ORIGINAL PAPER

Digitalization, innovative work behavior and extended availability

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Abstract

Digitalization has tremendous positive, but also negative potential for the organization and individual employees. The basic question therefore is how to design a digitalized environment that fosters idea generation and development and ensures good working practices of employees. In order to understand the requirements for the latter, the current implications of digitalization on employees have to be understood. This is of specific importance for expert organizations as these are dependent on product and service innovation as competitive advantage. In this paper, we focus on the antecedents of a very specific outcome of digitalization related to employee behavior with postulated influence on innovative capacity: extended availability and subsequent insufficient detachment with its potential consequences. Since the drivers and the extent of extended availability for work have not been sufficiently researched so far, the basis for developing solutions is incomplete. In this paper, we therefore investigate the working habits and reasons related to extended work related availability. Based on a quantitative investigation in three steps and using structural equation modelling, we show the interaction between the drivers of extended availability and the resulting additional time spent for working in expert organizations. By doing so, our research contributes to the discussion of optimizing the degree of digitalization employed or promoted in organization and establishes the link between the digitalized work setting, observed behavior, and its reasons.

Keywords Digitalization · Innovative work behavior · Extended availability · Employees · Drivers · Detachment

JEL Classification I230 · J810 · M540 · O310

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1 Introduction

Value-creation in companies depends on the effective and efficient combination of resources and capabilities, and a positive alignment and interaction of strategy with the relevant contextual surroundings. Organizational success is derived from excellent leadership, a good strategy, the right employees, tactical measures with quick results, and luck (Hinterhuber 2015). Digitalization—the increased use of and restructuring of life domains around information and communication technology (ICT) (Brennen and Kreiss 2016; Stolterman and Fors 2004)—is an internal optimization tool, outward market(s) related opportunity and general trend which can have a tremendously positive effect on all these aspects. Among the further potentials of digitalization are the generation of and access to (more) data with subsequent knowledge creation, and general higher flexibility. As digitalization requires high investments, however, flexibility can also be reduced and, in the worst case, result in a strategic lock-in.

On the individual level, a potential perceived data overload might block creativity. Digitalization can lead to increased stress, extended availability, boundary blurring, reduce the ability to detach and thus to enter regenerative mental phases potentially needed for creativity leading to innovation. In his review of the literature, McLean (2005) clarifies the difference of the two words. While creativity is needed for innovation (Amabile 1988; Amabile et al. 1996), innovation refers to the process of bringing the—creative—idea to the market (McLean 2005) or successfully implementing it in an organization (Amabile et al. 1996). Innovation thus involves all aspects of (strategic) management and should therefore be taken care of on the corporate level. Inventions, which are the basis for innovation (Schumpeter 1912), can be discovered by chance, big data analysis, or simply general technological advancements, but they still originate mostly from individual or team-based ideas. The basic question therefore is: how can a digitalized environment be designed to foster idea generation and development and to ensure good working practices of employees? In order to understand the requirements for the latter, the current implications of digitalization on employees have to be understood. This is of specific importance for expert organizations as these are dependent on product and service innovation as competitive advantage. This is because knowledge as such does not constitute a competitive advantage as it is acquired through hiring experts (Mintzberg 2003).

In this paper, we will thus focus on the antecedents of a very specific outcome of digitalization related to employee behavior. Using structural equation modelling, we show the interaction between the drivers of extended availability and the resulting additional time spent for working in expert organizations. We theoretically link these issues to the antecedents of innovative work behavior, empirically highlighting psycho-social capacities with a focus on detachment and the influence of the organizational culture regarding segmentation norms, as "perceptions of cultural support for innovation are largely ignored in studies of employee innovative behaviors" (Lukes and Stephan 2017). By doing so, our research contributes to the discussion of optimizing the degree of digitalization employed or

promoted in organization and establishes the link between the digitalized work setting, observed behavior, and its reasons.

2 Background

E-Mail overload and high extended availability are highly prevalent in expert organizations, and ICT use and digitalization are seen as basic causes. Still, the reasons for individual behavior as well as their effects are unclear. To efficiently design digitalized work environment to promote innovative work behavior, the determinants for extended availability have to be checked for and then linked to innovative work behavior. The outline of this section follows the structure of this argument. After introducing the concept of extended availability, we will focus on innovative work behavior, expert organizations, and detachment.

2.1 Extended availability

There is no common definition for extended availability (Maier 2019). For this paper, we refer to work related extended availability, which can be further subdivided into (a) availability of the working individual for work related matters, which can be regulated or not, and (b) the availability of work related matters for the working individual (e.g. via VPN access to the company from a home office). Both are occurring outside of the regular workplace and the regular working hours, can vary in extent, and are often made possible by new information and communication media (Maier 2019; Pangert and Schüpbach 2013). The present study focuses on the not regulated part of (a). A typically more regulated aspect of (a) would be on-call work, which is not covered here, but also results in negative health-related outcomes (Bamberg et al. 2012).

Why extended availability for work and sacrificing off-time for organizational tasks is a growing phenomenon is theoretically discussed in border theory (Clark 2000) and boundary theory (Ashforth et al. 2000). The borders between the private and the work sphere are postulated to be permeable, to have various degrees of overlaps, and to even have salutogenetic (health creating) potential as they can constitute a resource (Desrochers and Sargent 2004). Boundary blurring can be an element of high job control, thus offering possibilities for reducing strain, but also the opposite in case there are external demands forcing them on individuals or groups (Adler and Koch 2017). Extended availability is, for example, expected from experts and managers (Schieman et al. 2009), and very common also for knowledge workers (Maier 2019).

High individual involvement and ambition are known to be related to extended job related availability (Boswell and Olson-Buchanan 2007). In extreme cases, job related extended availability becomes deeply engrained in the corporate culture (time regime), which has the potential to suffocate any attempts for change. Tailoring solutions to underlying problems and reasons making people available after working hours is necessary (Pangert and Schüpbach 2013). Therefore, the drivers

for excessive working hours have to be analyzed in order to substantiate the types of reasons, and their level of origin (individual or organizational). However, "[t]he disparate literature on extreme jobs does not allow conclusions about the relative importance of different drivers" (Gascoigne et al. 2015), which is why the present paper also aims to help close this research gap. Good solutions have to be developed so that current working regimes are not perpetuated even if already proven to be detrimental (Maschke et al. 2014). Extended availability is related to negative health effects and life-domain-balance (Derks et al. 2014) and connected to a reduction of creative and innovative potential (Wendsche and Lohmann-Haislah 2017).

