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Interdisciplinarity and communication across research employing different methods under the loupe: A bibliometric examination of the literature on boundary-crossing ICT use

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ABSTRACT

In this article, we present a bibliometric analysis of studies examining the consequences of boundary-crossing information communication technology (ICT) use, e.g., the use of ICT to conduct tasks across the work and family domains. We explore main contributors, disciplines, and topics of focus, as well as knowledge gaps, and lines of communication within this interdisciplinary field. Our aim is to explore knowledge production and knowledge exchange across disciplines and research employing different methods. Our findings reveal two clusters of publications: an interdisciplinary cluster, and a cluster dominated by organizational psychology, organizational science, and human resource management. Furthermore, our findings show that despite overlapping topics, qualitative and quantitative studies primary rely on two different bodies of literature. We argue that more communication across research employing different methods and a greater variety of disciplines is needed to advance the research on boundary-crossing ICT use.

Introduction

Today, the use of technological devices such as smartphones, tablets, smart watches, and laptops continue to blur the boundaries between work and life domains. These devices allow employees to stay connected to the workplace, as well as their family and friends, from anywhere and at any time (Adisa, Gbadamosi, and Osabutey 2017; Demerouti et al. 2014; Fenner and Renn 2004; Mazmanian, Orlikowski, and Yates 2013; Valcour and Hunter 2005).

The opportunity to stay connected across the work and home domains has spurred concerns about its consequences for work, health, and home life – giving rise to a growing research centered on these concerns. From the early 1990s, studies have addressed the potential consequences of after-hours telecommuting for the family and work environment (Duxbury, Higgins, and Mills 1992; Duxbury, Higgins, and Thomas 1996). As portable technology has advanced, the research field has grown to encompass topics such as cross-domain information communication technology (ICT) use (Olson-Buchanan, Boswell, and Morgan 2016; Tennakoon 2018), Technology-Assisted Supplemental

Work (TASW) (Eichberger, Derks, and Zacher 2022; Fenner and Renn 2010), off-work hours Technology Assisted Job Demand (off-TAJD) (Ghislieri et al. 2017; Ghislieri et al. 2022), work-related smartphone use and work connectivity behavior after-hours (Derks, Bakker, and Gorgievski 2021; Derks, Van Mierlo, and Schmitz 2014; Duxbury et al. 2014), non-work social media use at work (Farivar and Richardson 2021; Wushe and Shenje 2019) and cyberloafing (Andel et al. 2019).

We will use the overarching term boundary-crossing ICT use, which is a technology- and time neutral concept, to provide an overview of studies examining the intersection of work, family, and technology. We define it as conduct of work-related activities from home, outside of normal working hours, or conduct of non-work activities during normal working hours. Here the individual is physically located in one role's domain (e.g., family) while behaviorally involved in another role (e.g., work) (Ashforth, Kreiner, and Fugate 2000). With the COVID-19 pandemic, boundary-crossing ICT use by employees has become even more salient (Ghislieri et al. 2022; Tedone 2022).

The research on boundary-crossing ICT use is expanding rapidly, the field lacks a systematic

overview of the research on consequences of boundary-crossing ICT use. To address this shortfall, in the current article we conduct a bibliometric analysis of studies examining the consequences of boundary-crossing ICT use. We use metadata from the included publications to provide an overview of the field. Our bibliometric analysis not only provides insight into the topics covered, but also the lines of communication between researchers within the field. Mapping how the knowledge is clustered in terms of researchers, disciplines, and methods lays the ground for future knowledge production on boundary-crossing ICT use.

We focus on ICT use for work purposes outside the work office and outside workhours, and ICT use for private purposes at the office during work hours. In other words, our focus is not teleworking as such, but boundary-crossing ICT use as behaviors that crosses the work and home/family boundaries in both time and place.

Why an interdisciplinary, cross-methods, systematic mapping of the field?

Researchers have argued that problems related to complex phenomena, in our case boundary-crossing ICT use, require interdisciplinary solutions (Petrie 1976). Boundary-crossing ICT use calls for the active integration of aspects of work, home/family, and digital technology. As such the field on boundary-crossing ICT use research is interdisciplinary in nature and requires attention to aspects of individuals (e.g., health and restitution), their relationships to other actors (e.g., colleagues, supervisor, and family members); the context (e.g., the home, the office, the organization, and the country); and digital technologies (both different devices and software). Correspondingly, the research taps into disciplines such as psychology, sociology, human relations/management science, and technology studies using both qualitative and quantitative methodologies.

In interdisciplinary research scientists combine resources from different fields to address problems that cannot be addressed adequately within one individual field. Combining perspectives from different fields may enable the development of new hypotheses, data, concepts, and theoretical frameworks (Andersen 2016). Different disciplines are informed by different epistemologies, meaning they have different conceptions of what constitutes knowledge, how it is produced, and how it should be applied (Rescher 2003). Hence, multidisciplinary, interdisciplinary, and transdisciplinary research produces multifarious scientific and local

knowledge that can contribute to more thorough understandings of complex phenomena (Miller et al. 2008). As boundary-crossing ICT research taps into several disciplines, there is a huge need for synthesizing previous research with an interdisciplinary perspective. Yet, no one has provided an interdisciplinary systematic mapping of boundary-crossing ICT use.

Furthermore, scholars have argued that communicating across research employing different methods is of value. The qualitative and quantitative methodological approaches differ in data collection, research questions, goals, practices, etc.; often they even have different philosophical foundations (Johnson, Onwuegbuzie, and Turner 2007; Mahoney and Goertz 2006; Plano Clark and Creswell 2008; Tashakkori and Creswell 2007). Communicating across research employing different methodologies is fruitful for generating new research questions, and for providing more complete understanding of the phenomenon of interest (Johnson, Onwuegbuzie, and Turner 2007; O'Cathain, Murphy, and Nicholl 2007; Tashakkori and Creswell 2007). To our knowledge, no one has mapped communication across research employing different methods on boundary-crossing ICT use. In the current bibliometric analysis, we will investigate whether studies using qualitative and quantitative methods within the field use each other's work, how the research front appears when we examine qualitative and quantitative studies, and discuss the implications of our findings on communication across research employing different methods.

The research questions in the current bibliometric review are: What can the number of publications per year tell us about how the field has developed over time? What are the most common topics within the literature examining the consequences of boundary-crossing ICT use? What are the most influential publications in the field? Which disciplines have examined the consequences of boundary-crossing ICT use, and with which methods? To which extent is do disciplines and research employing different methods communicate which each other?

Materials and methods

The current study is a bibliometric analysis of 154 peer-reviewed publications reporting empirical studies on the consequences of boundary-crossing ICT use. The included studies were selected on the basis of a systematic literature search conducted for a scoping review of the field of boundary-crossing ICT use (Nilsen et al. 2024).

Search and screening

The search process is registered with International Prospective Register of Systematic Reviews (PROSPERO) (Drange et al. 2020). It employs the PICO[1] framework (Schardt et al. 2007).

A broad search was conducted on boundary-crossing ICT use. As various concepts are used to discuss boundary-crossing ICT practices, the initial systematic literature search was broadly cast to capture various forms of boundary-crossing ICT use, using search terms such as cross-domain ICT use, Technology-Assisted Supplemental Work (TASW), inter connectivity, new ways of working, evening work, outside work hours, flextime, cross-domain, technoference, boundaries, and connectedness. The search yielded 17388 abstracts. All abstracts were screened by two researchers independently of each other, using the online screening tool Covidence (www.covidence.org). To be included for full-text screening, the publication had to address: (1) the use of technologies to conduct work-related tasks when at home or in leisure time, or (2) conduct family/home-related tasks when at work. This meant that studies of telework were only included if they addressed boundary blurring ICT activities. The included articles also had to report empirical data exploring the association between boundary-crossing ICT use and outcomes. Of the 17388 abstracts, 399 were included for full-text screening. These were also screened by two researchers. After the screening process, 159 publications were assessed as relevant. The current article uses metadata in combination with manual extraction and coding of study designs (qualitative, quantitative, and mixed-methods) and the country in which the study was conducted to provide an overview of the research. In the manual coding process, one researcher extracted information from the studies, and this extracted information was checked by a second researcher.

