

# Three Generations of Telework

New ICTs and the (R)evolution from  
Home Office to Virtual Office

Conference Paper for the 17<sup>th</sup> ILERA World Congress  
7 to 11 September 2015, Cape Town, South Africa

*Authors:*

*Jon Messenger, ILO/WORKQUALITY, Geneva, Switzerland<sup>1</sup>*  
[messenger@ilo.org](mailto:messenger@ilo.org)

*Lutz Gschwind, Uppsala University, Sweden*  
[lutz.gschwind@gmail.com](mailto:lutz.gschwind@gmail.com)

---

<sup>1</sup> Presenting author.

## Table of Contents

1 Introduction.....	1
2 The three generations of Telework .....	3
2.1 Home Office.....	4
2.2 Mobile Office.....	7
2.3 Virtual Office .....	9
3 New technologies, new concepts? .....	12
3.1 Terms .....	13
3.2 Attributes.....	14
3.3 Conceptual Framework.....	17
3.4 Descriptive Analyses .....	21
4 Direct and indirect effects of Telework .....	24
5. Conclusion .....	27
Bibliography .....	30

## 1 Introduction

In the summer of 2013 Yahoo's CEO Marissa Mayer gave a public interview at the *Twelfth Annual Templeton Lecture for Economic Liberty and Constitution*<sup>2</sup> where she explained why the company decided to abandon its popular 'work from home' policy:

"I had heard from lots of people all over the company, who said 'Hey, the fact that our team is distributed, or the fact that we sometimes have to stop and coordinate with someone from home, causes drag. And so we said that, as a general principle [...], we want people in the office.'

This statement is followed by another note on the topic.

"By the way, it has also gotten taken to sort of hyperbole, in terms of, like, 'Wait! Are you not even allowed to type an e-mail when you are not in the office?' – No, obviously we all do that, we all work from home all the time. But during normal business hours, generally, we want people to be there.'

These two statements describe very succinctly the inner ambiguity of a fast growing multidimensional phenomenon. The idea of working from home with the help of information and communication technologies (ICTs) was promoted by California-based companies like Yahoo already in the 1980s under the term *Telecommuting*, also known as *Telework*. Three decades later, markets are flooded with cheaper, smaller and increasingly connected devices, so-called *New ICTs* like smartphones and tablet computers accompanied by a vast dispersion of the Internet and the World Wide Web. These devices are now enabling employees to stay connected to their colleagues from anyplace at any time. Yet, conceptually the two forms of work, Telework as described in the first statement and the use of New ICTs as described in the second, are not studied or debated in relation to each other. The definition of 'work from

---

<sup>2</sup> Conference video at: [http://fora.tv/2013/05/07/Yahoo\\_CEO\\_Marissa\\_Mayer\\_Remaking\\_An\\_Internet\\_Giant](http://fora.tv/2013/05/07/Yahoo_CEO_Marissa_Mayer_Remaking_An_Internet_Giant) [accessed: 27 January 2015]

home' thus becomes blurred and confusing. Mayer's comments also highlight the changing roles of Telework and the use of New ICTs. In recent years, traditional Telework has faced stagnation (Hjorthol, 2006) or even decline (Brenke, 2014), while the spread of New ICTs has accelerated, especially in emerging economies (ITU, 2014). Furthermore, there is need to understand the effects of both Telework and work with New ICTs on, for example, productivity and work organization, as mentioned by Mayer.

The above example shows that, to study Telework and New ICTs in this context, we need both a broad understanding of the phenomenon's history and a solid conceptual basis that embraces the wide range of potential research approaches and dimensions. Section 2 of this review will focus on literature about Telework and ICTs from its origins in the 1970s up to the most recent publications. The findings of this analysis will then lead to the creation of a conceptual framework of Telework in section 3. The effects of Telework and New ICTs on working time, work-life balance and related issues will be analysed in section 4, based on data from the 5<sup>th</sup> wave of the European Working Conditions Survey (EWCS). Section 5 will conclude.

## 2 The three generations of Telework

The conceptual separation of Telework and New ICTs that was mentioned in the introduction is mirrored in the vast amount of scholarly work on the topic. Firstly, many scholars describe Telework as a predecessor or an early form of work with New ICTs (e.g.: Bailey and Kurland, 2002). Highly flexible “cloud-based” work<sup>3</sup> accessible through smartphones and tablets from basically anywhere on the planet makes “Telework” in the terms of its original understanding sound old-fashioned. It is associated with stationary computers, fixed telephones and fax machines – nothing like the devices used by the ‘digital nomads’<sup>4</sup> of today and tomorrow. The concept of Telework is thus either considered to be antiquated (Anderson et al., 2007; Towers et al., 2006) or not even taken into account (Bittman et al., 2009; Cascio, 2000; Golden and Geisler, 2007; Heijstra and Rafnsdottir, 2010; Jones et al., 2008; Tu et al., 2005; Wajcman et al., 2008).