2.2 Innovative work behavior

Innovations are defined as "new and potentially useful products or processes that are developed and applied in a particular work context in order to address problems or improve the status quo" (Messmann and Mulder 2012). They are crucial for organizational effectiveness and competitiveness and are highly dependent on the contribution of staff members, i.e. innovative work behavior (De Jong and Den Hartog 2010; Messmann and Mulder 2012).

Innovative work behavior is "underlying intrapreneurship" (Lukes and Stephan 2017) and is dependent on individual and contextual factors, making it a dynamic construct (Hammond et al. 2011; Lukes and Stephan 2017). Its aspects range from idea generation, idea search, idea communication, implementation starting activities and involving others to overcoming obstacles (Lukes and Stephan 2017). Innovative work behavior can be the establishment of new routines, simplification of work processes, use of new materials and tools, improvement of cooperation, and/or creating new offers/services (Messmann and Mulder 2012).

Intrapreneurship is closely related and can be "defined as organizational venture creation and strategic renewal brought about by employees" (Gawke et al. 2019), creating economic value in already existing organizations (Parker 2011). Just as digitalization, intrapreneurship can thus increase the ROI of personnel cost (Klarner et al. 2013). The concept has been subdivided into several types, with innovation being "the common theme underlying all forms" (Heinonen and Korvela 2003). Intrapreneurship can not only lead to positive outcomes for the organization, but also the thus engaged individuals (intrapreneurs) (Gawke et al. 2017).

Likewise, the effects of innovative work behavior are not only positive for the organization, but also the individual as they include increased well-being, higher job-satisfaction, and improved working conditions (for an overview see Lukes and Stephan 2017). Moreover, innovative work behavior mediates between stressors and reactions (Sonnentag et al. 2010), it constitutes a resource.

Facilitators of innovative work behavior are organizational and supervisor innovation support, a "progressive" national culture, and certain personality traits (Lukes and Stephan 2017). Also, job characteristics like complexity, autonomy and a good social climate are highlighted (Hammond et al. 2011), just as social rewards (Akhavan et al. 2015; Cingöz and Akdoğan 2011) and expected performance outcomes (Cingöz and Akdoğan 2011) together with an Effort-Reward-Balance

(Janssen 2000) and related concepts like justice perceptions or meritocracy (Rama-moorthy et al. 2005). Human resource management plays a vital role in designing a supportive setting for innovative work behavior by focusing on training and development, implementing a reward system (for innovative behavior), guaranteeing job security, providing for autonomy, an interesting task composition and resources that match job demands, and ensuring feedback is received (Bos-Nehles et al. 2017). Organizations with traditionally high levels of job complexity and individual autonomy are expert organizations. We only cover their individual innovative work behavior here.

2.3 Expert organizations

As mentioned above, innovation is of specific relevance for expert organizations as these need to be characterized by cutting edge technology and services to sustain their competitive advantages. In expert organizations, value is created by highly skilled people who need a fitting organizational context (Mintzberg 2003). However, the traditional structure and procedures of professional or expert organizations are ideal in a complex but stable environment (Mintzberg 2003), which is no longer the case for many traditionally expert organizations. Dynamic surroundings create more room for innovation and foster intrapreneurship (Antoncic and Hisrich 2001; Heinonen and Korvela 2003), but also increase pressure. Given the decentralized decisional power (Mintzberg 2003), professionals can therefore be required to submit to new logics (Alvehus 2018; Bednarek et al. 2017), take decisions whenever they arise—even outside office hours, generally more quickly, and under higher uncertainty. This not only increases stress, but can also call for extended availability for so far non-managers, and be introduced in organizations traditionally not necessarily following business models. In the course of introducing market logic, this can for example also happen at the contemporary university (Bednarek et al. 2017).

Expert or professional organizations like universities or hospitals are bureaucratic, but grant a lot of freedom to the professionals working in them (Mintzberg 2003). Having been trained in specific skills outside the organization (e.g. at colleges, etc.) and prior to their hiring (Mintzberg 2003), the professionals are expected to demonstrate independence and self-leadership. However, self-management skills may be underdeveloped in comparison to task-related abilities, which may lead to individual problems regarding time management. As high expertise results in lower degrees of substitutability, specialized tasks are difficult to delegate, which can also contribute to excessive working hours or extended availability, and reduce individual capacities for detachment.

2.4 Detachment

Detachment is defined as "the individual's sense of being away from the work situation" (Etzion et al. 1998). Psychological detachment from work is a crucial ability and requires total abstinence from work related matters during off time, leading to a high likelihood of true relaxation (Sonnentag and Fritz 2007) and positive health

effects (Sonnentag et al. 2010) like better well-being (Wendsche and Lohmann-Haislah 2017) and recovery (Etzion et al. 1998; Sonnentag and Bayer 2005), which in turn improves on-the-job behavior (Wendsche and Lohmann-Haislah 2017). An increased need is reported for stressful situations (Sluiter et al. 2001), and the use of ICT (Boswell and Olson-Buchanan 2007), plus supposed for situations with high job strain (Sonnentag et al. 2008).

Between 51% (Spain) and 41% (Germany, Austria: 45%; Switzerland: 49%) of those questioned in a European household survey on the separation of life spheres report not experiencing enough detachment (gfu 2015).[1]

Inhibiting factors are stressors at work (Sonnentag and Bayer 2005), high work load (Sonnentag and Kruel 2006), high job involvement (Sonnentag and Kruel 2006), high job demands, low job resources (Wendsche and Lohmann-Haislah 2017), low spatial boundaries between work and private sphere (Sonnentag et al. 2010), and work engagement outside office hours (Wendsche and Lohmann-Haislah 2017)—especially using ICT (Derks et al. 2014) or receiving work related calls (Sonnentag and Kruel 2006). Regarding personal characteristics, negative affectivity and neuroticism (Wendsche and Lohmann-Haislah 2017) are mentioned. According to research, too little detachment experience has a significant negative relationship with contextual performance and creativity (Wendsche and Lohmann-Haislah 2017), lowers satisfaction rates, and leads to sleep problems, tiredness, depression and chronic fatigue (Derks et al. 2014; Sonnentag 2012; Sonnentag and Fritz 2007).

Increasing personal choice regarding work design—for example with the help of ICT—is advisable to decrease the likelihood of mental issues (Griffin et al. 2002), increase resources and in turn improve detachment possibilities (Sonnentag and Fritz 2007). Signs of low choice are a high work load, conflicting demands, time pressure perceived during work (Belkic et al. 2004), the amount of overtime, implicit expectations of the employer towards employees to be available during off-times and the anticipation of negative consequences in case of non-adherence as well as low management support (Rexroth et al. 2014). The latter has been reported to decrease generally in the German speaking part of Europe (Stummer 2007). Organizational culture, however, is shaped by the values management promotes. To increase the likelihood of detachment, management should ensure employees reach an adequate work–life-balance (Rexroth et al. 2014), for example by encouraging a clear segmentation norm.