We include 154 of the 159 prescreened scholarly articles, as they were included in two major databases for social science research that provide rich metadata, which can be analyzed using R's Bibliometrix package: Scopus and Web of Science (WoS). These databases have comprehensive and long-term registrations and indexes high quality research in from peer-reviewed journals worldwide. Hence, the databases have sufficient information to decipher patterns in the literature and provide an overview of the current research field. We harvested all data on the consequence of boundary-crossing ICT use up to January 31, 2022[2].

Bibliometric analysis

Bibliometrics is a methodology wherein statistical measurements are used for understanding and organizing a body of literature based on bibliographic metadata. This approach is fruitful for identifying the knowledge base of a topic or research field and its intellectual structure (Donthu et al. 2021; Ellegaard and Wallin 2015).

We used R's Bibliometrix package to construct a bibliographic data file from the Scopus and WoS references, and the app Biblioshiny (Aria and Cuccurullo 2017) to perform a bibliometric analysis of bibliographic metadata, i.e., authors' names, publications' titles, keywords, citations and co-citations, mapping:

1. Annual paper production
2. Country specific production
3. Methodological approach
4. Central topics, based on KeyWords Plus
5. Most influential publications
6. Leading journals and disciplines
7. Based on co-citation data, explored the lines of communication between the publications within the field
8. Based on separate analyses of publications using qualitative and quantitative methods, explored the lines of communications across research employing different methods, by mapping similarities and differences in:
   a. Co-cited publications
   b. Topics (KeyWords Plus)

A key field of interest in our bibliographic analysis was whether researchers using qualitative and quantitative methods read and cite the same literature, or if these strands of literature develop in parallel with limited cross-communication. Because the WoS and Scopus entries do not contain information about research methods, we used the manual extraction and coding of study designs (qualitative, quantitative and mixed methods) to divide the papers into two data files for qualitative and quantitative research methods and conducted analyses on these sub-sets. The purpose was to investigate if the two datasets have different focus and structures.

Results

General characteristics of the included studies

Table 1 displays the number of annual publications, 1992-2022. Most of the publications (90%) date from between 2010 and 2021, increasing per year.

Studies were categorized into seven country regions, North America, Europe, Oceania, South Asia, Middle East, Latin America, and Africa. Most publications originate from North America ($n = 54$), other regions in descending order are Europe ($n = 51$), Asia ($n = 24$); Oceania ($n = 8$), Africa (5), and Latin America (2) as well as other categories: multiple regions (5) and missing (6). Table 2

In the 154 included publications, there are 160 different methodological approaches. One hundred and forty eight publications report data from one study, whereas six studies report from two studies. Of the 160 research designs, most research designs were quantitative ($n = 111$), the others were qualitative ($n = 46$) and mixed-method ($n = 3$). Of the 154 included publications, three publications report mixed-methods data, 105 publications report quantitative data, and 45 publications report qualitative data. Because one publication included one quantitative and one qualitative design that were not mixed methods, we have one doublet publication in our quantitative and qualitative subset. Hence, these two subsets contain 106 and 46 studies, respectively.[3] Table 3 displays the distribution according to research methods and primary data source.

Most common topics

To map the most common topics in the literature on boundary-crossing ICT use, we conducted an analysis of the most frequent keywords in the included studies. We used WoS' KeyWords Plus, which are the most frequently used words or phrases in the titles of an article's references but not in the title of the article itself, generated by Clarivate's algorithm. KeyWords Plus are fruitful for investigating the knowledge structure of scientific fields (Zhang et al. 2016). We used binary counting, which means we did not count the number of times a term occurred in each publication, but only the presence or the absence of the term (Saltkjel et al. 2023). Figure 1 shows the most common topics used in the included studies, and how often these occur in relation to each other. The most common topics are smartphone use, psychological detachment, time, [work-]family conflict, and technology.

Most influential publications: Citation analysis

Counting the number of times a publication has been cited is a widely used method to map its influence, as the number of citations gives an indication of the importance of the publication (Goyal and Kumar 2021; Tsay 2009). Hence, we used citation analysis, counting the number of times each publication had been cited, to map the field. We counted both *local citations*, i.e., the number of times an included publication had been cited by other publications included

Table 1. Number of annual publications, 1992-2022.

Year	Frequency	Percent	Cumulative percent
1992	1	1 %	1 %
1996	1	1 %	1 %
2003	2	1 %	3 %
2005	1	1 %	3 %
2006	2	1 %	5 %
2007	2	1 %	6 %
2008	1	1 %	6 %
2009	1	1 %	7 %
2010	5	3 %	10 %
2011	4	3 %	13 %
2012	3	2 %	15 %
2013	11	7 %	22 %
2014	13	8 %	31 %
2015	9	6 %	36 %
2016	9	6 %	42 %
2017	9	6 %	48 %
2018	20	13 %	61 %
2019	17	11 %	72 %
2020	12	8 %	80 %
2021	26	17 %	97 %
2022	5	3 %	100 %
Total	154	100 %	

Table 2. Distribution according to country region.

Sample country	Frequency	Percent	Cumulative percent
North America	8	5%	5%
Europe	51	33%	38%
Asia	23	15%	53%
Africa	59	38%	92%
Latin America	2	1%	93%
Multiple regions	5	3%	96%
Missing	6	4%	100%
Total	154	100%	

Table 3. Distribution according to research methods and primary data source.

Methodology	Primary data type	Frequency	Percent	Cumulative percent
Mixed methods ($n = 3$)	Questionnaire/ interviews	3	100	100
Qualitative study ($n = 46$)	Focus group	1	2%	2%
	Individual interviews	40	87%	89%
	Observations	1	2%	91%
	Diary	1	2%	93%
	Questionnaire	2	4%	98%
	Social media/ online data	1	2%	100%
Quantitative study ($n = 111$)	Questionnaire survey	110	99%	99%
	Registry data	1	1%	100%
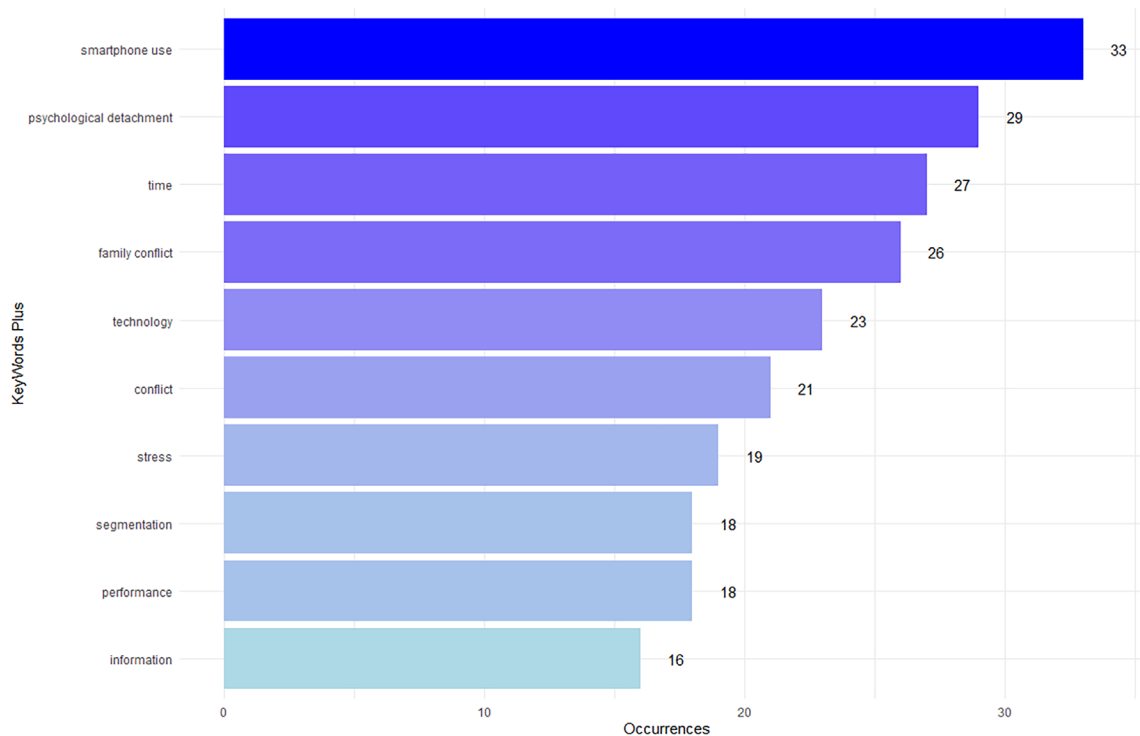
Figure 1. Most common topics as per KeyWords Plus.

