19 pandemic, demand for online-based consulting products has increased dramatically and providers of these solutions have had an immense competitive advantage.

Coaching is understood to be a "person-centered counseling and support process that can include professional and private content and is limited in time" (Rauen, 2001, p. 64). In this context, coaching seeks to provide "intensive and systematic facilitation of result-oriented problem and self-reflection as well as counseling of persons or groups to improve the achievement of self-congruent goals or to consciously change and develop oneself" (Greif, 2008, p. 59).

Not only can digital media be used directly in the coaching sessions, but the entire coaching process can benefit from digitalization at its various stages (Pascal et al., 2015). Digital media play an important role in the selection process of the appropriate coach, for example, with a good match between coach and client (e.g., in terms of certain personality variables) being a relevant predictor of coaching success

(De Haan et al., 2013). The past limitation of geographic proximity between coach and client can now be lifted and time and location can be flexible. Clients can instead select their coaches based on whether the coach's experience is considered sufficient, whether relevant knowledge about the client's industry is available on the coach's side, or whether the coach holds certain certifications. In addition to a digital-based self-search, a data-based development of algorithms is also conceivable in order to optimally predict a match between coach and client for the success of the coaching (similar to the applications of chatbots discussed by Pijetlovic & Müller-Christ, 2022 and Klein et al., 2022). Numerous providers of web-based coaching management systems have emerged to meet the various requirements of organizations, coaches and clients. These web-based systems help all parties to optimally control the entire coaching process and to make it easier and clearer (e.g., with regard to the selection of the coach, the scheduling of appointments or the tracking of the content of the coaching sessions). Evaluations, which are essential for the success of a coaching process, can be integrated into the coaching management systems or carried out separately. For this purpose, too, there are various commercial and freely available software solutions to distribute digital and online-based evaluation forms.

One of the most common cases of digitalization in coaching concerns the coaching relationship itself, which can proceed without personal contact between coach and client. We talk about distance coaching or e-coaching when, for example, e-mail exchanges, telephone, chat or video telephony are used (Geißler & Kanatouri, 2015; Kluge & Hagemann, 2016). It is also possible that coaching sessions take place in virtual rooms where participants are represented by avatars (Heller & Koch, 2018). In this way, the relationship between coach and client, a factor that is essential for successful coaching, is supported through the use of new media that is adapted to the context (Berry et la., 2011). One way of classifying digital support in the coaching process can be as follows (Heller & Koch, 2018):

- Human vs. machine: Does a machine (a bot, for example) generate coaching content exclusively, or does the client communicate with a human coach using digital media?
- Synchronous vs. asynchronous: Do the coach and client communicate contemporaneously with each other or is the answering of questions time-independent
- Verbal vs. written: Is there verbal communication or purely written communication, possibly with corresponding imagery?
- Avatar vs. human: Will the process integrate the use of avatars as representatives of the participants?

An illustrative example of an e-coaching application within the production and logistics sector can be found in Klumpp et al. (2020). This use case is an e-coaching system for employees and managers to expand self-efficacy as well as learning-, competence- and health-promoting work design and to enhance self-directed, flexible and context-related learning with the support of digital media.

For the successful use of e-coaching, it is important for clients to have an affinity for computers and an expectation of internet self-efficacy. Even though computers and other electronic devices are part of daily life, people exhibit different attitudes towards their use, and are sometimes averse to using computers and other technical devices. Computer aversion means "a negative affective state (discomfort or apprehension) relating to computer technology" (Schulenberg & Melton, 2008, p. 2621). A positive attitude toward the use of computers positively influences their acceptance in a coaching process. Internet self-efficacy is defined as "the belief in one's capabilities to organize and execute courses of internet actions required to produce given attainments" (Eastin & LaRose, 2000, p. 1). If this form of self-efficacy (i.e., the conviction that one can perform a certain action and meet challenges) is highly pronounced, people may have greater confidence in the e-coaching process; hence, the assessment of one's own skills influences the client's motivation and behavior in using these applications (cf. Bandura, 1986).

Computer affinity and self-efficacy are important client-side resources for dealing with the challenges and new demands within the digitalized coaching process. Overall, individuals with higher self-efficacy expectations and motivation to learn are more likely to seek out coaching situations and initiate processes for change (Kluge & Hagemann, 2018).

3.5.2 The Impact of Digitalization and Automation on Required Competencies

Existing task structures and work roles will be fundamentally changed by digitalization and automation (Härtwig & Sapronova, 2020). Organizations face new challenges and new competence requirements for employees (Cascio & Montealegre, 2016; Demerouti, 2020; Härtwig & Sapronova, 2020; Rieth & Hagemann, 2021; Umbach et al., 2018). For organizations to be successful, it is essential that they systematically support the development and expansion of employees' competencies. This requires planning, implementation, and monitoring of employee competence development in alignment with the strategic goals of the organization (Kauffeld & Paulsen, 2018). In the context of such strategic competence management, it also is essential to consider future requirements that may arise (e.g., due to increasing automation) at an early stage in order to remain competitive.