3 Methods

Our study design comprised three steps. In the first and second, our aim was to investigate the drivers of work related extended availability for (1) the management level only and (2) all employees of selected professional organizations. Step (3) linked the main drivers identified to innovative work behavior.

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[1] These are results of a representative study on buying intentions, user attitudes and behavior regarding electronic products which was conducted in May 2015 by Value_A Marketing Intelligence (by order of gfu Consumer & Home Electronics GmbH) including 6000 households: 1000 in Germany and an additional 5000 in France, Great Britain, Italy, Austria, Spain and Switzerland (gfu 2015).

To create robust data by a diverse sample, we investigated the management level of two hospitals and one technical company in step (1). In step (2), we surveyed all employees of two private universities. In step (3), we included all employees of the private universities as well as the technical company.

All elements of the study design were quantitative, bi-lingual (German and English) and online. For step (1) and (2), we used a mixed-method design comprising of a questionnaire and subsequent diary study (1 week), linking the data with an anonymous code. This structure is suggested for covering stable (questionnaire in our case; but also medical examinations are a possibility (Bamberg et al. 2012) and more flexible (diary study) characteristics that may change due to varying circumstances (Ohly et al. 2010). In case only the latter are of interest, diary studies can also measure several points in time on one single day (Brosch and Binnewies 2018).

Step (3) only used a quantitative questionnaire. The study was approved by the management, the workers council where available and guaranteed to be anonymous. Participation was completely voluntary and possible during working time. All potential participants received detailed information on the aims of the study, its elements and procedures, plus anonymity aspects and were invited to contact the investigators in case of further questions.

In the following sections, the elements and aims of the three steps are described in more detail.

3.1 Step (1) and (2)

The main aim of step (1) and (2) was to investigate the drivers for extended availability. Also, we wanted to measure the estimated versus real amount of extra hours and to differentiate between the tasks done outside of office hours regarding time spent on them plus the respective reasons. Therefore, participants had to fill in a questionnaire before taking part in a diary study. Moreover, we intended to investigate the stress of higher status phenomenon (Schieman et al. 2009), which is why step (1) only included management positions.

All questionnaires and the diary study were pre-tested. After agreeing to participate and choosing one of several starting points for the diary study (all Tuesdays), participants received the link to the questionnaire to be taken prior to the diary study.

3.1.1 The questionnaire

The survey the participants received before participating in the diary study mainly investigated driving forces for extended availability for work as described in the literature. To bundle the ideas of potential drivers of extended availability of professionals working in expert organizations, individual, job related and organizational aspects were checked for. Individual aspects were investigated using the scales of effort-reward-imbalance/over-commitment (Rödel et al. 2004; Siegrist et al. 2004; Siegrist et al. 2009), detachment (Sonnentag and Fritz 2007) as well as demographic variables which differed in step (1) and (2) due to divergent populations. Job related

potential drivers were measured using the following scales: work schedule control (Kelly et al. 2011), information overload (Williamson et al. 2012), e-mail overload (Hogan and Fisher 2006) and workplace telepressure (Barber and Santuzzi 2015). The latter three together with the questions regarding e-mails focus on the role of ICT. The organizational culture regarding extended availability was covered by the perceived segmentation norm scale (Kreiner 2006). Also, we added further reasons described in the literature (Pocock and Skinner 2013; Unfallversicherung 2012).[2] Moreover, we differentiated between types of tasks and asked about devices used, plus if notifications were received in case e-mails came in, and if extended availability could be clocked in.

Some of the scales mentioned above were shortened due to overlaps or items not referring to the interests of this study. Those not available in German and English were professionally translated. The questionnaire took 20–25 min to answer.

3.1.2 The diary study

Starting on the chosen Tuesday until and including the following Monday, the participants received a daily email with the link to the diary study questionnaire asking about the prior day's availability for work outside of office hours and the reasons. No emails were sent on the weekends, which is why the diary on Monday asked about Friday plus separately regarding the weekend days.

Each diary questionnaire took about 5 min to answer and asked for the time actually spent for diverse work issues [emails in- and out-bound, material taken home, phone calls, and in step (2) also rumination] during off-time at the workplace and at home. Doing so, we operationalized extended availability in detail [telephone calls, emails, taking work home, and in step (2) also rumination], plus measured the respective duration. Moreover, we had the respondents give the reasons and rate them according to relevance. Also, the respondents had to indicate the type of day (i.e., was it a regular work day, a business trip day, etc.) and answer to a question regarding behavioral change to check whether the study had led to adaptations in availability. The latter had four options: (1) I am more apt to call into question if using information and communication technology for work-related reasons is necessary during my free time. (2) I consciously try to reduce the amount of time I spend using information and communication technology for work-related reasons during my free time. (3) I no longer spend time using information and communication technology for work-related purposes during my free time. (4) No effect. My behavior has not changed in this regard.

3.2 Step (3)

The aim of step (3) was to link the main drivers of extended availability identified in step (1) and (2) to innovative work behavior and the perceived innovation

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[2] The source (Unfallversicherung 2012) is in German but includes an abstract in English.

possibilities. The questionnaire consisted of the following scales: segmentation norm (Kreiner 2006), innovative work behavior (Janssen 2000), innovation orientation (adapted from (Hardt 2012), detachment (Sonnentag and Fritz 2007), effort-reward-imbalance/overcommitment (Rödel et al. 2004; Siegrist et al. 2004; Siegrist et al. 2009), and possibilities for further training and development (Gerdes 2018). Example question: The innovation orientation had to be rated on a continuum ranging from innovator to preserver as reply to the following question: People differ regarding their approach towards ideas. Some are more inclined towards developing new ideas and implementing them, others lean more towards using and preserving existing ideas. In organizations, both groups fulfill crucial and imperative functions. Please do indicate on the following continuum, what you feel you are more. After this, the respondents had to state how viable this orientation was (a) in their direct working environment and (b) in the organization using the grading system.

4 Results

The data analysis was done using SPSS and AMOS and focused on type, duration and reasons for extended availability plus their links to innovative work behavior. The results reported here are based on descriptive statistics, regression analyses and structural equation models. The description of the results is subdivided according to the steps outlined in the methods section.