in the analyzed publications, and *global citations*, i.e., the number of times an included publication had been cited by other publications contained in the entire database (WoS or Scopus) (Aria and Cuccurullo 2017). We did this to assess: (1) which publications have a high number of local citations and are influential within the analyzed collection of literature on boundary-crossing ICT use, and (2) which publications have a large number of global citations and have received interest from the whole bibliographic database, i.e., from other areas of study (Aria and Cuccurullo 2017; Goyal and Kumar 2021).

The publication with the most local citations is Boswell and Olson-Buchanan (2007) (see Figure 2). This publication is also among the publications with the most global citations (see Figure 3). The publication with the most global citations is Mazmanian, Orlikowski, and Yates (2013). This publication examines a more general trend of blurring spatial and temporal borders. Hence, while it is also a central publication among the included publications on boundary-crossing ICT use, it has greater spill over to other fields of study.

Leading journals and disciplines

Next, we examine which journals are most common publication outlets, and thus also within which disciplines the research is conducted. We supply this analysis with a co-citation analysis, further exploring patterns in leading journals and disciplines in the field.

The leading journal, i.e., where the largest number of the included studies have been published, is *Computers in Human Behavior* (see Figure 4). Half of the leading journals have a psychological emphasis (organizational psychology, organizational science, and management): *Computers in Human Behavior* (psychology and psychiatry), *Frontiers in Psychology* (psychology), *The Journal of Occupational and Organizational Psychology* (psychology, interdisciplinary), *Stress and Health* (psychology, psychophysiology, clinical medicine) and *The Journal of Occupational Health Psychology* (psychology, interdisciplinary).

The other half are interdisciplinary social science journals: *Human Relations* (interdisciplinary studies of social relationships at and around work), *Information, Communication and Society* (social sciences, gender and cultural studies, communication and media studies, information, and computer sciences). *The Journal of Vocational Behavior* (interdisciplinary studies of career choice, career development, and work adjustment across the lifespan), *Mediterranean Journal of Social Sciences* (i.e., economics, sociology, psychology, anthropology, communication studies, law, cultural studies, political studies, and development studies). Only *New Technology Work and Employment* has a sociological basis of study.
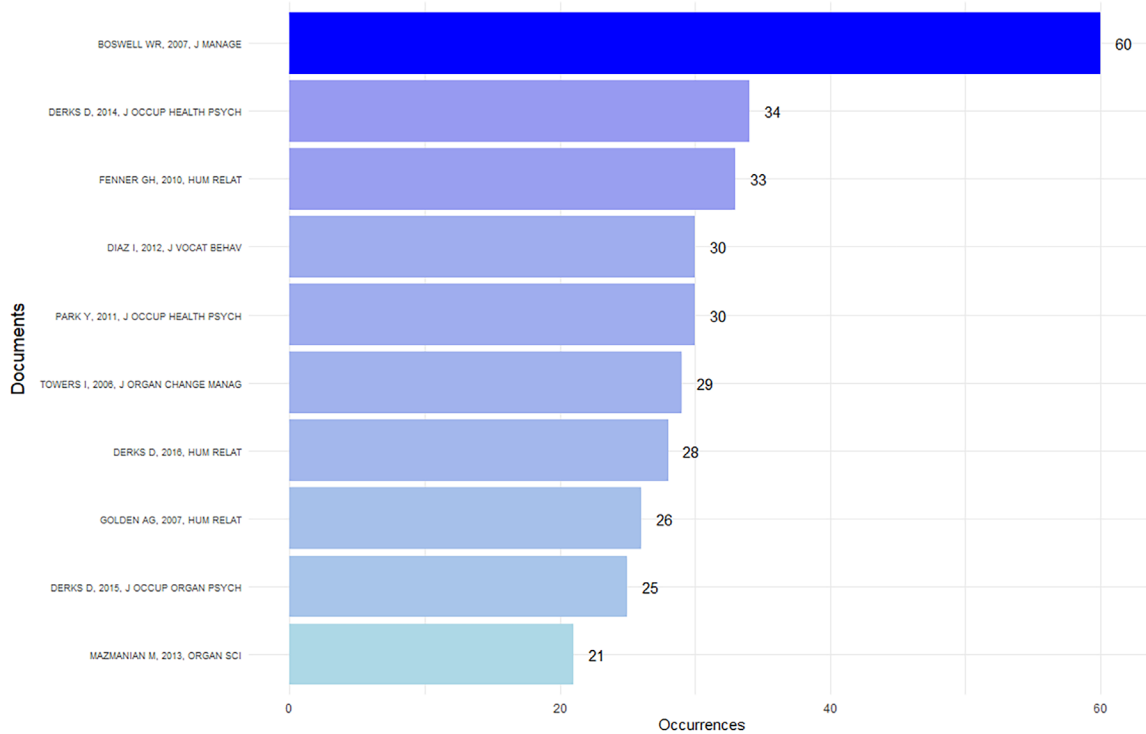
Figure 2. Publications with the most local citations.
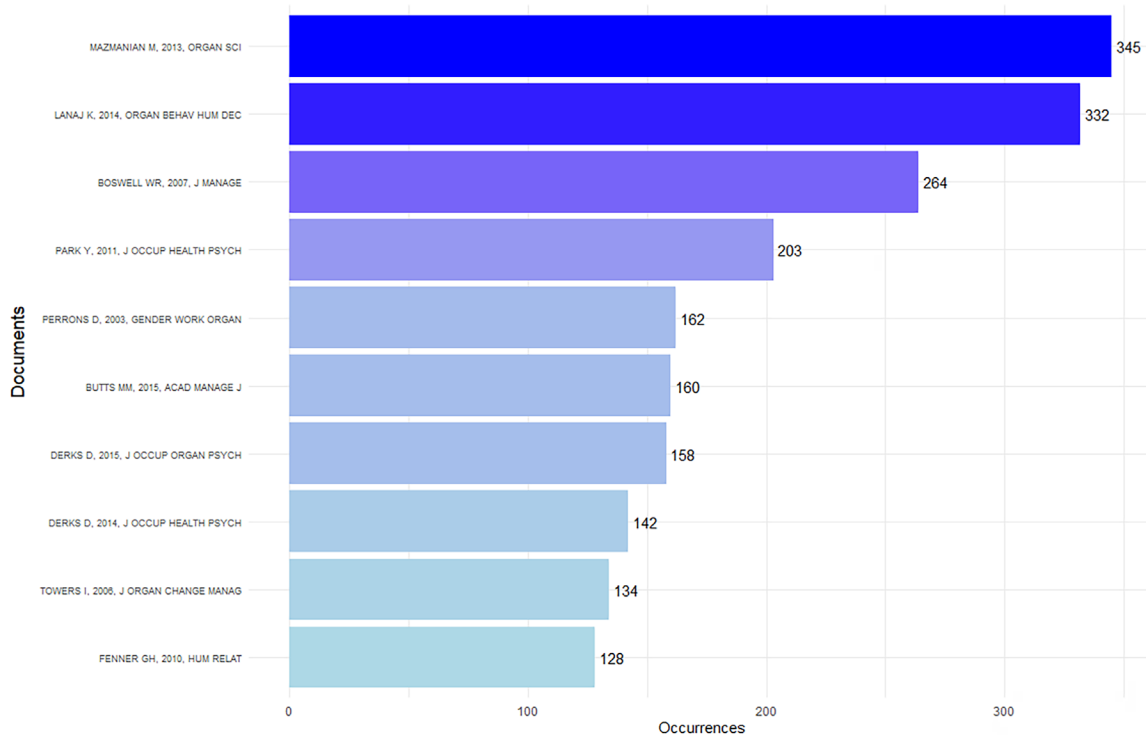
Figure 3. Publications with the most global citations.