The changed competence requirements as a result of automation have been analyzed primarily in the industrial sector (Grzybowska & Łupicka, 2017; Hecklau et al., 2016; Hirsch-Kreinsen, 2018). Occasionally, the focus is also on the consequences for logistics and retail (Böving et al., 2019; Umbach et al., 2018). Other organizations that are also strongly influenced by the automation of work processes are what are known as high-risk organizations (HROs). HROs are organizations for which mistakes can have serious consequences, and hence must maintain attentiveness and meet a high standard of reliability due to their acute responsibility toward other people and the environment. HROs include, for example, the police, fire departments, nuclear power plants, airlines and medical care providers, and make up

a large proportion of the overall workforce. Teams working in such organizations are called high responsibility teams (Hagemann, 2011). HROs thus place very specific demands on high responsibility teams and are not comparable to other organizations (Hagemann et al., 2012).

HROs work with very complex technologies (Weick & Sutcliffe, 2016). In HROs in particular, the goals of automation are to increase safety and reliability in addition to the economic benefits. At the same time, automated systems entail new risks that can have far-reaching consequences, such as in the event of faulty execution or automation failure. In these critical moments, humans must be prepared to return to service and independently perform the functions previously outsourced to automation (Manzey, 2008;). Humans thus remain an important resource in organizations, although their role is changing fundamentally (Rieth & Hagemann, 2021). Active control tasks are decreasing as automation increasingly performs them. Instead, humans must take on the role of system monitors and check whether the automation is working correctly. Thus, passive monitoring tasks become more important for humans (Manzey, 2008; Sheridan & Parasuraman, 2005). Consequently, one of the greatest challenges of human–machine interaction is that humans in their passive role must remain vigilant at all times, maintain appropriate situational awareness, and be able to intervene in the event of a malfunction (Manzey, 2008). However, it is often the case that the more reliably automation works, the more likely it is that there is an overconfidence in it – what is called one of the "ironies of automation" (Bainbridge, 1983). Automation is supposed to reduce the burden on humans; however, the more complex the processes and the more automated the tasks, the more challenging human intervention becomes in the event of a malfunction (Bainbridge, 1983). Another consequence of using automated systems can be the loss of necessary skills (Parasuraman et al., 2000).

With this in mind, it is especially important to train for skill retention (Frank & Kluge, 2019; Kluge et al., 2016; Parker & Grote, 2020).

3.6 Human Resource Analytics

Drastic changes in our working world are currently leading to HR seizing the opportunity to shed its dusty image and assume a new, decisive function in companies. The current changes are driven by a growing amount of both employee and company data (see Fieberg et al., 2022), and HR increasingly has the crucial role of advising the company on the basis of this data. The future of HRM, one could say, lies in understanding the data, analyzing it, and deriving recommendations from it for charting the future course of the organization.

The use of data and statistical analysis in HRM is central to the field of human resource analytics (HR-analytics or HR-A) (Angrave et al., 2016; Marler & Boudreau, 2017). Through HR-A, managers of HR aim to collect, analyze, and process data relating to employees to provide a basis for decision-making on strategic business issues. Increasing amounts of available data and data analysis are gradually transforming what is still a widespread administrative role of HRM into a more

strategic one, whereby key decision-making processes are data-driven and evidence-based. In addition to this strategic orientation of HR, which is ultimately seen as a competitive advantage for the company (McIver et al., 2018), decision-making processes that have often been perceived as subjective or intuitive can be approached more objectively. This in turn affects HR in all its functional areas, from HR marketing and personnel deployment planning to people development and staff retention (Isson & Harriott, 2016; Marler & Boudreau, 2017).

3.6.1 Application Options

There is great diversity in the possible designs of HR-A in practice. In personnel recruitment, for example, artificial intelligence software could be used as a complement to traditional interviews, not only to analyze the application documents in advance, but also to analyze the personality of the applicants by evaluating, say, nonverbal behavior or voice, thus providing additional data about the candidate (Chamorro-Premuzic et al., 2017). In the context of stress and burnout prevention, fitness trackers and smart keyboards could be used to collect data on employees' sleep patterns, heart rates, and keystrokes, with the goal of promoting employee health and preventing overwork. An interesting example is the project Marble by Lanwehr and Gober (2017). It should be noted that these examples may skirt the limits of incursion into personal space, highlighting the absolute care that must be taken with respect to ethics and data protection (see Hornuf & Mangold, 2022 and Klein et al., 2022). Above all, the EU General Data Protection Regulation must be applied at all times (Binder, 2018).

In the area of professional development, information on which group of employees (e.g., analyzed via the stored curriculum vitae) would benefit most from an internal seminar or coaching session (e.g., tracked via the HR system) could be helpful in offering employees tailored solutions for their development and career. Based on this, advanced technologies could be equipped with smart learning analytics – learning systems that adapt to the respective learner in terms of difficulty and pace (Giannakos et al., 2016).