4.1 Step (1)

4.1.1 Demographics

For the first step, 173 managers were invited to participate, 70 responded. 45 respondents completed the questionnaire, and 34 completed at least one diary entry. In total, 205 diary entries could be analyzed. Of those who completed the questionnaire, 68.9% were male, and the majority (86.7%) were born before 1980. Again 86.7% were married or living in a partnership. Over 84% indicated having a university degree. As 26 responded to be working at the Austrian, 3 at the German hospital and 16 at the technical company, creating very small subpopulations, we analyzed all together. Over 91% reported to be working full time. On average, the respondents indicated having worked 46.1 h per week during the past 2 months. The majority (36 out of 45) earns more than 2.500€ per month (net income), and 86.7% have been working at their current employer for over 7 years. Slightly over 13% report to be working in a top-management position, 55.6% in a middle-management role, and about 31% in a lower-management area. Of the 45 who completed the questionnaire, 21 have more than 15 subordinates.

4.1.2 Devices in use and overtime

The majority (41) of the respondents use mainly their smartphone (incl. blackberry and PDA) and a PC as ICT device. Still 37 use these also during their free time for work related issues. Only one person indicated not using ICT. A total of 35.6% stated to be directly connected to the company E-Mails via their smartphone and to receive a notification via sound when they received an E-Mail. Moreover, 55.6% used their company E-Mail also for private messages.

The responses were unequivocal regarding the perception of work-related e-mails or calls in their free-time as distracting and annoying or helpful. As for work-related emails during off-time, 26.7% think these are annoying, 33.3% helpful. Calls, however, were considered annoying by almost 49%, and 26.7% found them helpful. When comparing e-mails and calls using the Chi-square test, the difference in perception of them being a nuisance is significant with a p value at 0.005 (two-tailed).

When asked how much they had worked during their free time in the past 6 months, 21 indicated "at least once per week", 8 even every day, and only one never. As could be assumed based on the literature, top-management positions were more apt to be available for work-issues during off-time than middle- or lower-management positions. Also, the male respondents were available more often than the females.

The estimated extended availability based on the questionnaire data was, on average, 96.34 min per day.

4.1.3 Reasons for availability according to questionnaire data

The main reasons (over 60% agreement) stated for being available were: having control over processes at work, enjoying the job, sense of duty towards clients and towards the company goals. Over 66% also stated wanting to know what was going on at work when they were absent. The majority also thought that it was practical to be available, especially for short term planning. Moreover, 60% think they can make better use of their official working time when they were available before. Still, over 84% believe they can decide about their availability during off-times.

It is interesting to note that the following reasons did not receive high rankings (selection): handling the amount of work, interdependencies of work steps/colleagues who depend on work finished, expectancies on the organizations' side, fear to miss something, recognition, pressure to deliver results, job security, career prospects, or earning more money.

4.1.4 Reasons for extended availability according to diary data

For the statistical analysis of the diary study, we could analyze 205 replies. Of these, 160 referred to a week day and 45 to weekends including Fridays. The diary study alone was completed by 59 respondents who on average sent in 3.5 replies. Table 1 shows the average and median (in minutes) of the overtime spent at the workplace per day of the diary study. Weekends and weekdays differ notably as the overtime reported on weekdays is more than three times higher than for weekends. Only five

Table 1 Overtime at the workplace during the diary study

	Number of respondents	Average (min)	Median (min)
Overtime on weekdays	54	93.5	62.7
Overtime on the weekend	45	24.5	0.0
Overtime in total	59	66.3	42.0

Table 2 Type and duration of work-related availability during off-time

	Number of respondents	Average (min)	Median (min)
Working on material taken home	59	15.6	0.0
Reading of work-related e-mails	59	10.9	5.0
Replying to work-related e-mails	59	6.9	0.0
Sum of working on work-related e-mails	59	17.8	8.3
Work-related calls	59	3.8	0.0
Sum for weekdays	54	41.2	18.1
Sum for weekends	45	20.2	6.7
Sum (average)	59	37.2	16.4

respondents did not work longer hours. Moreover, overtime at the workplace is positively correlated to availability for work-related issues outside the workplace during off-hours.

Using a regression analysis, we wanted to better explain availability and included all sum indices of the scales mentioned above plus the hierarchy level. In total, 34 respondents (of the diary study) could be analysed, and the variables included explain 37% of the variance (adjusted R^2): The highest explanatory values were derived for overcommittment (Beta: -0.605), detachment (Beta: -0.672) and the hierarchical level (dummy coded). The better respondents could detach, the less they were overcommitted and the lower their position was, the less they were available.

We found that 31 respondents did not take any work related material home during the whole study. However, 23.4% did state they did, mainly on weekends incl. Fridays. The difference between weekdays and weekends is highly significant (Chi-square test, p value at 0.000). In total, over 62% did work-related read e-mails during their free-time (almost 69% on weekdays and about 60% on weekends). However, only about 30% replied to the messages. As for work-related calls, close to 11% replied they did take some, close to 12% reported making calls. Table 2 shows the amount of time needed as indicated for the three types of work we studied (taking work home, e-mails, calls). As can be seen in the table, calls require the least amount of time, while e-mails and working on material on average are very close with 17.8 and 15.6 min. The median, however, indicates that e-mails are relevant for more people than working on material, which in turn suggests that those who do take things home work on them for a longer time.

The reasons why e-mails were replied to were: sense of duty and responsibility and high workload, but also being afraid of missing out on important information, subordinates who are dependent on answers, and pressure to deliver results. On weekends, sense of responsibility and time pressure scored higher while sense of duty was lower. Regarding calls, on weekdays sense of duty and on weekends sense of responsibility and time pressure scored high. Behavioural changes due to participation in the study were not reported.

4.2 Step (2)

4.2.1 Demographics

For the second step, roughly 200 people were invited to participate, 55 agreed. In total, the sample submitted 52 questionnaires and 243 diary datasets.

At the larger university, 41 people participated, at the smaller one 11, which is why the data was not analyzed separately. Of the 52 respondents, 36 (70.6%) answered to be female, 60.8% were born after 1980. About 31% (30.6%) reported to be single, about a third (32.7%) are married, 34.7% are living in a partnership, and again about a third (32.7%) have children living in the same household. The majority is working full-time (66.7%), about a fifth (19.6%) part-time with 25 h/week or more, and 13.7% below 25 h/week. Most do not have a management position (78.3%) and have no all-in contract (59%).

4.2.2 Devices in use and overtime

Almost 90% use a smartphone/Blackberry/PDA, only roughly 8% a classic mobile phone. About 94% use a PC/Laptop, 2% a Netbook, almost 41% a tablet. For work related matters, 77.6% use a smartphone/Blackberry/PDA, a bit over 10% a classical mobile phone, almost 84% a PC/Laptop and roughly 26% a tablet. None of the respondents replied using none of the above.