However, as it also has an interdisciplinary scope, it could be grouped with the other interdisciplinary journals. Among the leading journals, the discipline that dominates is that of psychology.

Network analysis: Interdisciplinarity

To explore citations across disciplines, we performed a co-citation analysis, e.g., two authors, publications or journals are both cited in a third publication.
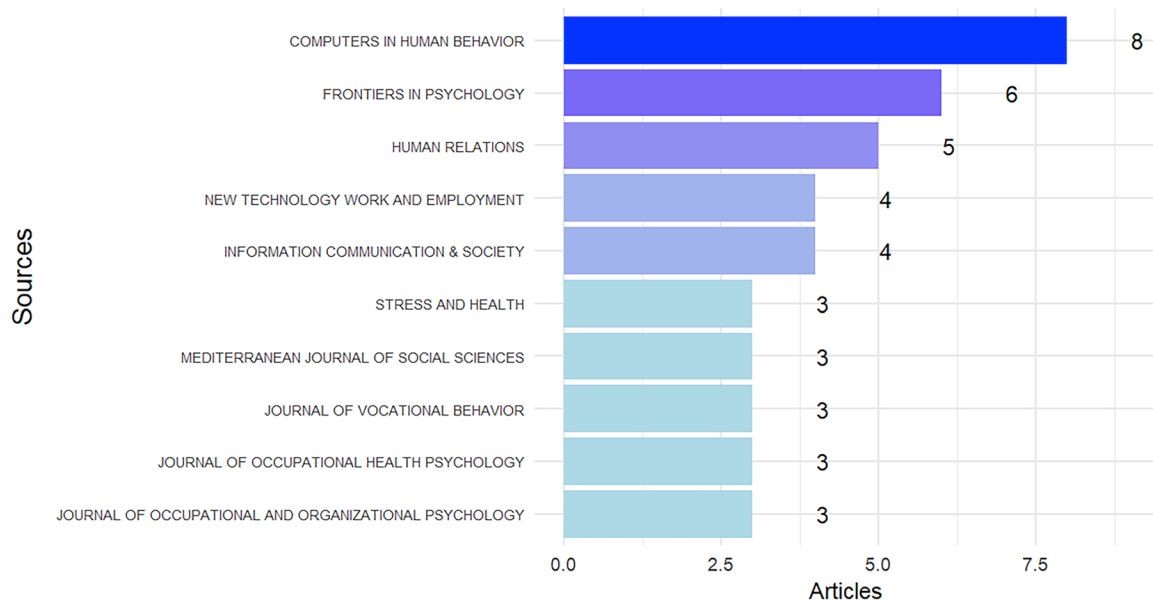
Figure 4. Leading journals.

Small (1973) showed how co-citation is a measure that reflects the existence of direct citation links, hence corresponding to significant intellectual connections within a research field. Because frequently cited publications represent key ideas in a field, co-citation patterns are used to map out the relationship between key ideas in a field. Co-citation analysis is widely used in a bibliometric analysis for exploring the intellectual structure or knowledge base of a field of research, as a measure of similarity amongst the citing authors, publications, and journals (Aria and Cuccurullo 2017; García-Lillo, Úbeda-García, and Marco-Lajara 2016; Goyal and Kumar 2021). Co-citation data on citing journals allowed us to explore the network of communication between the publications within the field. We created network maps for key journals based on which journals that were co-cited by the included studies.

Interpreting Figure 5, we need to pay attention to the strength of relationships (links), the centrality/peripherality of each journal (position) as well as the relative volume of citations, as these factors provide information about the centrality of and relationship between the journals. The larger the bubble, the higher the number of citations. Importantly, proximity between two nodes corresponds to shared substance: the larger the proportion of articles that consider them together, the closers the nodes are. Conversely, they are distant from each other if only a small fraction of articles cite them together (Aria and Cuccurullo 2017).

We draw two insights from the co-citation map (see Figure 5). Firstly, as the network map shows, there are two clusters of co-citation. The bottom cluster is dominated by publications from journals from the field of organizational psychology, mixed with organizational science, human resource management, and occupational health. The most central journals/disciplines in the bottom cluster are, judging by centrality and bubble size, *Journal of Applied Psychology* (psychology), *Journal of Management* (organizational science/management) and *Journal of Occupational Health Psychology* (psychology).

The top cluster mainly comprises interdisciplinary-oriented journals from a broad range of social sciences, including sociology, human relations, organizational science, management, as well as psychology. Judging from centrality and bubble size, the most central journals in the top cluster are *Academy of Management Review* (interdisciplinary), *Human Relations* (interdisciplinary) and *Journal of Organizational Behavior* (organizational science).

The network clusters correspond with the findings that the leading journals fall in two distinct clusters – psychology and interdisciplinary studies (Figure 4). Additionally, the network analysis shows connections between several sources across the two distinct clusters, implying that they are not mutually exclusive.

Secondly, the network analysis reveals that while interdisciplinary approaches are common within the field, while psychological studies dominate. In comparison, technology and sociological journals are more peripheral.
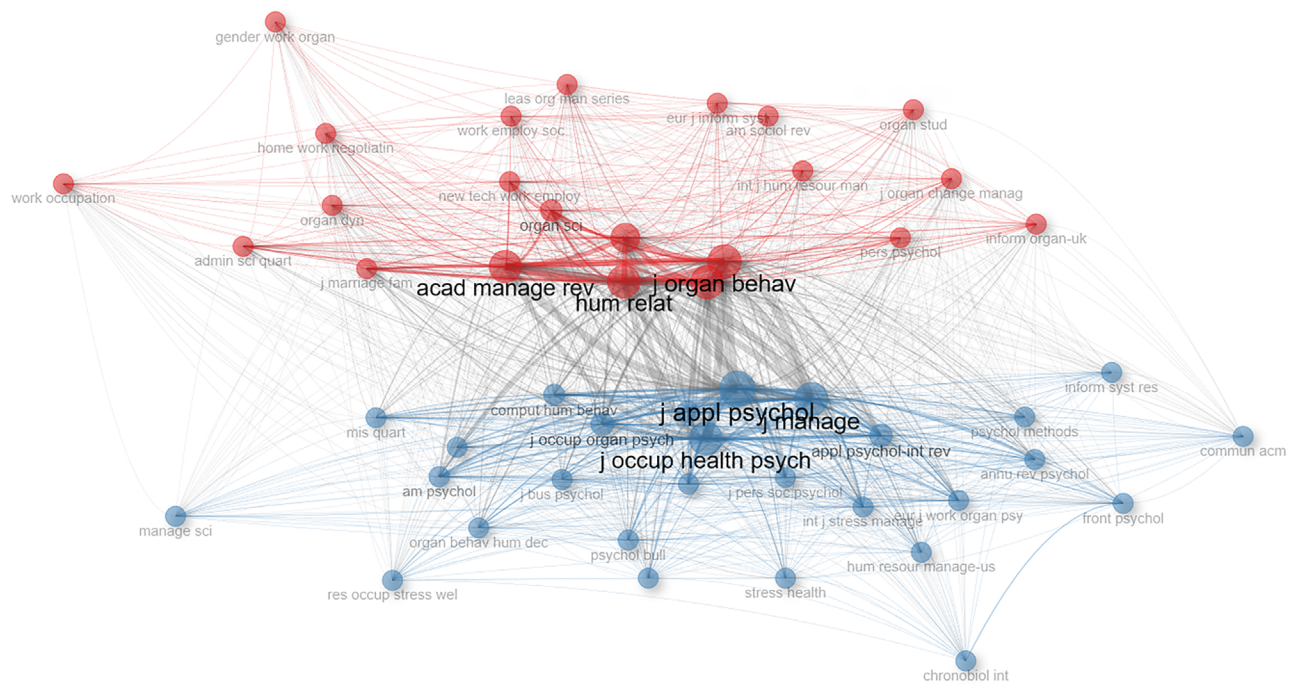
Figure 5. Co-Citation network of journals/disciplines.