HR-A projects may also apply to areas of leadership, such as employee performance appraisals, using algorithms to make decisions based on such data as the number of hours worked, the rate of project completion, employee attitudes towards work and colleagues, and personal development potential. What is known about this so far is that, on average, employees perceive less fairness and show lower commitment when their performance is assessed by an algorithm instead of their leader, especially when it comes to qualitative performance data. Leader decisions supported by an algorithm have been found to be more accepted than decisions arrived at through an algorithm alone or with minimal intervention by the leader (Newman et al., 2020).

In summary, HR-A plays a significant role in the overall employee journey in an organization. From the first point of contact, which can be before joining the company, through one's time in the company to leaving it, there are numerous

touchpoints between the employee and the company and its managers. Whether it is applied to performance appraisal, motivation, employee retention, appraisal interviews, vacation planning or promotions, HR-A can, if applied in smart projects, provide important insights for the company and shape these touchpoints in an optimal way.

3.6.2 Process Models for the Implementation of HR-A Projects

For an effective HR-A project, a strategically relevant question is needed at the beginning. This makes it clear to all stakeholders and the company that HR-A is not an end in itself, but serves to provide strategic value for the organization. This strategically relevant question forms the starting point and determines the course over which data is needed for the processing of the project. For example, it must be clarified to what extent existing data sources can be used or whether new data must be collected. The next step is to determine how the data can be analyzed. Because HR-A projects go through different phases, there are process flow models in which the individual phases are clearly presented. Although there are a large number of process models that describe the course of an HR-A project, the unifying logic behind all of these models is the necessity of starting out with a strategically relevant question.

A well-known example of such a process model is the I-CAN-Enable model established by Mühlbauer and colleagues (2018). In the first phase, *identify*, the research question and the analysis objective must be identified and defined. This central question can be brought to the HR department by the management or a specialist department of the company, or it can be developed independently by the HR department. In the second phase, *collect*, it must now be determined which data can be used to answer the question, where and how such data are available, and how they can be linked. The third phase, *analyze*, relates to the evaluation of the data. It is important to choose the right analysis method based on the question at hand and the quality of the data. The aim of the fourth phase, *navigate*, is to unleash the benefits of the HR-A project by automating the analysis routines and making them accessible to the relevant stakeholders in the company. Software-based solutions with interactive user interfaces should be used for this purpose. The solutions can be made widely available to employees from different areas in order to underpin the respective decision-making processes with empirical evidence. The fifth and final phase, *enable*, focuses on the derivation of action implications as well as the evaluation of the project. It is now important to incorporate the results into the decision-making process and then to continue to use the analytical procedures to check how the circumstances are changing. In this way, the best measure can be identified and, if necessary, rolled out company-wide.

Another process flow model that is similar in many respects to the previous model, but which offers a higher level of detail in the description of individual phases, is the people analytics *Prozessmodell* (PAP), with eight phases in total (Reindl & Krügl, 2017). After the first step of identifying the question, the PAP

model emphasizes the important point that analyses in the context of HR-A projects should be hypothesis-driven, and their basis should lie in assumptions that make sense in terms of content. Theories or models known from the literature can be invoked for this purpose. This is followed by the concrete planning of the research design. In order to properly analyze the data in the next step, the PAP model recommends a thorough data cleaning beforehand. The analysis of the data is followed by visualizing and communicating the results. To ensure that evidence based on the data has an impact and can be used as a basis for decisions, this evidence must be presented and communicated in a coherent and transparent manner. Successful presentation often hinges on storytelling and good data visualization. After all, if the recommendations that result from the analysis are not understood, they will fail to elicit dialogue and the insights will not lead to action within the organization (Welbourne, 2015). After the implementation of planned measures, the final step of an HR-A project is evaluation, that is, the review of whether and to what extent decisions made or measures derived were successful.

The potential benefits and process models outlined above make HR-A a powerful tool for human resource management, enabling HR work to be aligned with the requirements of the company in a targeted manner. Especially in view of the challenges that arise in the context of industry 4.0 requiring a high degree of agility with regard to HR decisions, such an approach is of great importance. By focusing on evidence and positioning itself as a strategic partner, HR-A is also helping to overcome the administrative image of HR work, strengthening its capabilities to face the challenges of the future.

3.7 Conclusion

Digital transformation affects almost every aspect of organizational life relevant for HRM, from organizational structures supporting leadership and collaboration to the people interacting with technology and their competencies, development and well-being. Given this pervasiveness, it is beyond the scope of this discussion to detail all implications of technological change in all areas of HRM. Instead, this chapter provides an overview of recent developments and selected issues in the HRM fields of health management, leadership, work design, people development and HR analytics, emphasizing employees' mental health as a vital outcome. It is the aim of this discussion to stimulate further exploration, both in research and in practice, of an active role of HRM for organizations' successful adaptation to their digital transformation.

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