When asked about the perception of permanent availability during off-hours, about 53% rated it as annoying, roughly 18% as helpful, about 10% as tiring, the same percentage as distraction and about 8% as efficient. Rumination received more ratings as tiring (32.7%), but also helpful (24.5%) and efficient (18.4%), while roughly 16% perceive it to be annoying and about 8% as distraction. The majority of almost 88% does not receive an acoustic notice when they received a work related E-Mail.

The estimated extended availability based on the questionnaire data was, on average, 95.1 min per day. Of these, 36.2 were reported to have been rumination. When asked about the frequency of working in their free time in the prior 6 months, more than a third replied this had happened every day (35.6%), almost 27% (26.7%) once or twice a week, 31.1% less often and only 6.7% had never worked in their free time. For three quarters (75.5%), these hours are not being recorded, and only 3.8% receive payment for them, 34.6% receive compensation time. Gender, age and management position as well as the rest of the demographic variables are not related to

overtime. However, those who have a full-time position also seem to put in more extra hours.

4.2.3 Reasons for extended availability according to questionnaire data

The main reason for extended availability (over 80% agreement) was reported to be "liking to work", almost 80% reported that liking the job leads to being available in an extended way. 75% report this is due to deadlines, 73.1% that commitment towards the goals of the job drives them, and 61.6% want to be continually informed about current developments and processes. Almost 60% report being extendedly available is due to a felt commitment to supervisor or colleagues, and again almost 60% agree to work being a large part of their personal identity and therefore leading to increased availability. Over 55% agreement was reported for workload, finding extended availability practical for short-time plans, sense of duty, and commitment towards clients. Still over 50% indicated commitment towards the organization and the impossibility of accomplishing all duties during official office hours. Nevertheless, slightly above 80% state that their supervisor does (rather) not expect permanent availability and almost 85% can mainly decide themselves when they are available during their off-time.

We subdivided average overtime per week into six groups ranging from 0 to 1 h, 1 > 5 h, 5 > 10 h, 10 > 15 h, 15 > 20 h and above 20 h and analyzed these using crosstabs with the reasons reported. As could be seen, those working more overtime reported a higher belief that success was dependent on being constantly available, a desire to earn more money, and expectation of colleagues or supervisors. The time spent on activities is specifically related to several of the above mentioned reasons plus issues that received lower ratings than 30% approval and are thus not listed above: having to read e-mails during off-times as the working time would not suffice, continually having to take important decisions, having to be available as otherwise colleagues or co-workers take wrong decisions, wanting to be continually informed, fear of missing something, fear of losing recognition, having to be there as a leader due to a shortage of managers, high identification with the job, deadlines, workload, the belief that success is only possible by continuous availability, pressure to deliver results, high demands, low possibility to perform all tasks during working hours, to improve career options and job safety, having been asked by colleagues, sense of duty towards colleagues or supervisors, wanting to improve relationships, and negatively related to personal control over time. However, a regression analysis showed that only perception of appreciation of availability and the desire to improve relationships had a (slight) significant positive effect. When tested as sole predictors, they failed.

When we tested for relationships between the reasons and demographic variables, years already employed at the university had the most influence. Those who had been employed more than 3 years felt less importance of always being informed about current developments, less need for being available to discuss short term plan changes, did not think continuous availability and job success correlated, had higher perceived own control over time, and had less often the feeling their colleagues were available during off-time. They also felt less need to be extendedly available to be

perceived better by others, and less pressure to deliver results. Also, they felt less expectation from their supervisor to be available during off-hours, and less sense of obligation or duty.

Interestingly, those with a full-time contract felt a higher need to improve their career changes and thus to be available. Also, they wanted to improve their job security. Men felt more obligated towards their colleagues and supervisors. Younger people wanted to improve career changes more than those born after 1980 by being available during off-hours. The department a person was employed at was connected to having no other obligations and having an all-in contract. People in partnerships felt more pressed by deadlines, and also more obligated towards the organization.

4.2.4 Reasons for extended availability according to diary data

The real extended availability based on the diary study was on average 71.9 min per day at workplace plus 68.3 min per day not at workplace (total 140.2).

The reasons given differed regarding task performed and whether it was on a weekday or on the weekend. Respondents had to rank the reasons regarding importance. In this section, we focus on the aspects stated as rank 1 most frequently, with the exception of weekends and calls, where we report on more ranks due to the smaller extent of occurrence. On weekdays, working on emails during off-hours was mainly reported out of a sense of duty (ranked 1 by 10 people), the workload (ranked 1 by 8 respondents), and the fear of missing out on something (ranked 1 by 6 participants). Material is taken home due to a high workload (rank 1 was stated 7 times) and because of deadlines that have to be met (ranked 1 by 8 respondents). Calls appear to be a rather small problem, which is why we include ranks 2 and 3, as well. In case they do happen outside of office-hours, this is due to a pressure to deliver results or deadlines that have to be met. Both reasons appear in rank 1 and 2, but each only once. For some, calls were necessary due to a sense of responsibility (rank 1 once), expectation of the clients/patients (ranked 1 once), expectation of the organization (ranked 2 once), or the workload (rank 1 and 3 each once). As already shown above, rumination is a major part of extended availability or not detaching from work. The respondents stated sense of responsibility (ranked 1 by 16 respondents), the workload (ranked 1 by 13 people), deadlines (ranked 1 by 8 participants) and the pressure to deliver results (ranked 1 by 5 people), but also sense of duty (ranked 1 by 4 people) as main reasons. Some, however, also expect positive feedback. On weekends, working on emails occurred mainly due to the workload (ranked 1 by 3, ranked 2 by 1 person, ranked 3 by 2 participants) and deadlines (ranked 1 by 3 respondents), plus partly due to a sense of duty (ranked 1 by 2 participants). Taking material home to work on during the weekend occurs due to the workload (ranked 1 by 4 people, ranked 2 by 3, and ranked 3 by 2 respondents), deadlines (ranked 1 and 2 by 3 people each) and the pressure to deliver results (ranked 1 by 2). In case work related calls are reported on the weekend, this is due to deadlines (ranked 1 by 2 respondents and 3 by 1 person), pressure to deliver results (ranked 1 by 1 participant) or the expectancy of clients/patients (ranked 1 by 1 person). While seemingly not as frequent as during the week, rumination also occurs on the weekend. The reasons stated are sense of responsibility (ranked 1 and 2 by
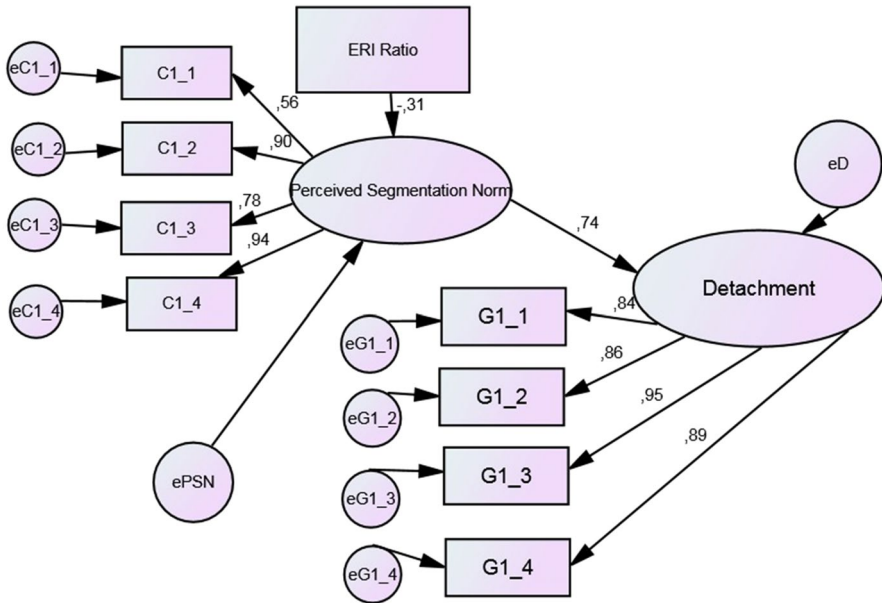
Fig. 1 Interrelationships of drivers of extended work related availability