To further explore the knowledge structure of the field, and to explore what topics are central within different clusters of knowledge, we divided the dataset in two according to: (1) qualitative, and (2) quantitative research methods.

Qualitative and quantitative methods: Similarities and differences in co-citations and focus

We conducted a citation analysis for the qualitative and quantitative articles in our sample – to examine patterns of citations across research employing these methodological approaches. The mixed methods articles ($n = 3$) were excluded from this analysis because they did not fit in either category. We explored the network of communications across research employing qualitative and quantitative methodologies, by mapping the most cited authors (disciplines) and common keywords in the qualitative and quantitative datasets, respectively.

Figure 6 maps out the broader body of literature which the qualitative dataset draws on, based on which authors are frequently co-cited within the dataset. Co-citation network of the qualitative dataset ($n = 46$ studies) reveals four clusters of networks (Figure 6). Based on size and centrality within each cluster, these are **Golden** (qualitative) (Golden and Geisler 2007), **Wajcman** (qualitative and quantitative) (Wajcman, Bittman, and Brown 2008; Wajcman and

Rose 2011)[4], **Mazmanian** (qualitative) (Mazmanian, Orlikowski, and Yates 2013), **Chesley** (quantitative) (Chesley 2005), **Boswell** (quantitative) (Boswell and Olson-Buchanan 2007), **Kreiner** (qualitative) (Kreiner, Hollensbe, and Sheep 2009)[5], **Clark** (qualitative) (Clark 2000), **Ashforth** (conceptual) (Ashforth, Kreiner, and Fugate 2000), **Nippert-Eng** (qualitative) (Nippert-Eng, 1996). Hence, we see that the most influential authors in the qualitative papers to a large degree are qualitative (five authors), but also that two co-cited authors are primarily quantitative, and one has authored both qualitative and quantitative papers.

Co-citation network of the quantitative dataset ($n = 106$ studies) reveals two clusters of networks (Figure 7). The most influential (first-) authors in the figure are highlighted by centrality and size within each cluster. In the first cluster the most central authors in the quantitative dataset are **Derks** (quantitative) (Derks and Bakker 2014; Derks et al. 2014; Derks, van Mierlo, and Schmitz 2014; Derks et al. 2015; Derks et al. 2016), **Sonnentag** (quantitative) (Sonnentag and Fritz 2007)[6], **Bakker** (quantitative and conceptual) (Bakker and Demerouti 2007; Bakker et al. 2007)[7], **Demerouti** (quantitative) (Demerouti et al. 2014)[8], **Park** (conceptual) (Park 2011), **Podsakoff** (Podsakoff et al. 2003).

In the second cluster the most central authors in the quantitative dataset are: **Boswell** (quantitative) (Boswell and Olson-Buchanan 2007), **Greenhaus** (conceptual)
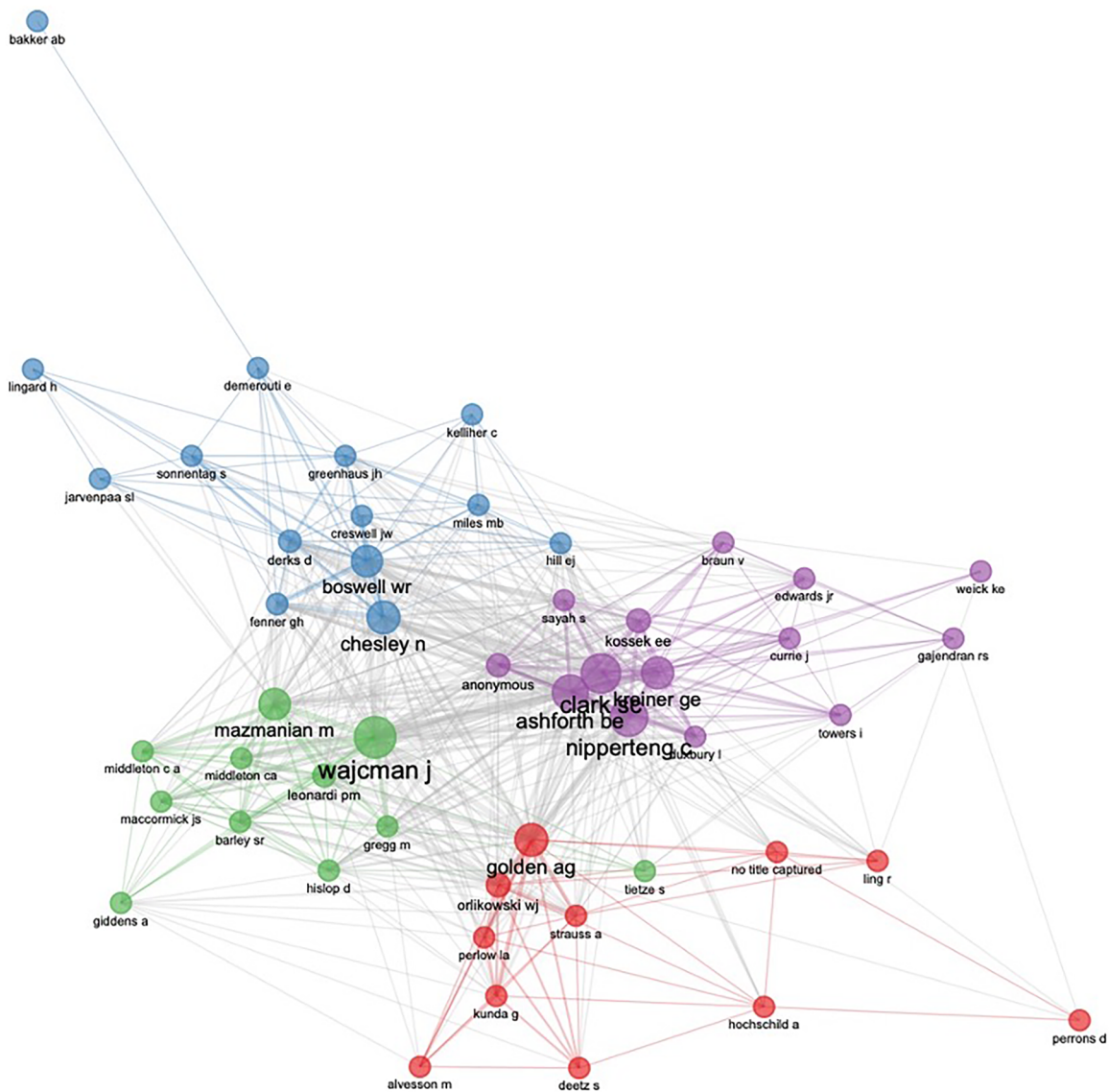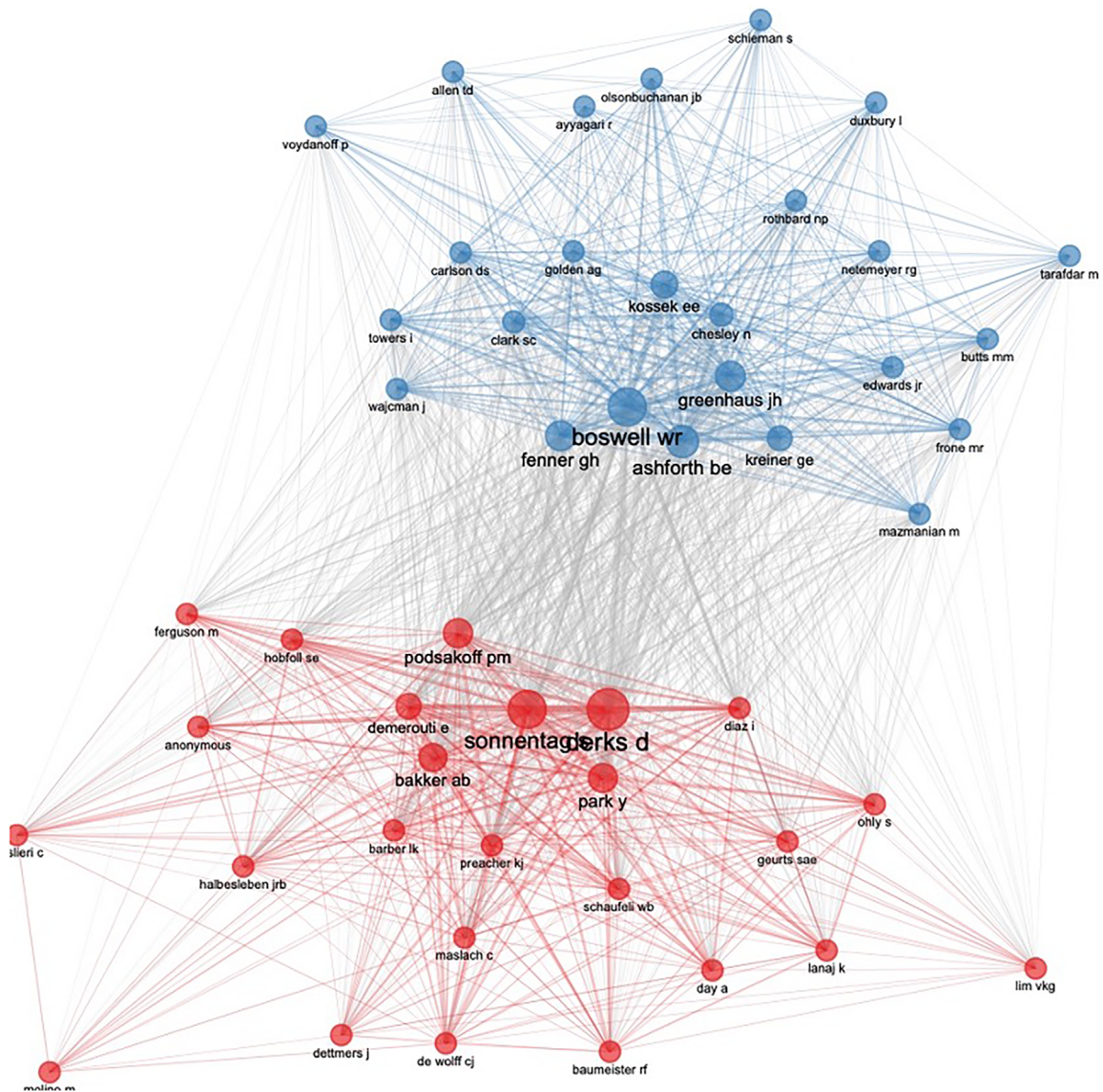
Figure 6. Co-Citation analysis of authors, qualitative dataset (*n* = 46 studies).

(Greenhaus and Beutell 1985), **Kreiner** (qualitative) (Kreiner, Hollensbe, and Sheep 2009)⁹, **Fenner**, (quantitative and conceptual) (Fenner and Renn 2004, 2010), **Ashforth** (conceptual) (Ashforth, Kreiner, and Fugate 2000), and Kossek (quantitative) (Kossek, Lautsch, and Eaton 2006; Kossek et al. 2012).

There is only one qualitative paper (Kreiner 2006) among the most central authors in the second quantitative cluster. Two papers in the second quantitative cluster overlap with the most influential cited authors in the qualitative dataset (Kreiner 2006 and Ashforth, Kreiner, and Fugate 2000), while there was no overlap between methods in the most central authors in the first quantitative cluster. The qualitative and qualitative studies mostly rely on different bodies of literature, dominated (naturally) by qualitative studies and by quantitative studies, respectively.

The differences in the bodies of literature that are cited in the two datasets are interesting from a starting point where the number of citations give an indication of the influence of the publication (Goyal and Kumar 2021; Tsay 2009). The difference suggests that the methodological approach of research is central for which body of literature a researcher will draw on, depending on their own methodological approach. The difference may partly be explained by practical, methodological reasons, such as the fact that Boswell and Olson-Buchanan (2007) and Derks and Bakker (2014) have developed instruments for measuring work-related ICT- and smartphone use after work hours, that are frequently used by other researchers. Also, using the same design as another study in the field means that it should be cited. Another explanation may be that qualitative and quantitative studies

Figure 7. Co-Citation analysis of authors, quantitative dataset (*n* = 106 studies).

simply investigate different topics within the field of boundary-crossing ICT use, and therefore cite different sources.

However, there is some overlap between the two datasets. Of the 50 authors in Figures 6 and 7, respectively, 12 authors overlap. Judging from the size and centrality in both Figures 6 and 7, we see that Boswell, Ashforth, and Kreiner, are central references for both qualitative and quantitative studies. The centrality of the other nine overlapping references differs in the two datasets. There is more overlap between the cited sources of the qualitative dataset and cluster 2 in the quantitative dataset, i.e., the "Boswell cluster", than cluster 1 in the quantitative dataset, i.e., the "Derks cluster". This difference between the clusters may be given some weight as the quantitative dataset is larger than the qualitative dataset, with 106

included sources. The difference supports the argument that some topics are more often explored with qualitative and quantitative methods. To investigate whether the qualitative and quantitative publications investigate different topics, we explored the most frequent keywords in the qualitative and quantitative datasets, respectively. We use KeyWords Plus in this analysis.