3 people each), deadlines (ranked 1 and 2 by 3 respondents each), the workload (ranked 1 by 3 participants, and 2 and 3 by one person each) and pressure to deliver results (ranked 1 by 2 people and ranked 2 by 1 respondent). Again, some do hope for positive feedback (ranked 1 and by 1 person each). Participation in the study did not result in behavioral adaptations.

4.3 Step (1) and (2)

To conclude the analysis, we tested the interrelationships of the drivers using a structural equation model, aiming at predicting detachment to prepare for step (3). Based on our data, the perceived segmentation norm (PSN) is the major predictor of detachment and can be theoretically subdivided in the organization's stated versus liveable norm (see espoused theory and theory in use according to (Argyris 1995), PSN: C1_1, C1_4: theory in use; C1_2, C1_3: espoused theory). The effort-reward-imbalance ratio has a negative influence (-0.31) on the perceived segmentation norm, meaning people with a perceived imbalance report a weaker perceived segmentation norm. A major secondary finding was that overcommitment has high overlaps with the construct of detachment (see line between the ellipses [0.74]) (Fig. 1).

With a RMSEA of 0.079 (90% CI = 0.19–0.124), a CFI of 0.976, χ^2 at 40.123 (df = 26) and p at 0.038, the model fit is tolerable.

4.4 Step (3)

For step (3), about 700 people were invited to participate. In total, 181 questionnaires were filled in. Using structural equation modelling, the aim of step (3) was to identify the interrelationships of the main drivers of extended availability and link these to innovative work behavior.

In a first model, innovative work behavior was explained using the scales for effort-reward-imbalance/overcommitment, the perceived segmentation norm, detachment, reported implementability of innovative work behavior and the self-reported personal innovation orientation. The resulting model has a RMSEA of 0.065 (90% CI = 0.059–0.070), a CFI of 0.833, χ^2 at 1414.505 (df = 806) and p at 0.000. In this model, innovative work behavior is predicted mainly by the individuals' self-description (0.36) on a scale ranging from 0 to 100, with 100 being an innovator and 0 being a conserver. Implementability has a direct, but only very weak influence (−0.12). Detachment has an indirect influence as it is negatively related to the self-description (−0.56), and itself influenced by the segmentation norm (0.25). This means people easier and better detach in the context of a strong segmentation norm allowing a separation of work and other life domains. Those who report better detachment, however, are also rather on the conserver side of the self-description. Overcommitment is negatively related to segmentation norm (−0.72), detachment (−0.64), and negatively influenced by rewards (−0.11). Interesting to observe is the negative influence segmentation norm shows regarding implementability of innovation (−0.24) (Fig. 2).

After analyzing the complete picture, only the main postulated influencers were tested. This second model comprises of effort, reward, segmentation norm, detachment, self-description of innovation orientation and innovative work behavior as outcome variable.

The resulting model has a good model fit with a RMSEA of 0.065 (90% CI = 0.058–0.072), a CFI of 0.863, χ^2 at 916.374 (df = 523) and p at 0.000. Low rewards negatively influence effort (−0.44), which in turn weakens (−0.64) the segmentation norm. Detachment is supported by segmentation norm (0.74), but is associated with the "conserver" end of the self-description. Describing oneself rather as innovator leads to more reported innovative work behavior (Fig. 3).

5 Discussion

Changing societal interpretations of the nature of work have an influence on the work setting. Nowadays, employees are expected to invest and sacrifice a part of their personal competences and resources for the company (Moldaschl and Voß 2002), even when no monetary remuneration follows (Blagoev 2015). They may have an interest in doing so in addition to the job related motivation mentioned above, should job security be an issue. Moreover, changes in organizational structures (Voß 1998) or processes can require extended work related availability, and especially digitalization encourages the latter. Though reported as being responsible for overtime at the workplace, changing management ideas fostering higher flexibility and autonomy
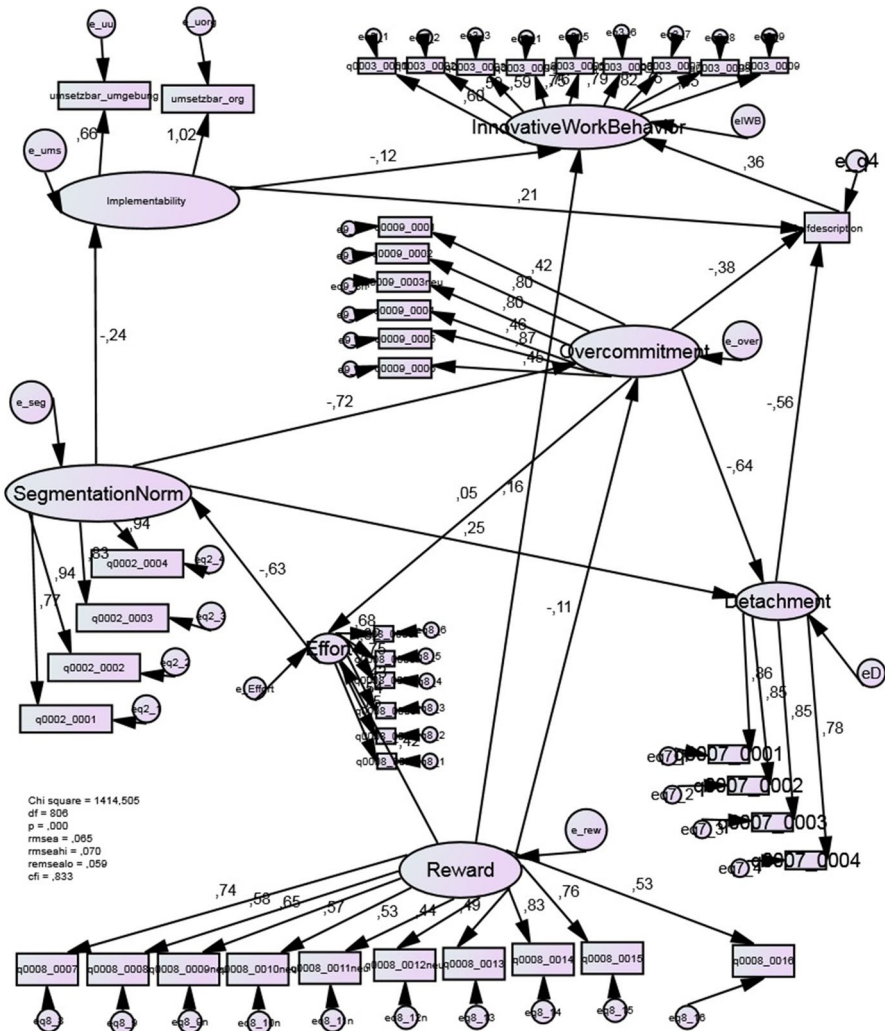
Fig. 2 Innovative work behavior: model 1

while at the same time increasing pressure (Peters 2005) may also lead to extended availability outside the workplace. These developments form part of a so called dislimitation, where social structures that developed over time in certain historical contexts dissolve again through social processes. This happens in a broad variety of social dimensions, affecting time, space, social organization, qualification, motivation, and meaning (Voß 1998). Still, digitalization and the subsequent possibilities to work dislocated from the organization and also at more flexible hours also constitute resources, which calls for a smart digital work design (Richter et al. 2018).

Since the drivers and the extent of extended availability for work have not been sufficiently researched so far (Gascoigne et al. 2015), the basis for developing

Chi square = 916,374
df = 523
p = ,000
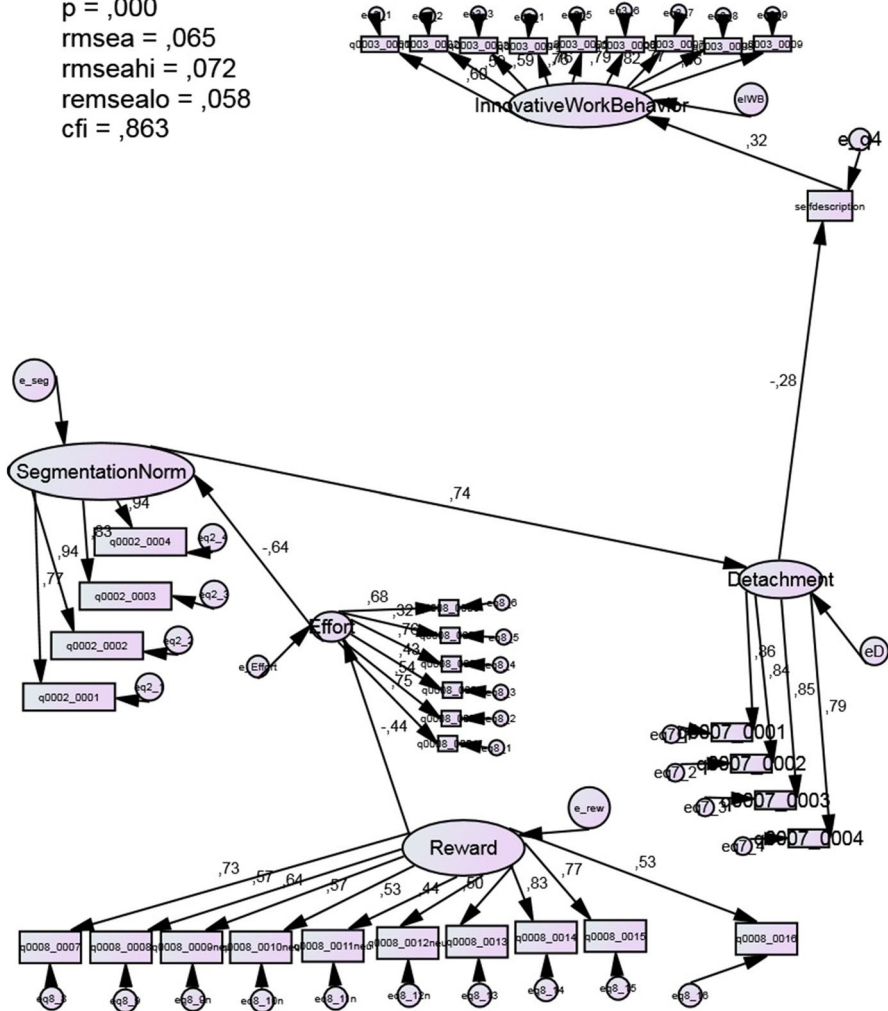rmsea = ,065
rmseahi = ,072
remsealo = ,058
cfi = ,863

Fig. 3 Innovative work behavior: model 2

solutions is incomplete. In this paper, we therefore investigated the working habits and reasons related to extended work related availability and found these to differ regarding task and weekday, plus to be thought of and evaluated as much more positive in the questionnaire than in the "reality check" via the diary study, which revealed high pressure, and high moral but low resource support for detachment. This may be the reasons why even when people saw by participating in the study how much more they invested for work related activities than they were officially expected to, the behavior was not altered. Moreover, the actual time spent working

more hours was (slightly) underestimated in the questionnaire when compared to the diary study, but in all cases on average significantly exceeded the time fixed in the individual's working contract. As e-mails (reading and composing) constitute a major factor, this highlights the role of ICT for extended availability, though material taken home and rumination may, at least for some, be even more important and is not connected to digitalization.