From Figure 8 and Figure 9, we can see that the qualitative and quantitative studies examine similar or related topics, i.e., topics such as technologies, smartphone use, family, conflict, balance, boundaries, management, and segmentation. Meanwhile, although the qualitative and quantitative studies focus on similar topics, they go in slightly different directions, such as segmentation/boundaries, impact/consequences, or family/conflict/family. Furthermore, the
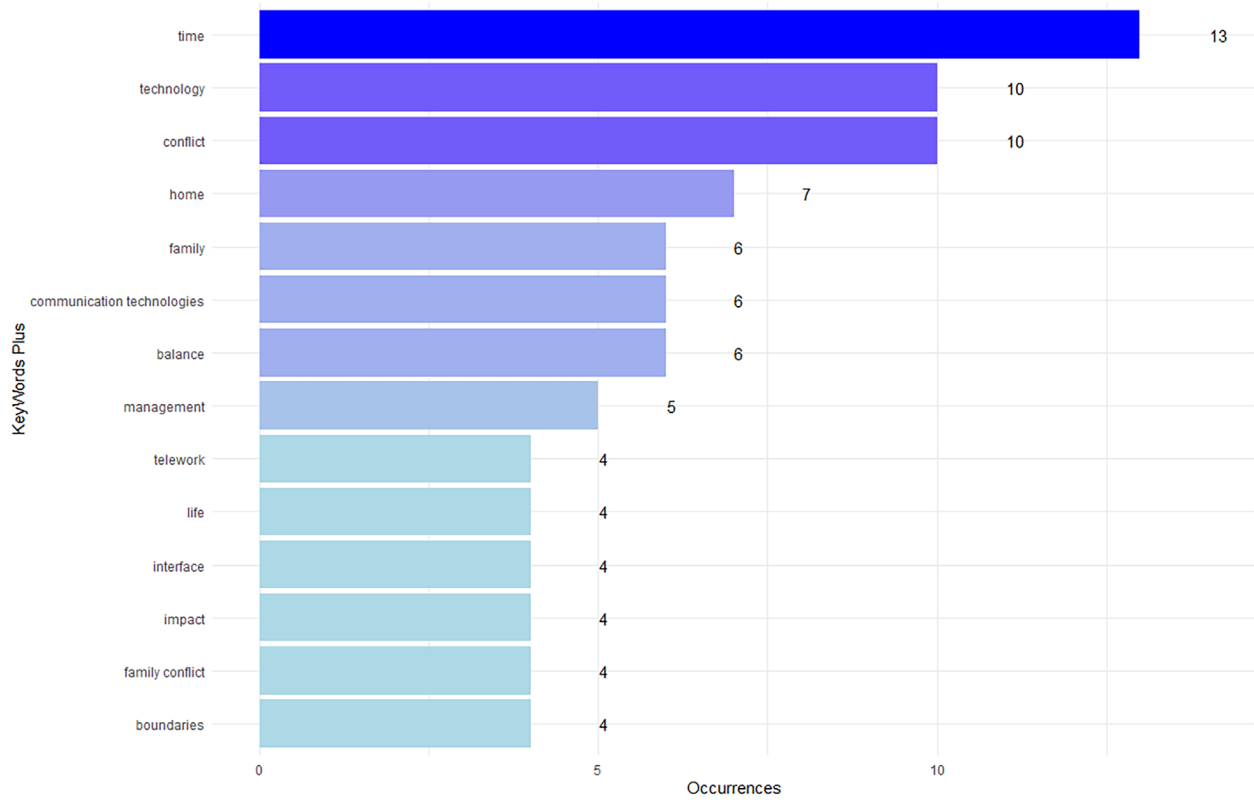
Figure 8. Common KeyWords Plus words, qualitative dataset.
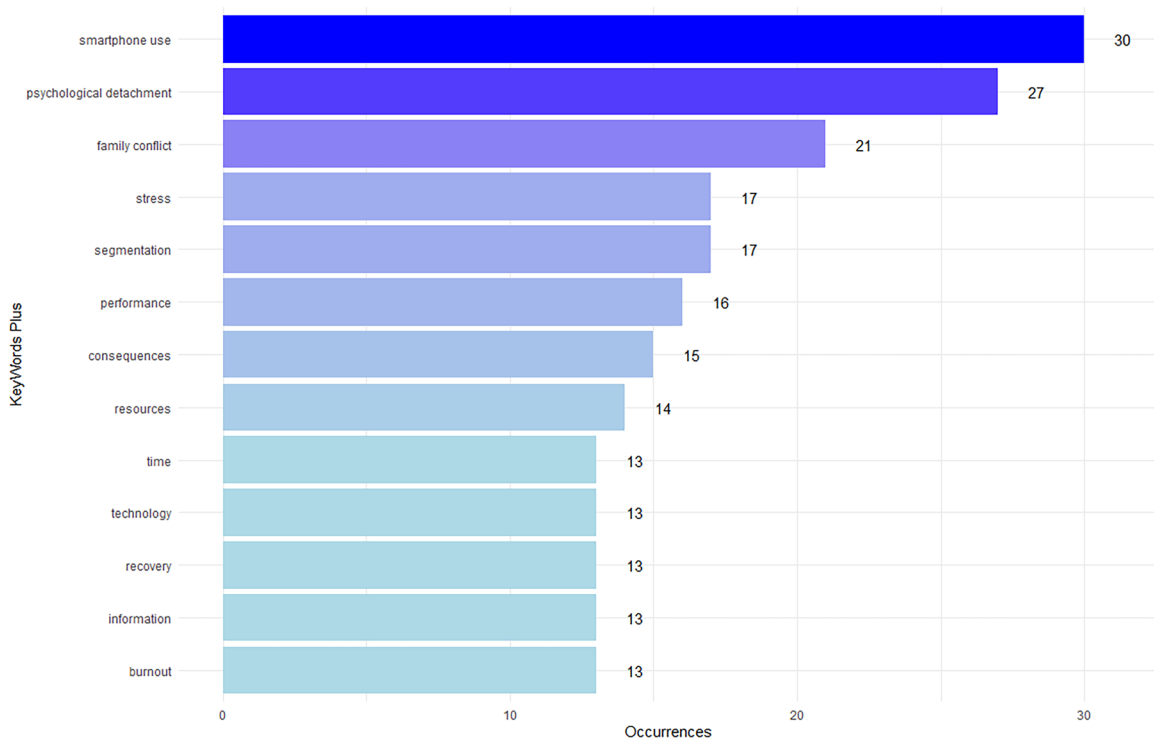

Figure 9. Common KeyWords Plus words, quantitative dataset.

qualitative studies, unlike the quantitative studies, explore the topics home and time. Similarly, the quantitative studies, unlike the qualitative studies, explore specific [work]-family outcomes such as recovery and stress. However, the differences between the most common topics in the two datasets are fewer than the similarities. Hence, it is not evident that the qualitative and quantitative datasets should draw on different literatures.

Discussion

In a time where boundary-crossing ICT is expanding rapidly, there is an increasing number of studies examining the consequences of everyday boundary-crossing ICT use, for concerns such as [work]-family balance or productivity. In the current study, we have mapped central topics, authors, disciplines, and methods in the empirical literature on the outcomes of boundary-crossing ICT use, aiming to identify patterns and knowledge gaps, providing a bibliometric overview of research trends, and identify current gaps and future directions. Below, we will discuss the key patterns and knowledge gaps in boundary-crossing ICT research, also contributing to an epistemological discussion based on our findings on interdisciplinarity and communicating across research employing different methodologies.

Overview: Publications and topics

The 154 included publications published between 1992-2021 are primarily based in the regions of North America and Europe. Moreover, the research on how we work across the work and family domains has had an exponential growth in the last decade, from one to two studies per year in the period from 1992 to 2010, to 21 studies investigating boundary-crossing ICT use in 2021.

The most influential publication in terms of global citations is Mazmanian et al. (2013). This publication has relevance beyond the field of boundary-crossing ICT use as it analyses more general trends of spatial and temporal fragmentation considering ICT. The most influential publication in terms of local citations studies is Boswell and Olson-Buchanan (2007), a key text on boundary-crossing ICT use and work-life conflict.

Several of the most common topics in the literature may be viewed as individual explanatory variables related to border management and the ICT used for border crossing (e.g., smartphone, communication,

technology, boundaries, segmentation), while others may be viewed as consequences of boundary-crossing ICT on the individual level, e.g., [work]-family conflict, stress, performance, psychological detachment. Noticeably the KeyWords Plus words in general relate primarily at an individual or family level. None of them relate to the organizational level or the societal level (e.g., profit, organizational culture, or formal regulations) among the most common ones. The KeyWords Plus words relating to common outcomes in the literature point to three central areas in which boundary-crossing ICT use may impact, the individual's health, well-being, and work-family interface.

A need to supplement individual/psychological perspectives

The most common topics relate to individual, and partly familial, experiences and outcomes. One explanation may lie in the early research on boundary-crossing ICT. While our findings show that there is a broad interdisciplinary focus in the field, we also find that among the leading journals, the largest disciplinary field is organizational psychology. Our findings indicate that organizational psychology would benefit from the integration of knowledge on individual and familial experiences and outcomes, and structural factors. Correspondingly, knowledge on the impact of organizational level or societal level factors could fruitfully supplement insights from studies on the individual and familial level, such as work-family conflict or stress.