Specifically, we examined professional organizations, where experts frequently act independently and are expected to be self-organized (Mintzberg 2003), thus being treated as intrapreneurs (Antoncic and Hisrich 2001; Heinonen and Korvela 2003). Digitalization can increase individual freedom and access to information, thereby promoting proactive behavior and innovation. This is crucial in dynamic environments as today's markets, but also in contexts of high uncertainty where expert knowledge and experience are among the few bases for decision making. Situations with those characteristics require the ability to screen for patterns that connect (Bateson 1979), which is an analytic as well as creative act with the potential to lead to innovation. Individuals and companies may fail to do this, and consequently fail to adapt due to various reasons. While all aspects relevant for change management apply here, specific features of digitalization add further challenges. Information overload may bind resources, patterns might not be screened for in the data available on a systems level, training in pattern recognition might be lacking, and employees may not be in a mental state allowing for innovation due to negative stress. However, the data does not support the notion of better detachment leading to more innovative behavior as personal innovative identity perception seems central. The self-description is negatively associated with detachment—better detachment comes with a self-perception more towards the "conservator" end of the spectrum, while thinking of oneself as innovator leads to more self-reported innovative work behavior. Sonnentag et al. (2008) already hinted towards a potential necessity to turn toward more positive aspects of relaxation like mastery experiences during off-hours. Our finding of the high overlaps between the constructs of detachment and overcommitment in step (2) give additional strength to this argument, which is why we argue for a better differentiation (a) between overcommitment and detachment and (b) highlight the need for studies linking various aspects of recovery to innovative work behavior.

As could be observed in step (3), overcommitment has a detrimental effect on the self-perception of being an innovator, and is itself massively reduced in case of a strong segmentation norm. Literature associates overcommitment with negative implications for performance (Feuerhahn et al. 2012), which alleviates our findings regarding detachment. Overcommitment might lead to misperceptions of the own (innovative) capacities and/or also misconceptions of the currently wise degree of novelty and change. Not overcommitted, better detached employees might have a better and more realistic overview. Still, this requires more testing.

Regarding resource utilization, research has shown these increase with position (Bakker and Demerouti 2007; Karasek 1979). However, we saw in our study that resources are not necessarily used for the reduction of extended availability, or not high enough independent of the position due to digitalization and time pressure. Especially the diary data reveals that slack (Damanpour 1991) is called for.

Though the perceived segmentation norm favors detachment, this only seems to be the espoused theory, as the participants do not believe their working time is enough for their respective job demands, so the theory in use (Argyris 1995) remains extended availability. Therefore, working on conflicting logics (Alvehus 2018) and starting a cultural change process based on assessing work load is needed. Policies and implicit norms for ICT use during non-office hours (Sonnentag et al. 2008) are called for to ensure high perceived control of time and possibility for longrange planning (Darini et al. 2011).

Certainly, employees on all levels have the responsibility to create own and maybe new boundaries and structures (Rexroth et al. 2014; Voß 1998) fitting for personal requirements and life phases (Ulich and Wiese 2011). Self-Leadership skills are required (Ghosh 2015), based on an improved recognition of own behavioral patterns (Bateson 1979). Nevertheless, organizations create the (digital) work setting (Richter et al. 2018), and digitalization should serve as a tool to help employees focus on innovative work behavior.

6 Conclusions

Intelligent ways to structure information are required, with a smart use of information processing systems, changes in training and a focus on designing an information culture that will ensure access to and availability of the necessary information for those requiring it, and allowing for enough slack (Marlin and Geiger 2015) to increase the likelihood for analysis, creativity and innovation. For that, specific tasks in managing digitalization, innovation, resources, and culture are imperative.

Digitalization management requires the definition of the goals of digitalization together with a check for potential unintended effects. Innovation management needs to clearly state the organizations position towards intrapreneurship (and necessity of innovation) plus the desired types of innovation, and to align the intrapreneurship strategy. Resource management has to analyze and benchmark the workload (Meijman and Mulder 1998), ensure information access and slack (Damanpour 1991), and provide the resources needed for creativity to the right people (i.e. Damanpour 1991). Our results indicate that the workload is too high in the sample studied, which may be the major reason why the extended availability was not reduced even though the respondents realized its extent. Based on this study, assessing the workload and the degree of overcommitment are the first steps in determining if action is called for. Then, the organizational culture and its explicit and implicit values and messages regarding detachment require attention. Working on the organizational culture is crucial in case there is reluctance towards detachment. Should detachment be officially promoted, its feasibility needs to be checked and if necessary worked on.

Digitization (Brennen and Kreiss 2016) can be used as a facilitating tool: automatizing work aspects that do not require creativity safe time and create free cognitive space. Culture management is responsible for safeguarding a positive climate towards innovative work behavior (Lukes and Stephan 2017), promoting the segmentation norm and protecting the alignment of espoused theory and theory in use (Argyris 1995). Put differently, organizations desiring innovative work behavior

should reassess their orientation versus intrapreneurship, mainly regarding resource allocation (Wolcott and Lippitz 2007), and reflect on the four determinants of behavior (and behavioral change) in organizations: individual (a) capabilities and knowledge plus (b) motivation (Comelli and Rosenstiel 2003), plus situational (c) social authorization and (d) resource availability. Experts can be expected to possess the necessary prerequisites for innovative work behavior, but need to be given the necessary resources, and among these also the feasible possibility to detach.

Also, employees themselves on all levels have the responsibility to create their boundaries and structures (Rexroth et al. 2014; Voß 1998) dependent on their personal requirements, which can differ with respect to life phases (Ulich and Wiese 2011). Distractions like role conflicts should be kept at a minimum, and in total the goal should be an individual balance that is felt to be positive based on an adequate fulfilment of expectations and needs in the life-domains. For the individual, the permeability between the life domains is perceived as positive or negative depending on personal choice within those areas, the degree of identification with the domains, and their similarity (Clark 2000).

There are some limitations of the study. The data is self-reported, mainly cross-sectional data. Total workload could not be objectively measured, but via employing a mixed methods design with a questionnaire and a diary study (Ohly et al. 2010), a better approximation was possible. Also, there may be a self-selection bias. Moreover, in order to create a diverse sample and robust data, our study was conducted in several organizations, which are all innovation driven, and stepwise. Nevertheless, there might be differences between professions and sectors that only become visible in a larger scale investigation testing all hypotheses at once. Further research requirements also include a scale adjustment for idea generation as this is not yet applicable for scientific professions—idea generation per se can be an innovation in this context without the need of commercialization, plus a clarification of the overlaps in the constructs detachment and overcommitment and studies linking various aspects of recovery experiences to innovative work behavior. In addition, team or group based innovative work behavior in the context of extended availability and recovery requires investigation.

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