We strongly encourage studies from a broader range of disciplines than we see currently. More studies from fields such as labor law, family studies, sociology, information technology, management, business administration, and social psychology could inform our understanding of the complex phenomenon from other angles. In line with the argument that combining perspectives from different fields may aid the creation of new hypotheses, data, concepts, and theoretical frameworks (Andersen 2016), we also encourage researchers on boundary-crossing ICT use to draw on knowledge from other disciplines than their own. This would advance the field by allowing us to integrate knowledge on individual experiences of increased spatial and temporal blurring of boundaries between the work and nonwork spheres brought on by technological advances, in relation to both work-family policies and regulations on organizational and national level.

To add to the scope of individual perspectives, researchers need to look outside their own disciplines

and schools of research. For example, integrating perspectives from law or policy studies with empirical studies originating within psychology, could increase our understanding of barriers and facilitators for policy implementation researchers. Similarly, engaging psychological perspectives on boundary-crossing ICT use with sociological theories on technology and time can be fruitful both for furthering theoretical development and empirical understanding in the field.

Communication across research employing different methods

Similarly, researchers have argued that communication across research employing different methods could advance a research field. For example, researchers have argued that qualitative methods can be used to enhance the development of quantitative instruments and vice versa. Hence, mixing qualitative and quantitative methods could be a way of optimizing the development of instruments by Onwuegbuzie, Bustamante, and Nelson (2010). Our findings suggest that there is little communication across research employing different methods: 106 publications are quantitative, 46 are qualitative, and the remainder are mixed method/experimental research. Meanwhile, we see a pattern where the qualitative and quantitative studies draw on different bodies of literature, although they investigate similar topics.

The different bodies of literature in the qualitative and quantitative datasets, respectively, may express that different disciplines and research traditions use different methods. For example, Alise and Teddlie (2010) find that quantitative methods are prevalent in articles from prestigious journals from "pure" disciplines. They find that quantitative methods are particularly closely associated with psychology, but also with disciplines such as sociology and political science. Furthermore, they argue that qualitative methods are more common within interdisciplinary areas such as social psychology, social anthropology, and cultural studies (Alise and Teddlie 2010).

However, the differences in the qualitative and quantitative datasets may also partly be explained by practical considerations. For example, some cited sources have developed instruments that are often used to measure boundary-crossing ICT, such as Derks and Bakker (2014), Boswell and Olson-Buchanan (2007) and Ghislieri et al. (2017). Nevertheless, our findings give reason to believe that methodological approach influences the literature researchers draw on. While this is not surprising, there is reason to further explore citation practices across research

employing different methods, and to discuss the reasons for this pattern, as well as the implications for knowledge production within a given field of study. Our findings show that there is a need to discuss across research employing different methods on broader terms than mixed methods research projects and look at knowledge production within specific research fields in broad terms. For example, quantitative studies measuring burnout could fruitfully integrate knowledge from qualitative studies which operationalize health in terms of subjective experiences, to gain new insights on the health consequences of boundary crossing ICT use. Similarly, qualitative studies of boundary-crossing ICT use in different work hour cultures, could fruitfully draw on quantitative studies on the quantity and frequency of boundary-crossing ICT use in different populations.

Strengths and limitations

Bibliometrics allow for analyzing an unlimited number of publications. Unlike many bibliometric analyses, which include hundreds of documents, we have included 154 publications. Hence, the analysis lacks some of the benefits of large datasets, such as statistical stability. However, the limitations in the number of included studies are made up for by the thorough search and screening process by which the studies were included, which has enabled us to map the research front on boundary-crossing ICT use. The statistical uncertainty led us to approach the analysis with care. For example, in interpretating the co-citation patterns in the qualitative and quantitative datasets, respectively, we emphasize the differences between the datasets. With a larger number of included studies, we could have drawn firmer conclusions also on the specific co-citation patterns *within* the two datasets. We have analyzed patterns with regards to for example the number of publications, topics, and authors. We have also analyzed patterns with regards to methods and disciplines, providing a roadmap of knowledge structures and communication within the research field which raise epistemological questions that are relevant beyond boundary-crossing ICT. Questions that need to be further explored and discussed.

A great advantage of a bibliometric analyses is the opportunity to analyze a great number of papers in a systematic manner and give an overview of a larger body of research than what would be possible in a narrative review. A drawback of a bibliometrician analyses is that it does not give in-depth knowledge

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on the individual studies included in the review. For more in-depth knowledge a different approach should be applied and a narrower scope than the present review. However, such an approach would not be able to give the same bird's-eye view of the field across disciplines and methods.

Conclusion

From a few papers addressing telecommuting in the early 1990s, the field of boundary-crossing ICT has had an exponential growth parallel to the technological developments such as the introduction of BlackBerries, iPhones, tablets, secure connections to workplace databases, and spike in the uptake of technology adoption during the COVID 19 pandemic. ICT is now become interwoven in the everyday lives of people, used throughout the day. Central topics within the field include smartphones and other information technologies, psychological detachment, [work-]family conflict, stress, performance, and segmentation. The current literature has primarily focused on the consequences of boundary-crossing ICT at the individual and familial level. There is a lack of knowledge about topics addressing boundary-crossing ICT at organizational or societal levels, such as productivity and gender equality. An integration of knowledge from psychological perspectives with perspectives from disciplines such as labor law, economics, technology studies, and sociology would be beneficial for gaining new insights into boundary-crossing ICT.

Co-citation network by journal shows that the field is primarily divided in two clusters. One cluster heavily dominated by organizational psychology journals, mixed with organizational science and management ones. Another cluster dominated by interdisciplinary oriented journals publishing from a range of social science.

The co-citation analysis also shows that the communication within the field is somewhat limited, as the same groups of researchers tend to cluster together. The limited communication within the field is also evident in that qualitative and quantitative studies draw on different bodies of knowledge, despite overlap in most common topics. With limited communication between researchers from different perspectives means we risk that doxic understandings, e.g., understandings which are unquestioned and taken for granted (Vakalopoulos 2023), remain as such rather than being questioned or nuanced. To further the research on boundary-crossing ICT use, it is important that researchers look outside their own disciplinary or methodological scope to developing new research interests and setting up collaborations.

Notes

1. PICO is the acronym for Patient problem, Intervention, Comparison, and Outcome, which researchers beyond clinical settings have abstracted and adopted for literature searches, including systematic reviews.
2. The first search was conducted on January 28, 2020, in Scopus and WoS. A supplementary search was conducted on January 31, 2022, in WoS. We consider this sufficient as we found that WoS covered all the studies which were included in the current study after the first search round in 2020.
3. The one publication that employees two different methodologies are Braukmann et al. (2018).
4. Wajcman (2008) is frequently cited by the included studies. However, Biblioshiny does not provide information about specific papers. Hence, when (first-)authors have published several papers during one year, Biblioshiny does not inform which paper that has been co-cited.
5. Kreiner is also co-cited on one paper from 2006. Of the following relevant papers, (first-)authored by Kreiner in 2006, one is non-empirical/theoretical/conceptual, and one is quantitative: Kreiner (2006) and Kreiner, Hollensbe, and Sheep (2006), respectively.
6. Sonnentag is also co-cited on one paper from 2005 and one from 2015. Of the following relevant papers, (first-) authored by Sonnentag in 2005 and 2015, two are quantitative and one is non-empirical/theoretical/conceptual: Sonnentag and Bayer (2005) and Sonnentag and Fritz (2015), respectively.
7. Bakker (first-)authored several relevant quantitative papers in 2007.
8. Demerouti (first-)authored several relevant quantitative papers in 2014.
9. Please see note # 5.

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