In a second way, Telework is inserted in a typological order with other work arrangements. Here the emphasis is less on history and more on variety. Telework is perceived as one of many co-existing modes of work like traditional office work, mobile work or virtual work (Di Martino and Wirth, 1990; Golden and Fromen, 2011; Golden et al., 2008; Hill et al., 2010, 2003, 2001; Kurland and Bailey, 1999) or as one type of many, so-called, ‘flexible work schedules’ alongside with part-time work, flexi-time<sup>5</sup> and others (Kossek and Michel, 2011; Stavrou and Kilaniotis, 2010; Stavrou, 2005). Either way, historically or typologically, scholars tend to describe Telework separately from the use of New ICTs. As we will discuss

---

<sup>3</sup> “Cloud computing” means that files and applications are stored in and shared by a network of computers and servers accessible through the Internet (Miller, 2008)

<sup>4</sup> (Makimoto and Manners, 1997)

<sup>5</sup> ‘Flexi-time’ means that employees have the discretion to vary the times they arrive and leave work, within established parameters, to meet their personal needs (Avery and Zabel, 2000).

in more detail in section 3, these approaches tend to neglect the definitional potential of Telework and limit the possibilities of studying its development over time.

In contrast to the perceptions of Telework outlined above, Craipeau (2010) offers a more flexible approach. Telework is described as undergoing an “evolutionary” process. According to the author, ICTs and their advancement are the main contributors to this development. They enable the transformation of what we generally perceive as office work. Personal computers and telephones initiated the relocation of one part of traditional office work away from the employer’s premises and closer to the employees’ homes. With the dispersion of mobile devices like laptops and mobile phones, this part lost its stationary grounds and entered places like trains, subways and cafés. The dispersion of internet access then virtualized work and made it accessible on smaller and more powerful devices like smartphones and tablets. This part of office work is what Craipeau calls “télétravail”. Building on this author’s evolutionary perspective, we will develop our own chronicle of Telework’s evolution over three generations: *Home Office*, *Mobile Office* and *Virtual Office*.

## **2.1 Home Office**

The term “Telework” originates in Jack Nilles’ analysis of the growing information industry in the U.S. State of California and of what the author calls the ‘telecommuting network’ (Nilles, 1975). As the term indicates, the main focus lies on the reduction of commuting time, which was and remains a major issue in the United States, and especially in large metropolitan areas such as Los Angeles. The workplace was relocated entirely or in part outside of the employer’s premises and close to or into the employee’s home to avoid the costly and long hours of commuting from home to work and vice versa. New technologies – namely the coupling of computers and telecommunication tools – enabled such forms of

decentralization. The largest scales of cost reduction were created for the growing information industry, due to its heavy reliance on work in front of computer screens and monitors:

“We anticipate increased use of telecommunications by information industry organizations, particularly of teleconferences supplemented by periodic face-to-face meetings.”

(Nilles, 1975)

The author subordinates the term Telecommuting to the more general term “Telework” in later publications, in order to include all kinds of work-related activities outside of the employer’s premises which are supported by ICTs (Nilles, 1988). Here again it is the advancement of technology that transforms the mode of work. Teleconferences, electronic mail and the fast dispersion of the Internet and the World Wide Web began to crowd out traditional means of correspondence in the late 1980s and early 1990s, and also enlarged the set of cost reduction possibilities for organizations (Wellman et al., 1996). In the vein of this chronicle, it thus makes sense to mention the evolution from “Telecommuting” to “Telework”, despite the fact that the two terms are mostly treated as synonyms by contemporary scholars<sup>6</sup>.

Nilles’ conceptual and visionary work on what we call first-generation Telework in this review inspired many other authors, scientists and politicians to glorify its seemingly infinite possibilities. In the chapter ‘The Electronic Cottage’ of Alvin Toffler’s *The Third Wave* (1980), these hopes and dreams are densely formulated in a quite luminous manner:

---

<sup>6</sup>“Telecommuting” has become the most common term used by U.S. scholars. “Telework” is mainly used in Europe and Asia (Andreev et al., 2010).

“[...] the new production system could shift literally millions of jobs out of the factories and offices into [...] where they came from originally: the home.”

(Toffler, 1980)

For Toffler, the potential of Telework expanded far beyond the mere reduction of commuting time and costs. The author’s predictions included greater community stability, a decline in pollution, flourishing new industries and entirely new family structures. All these hopeful visions were nourished by many early studies that underpinned the rising success of Telework in these areas (Clutterbuck, 1985; Curson, 1986; Daniels, 1987; Kraut, 1989; Nilles, 1988; Olson, 1982). As a result, Telework increased slowly but steadily. First, new organizational Telework forms like “satellite centres” emerged (Di Martino and Wirth, 1990; Handy and Mokhtarian, 1995). Then work outside of the employer’s premises became more sophisticated, causing Telework to evolve and spread out to other industries and countries (Haddon and Lewis, 1994). Finally, academic debate caught up with the rising new mode of work, and its advantages and disadvantages were discussed across many disciplines (Bailey and Kurland, 2002; Cascio, 2000; Di Martino and Wirth, 1990; Duxbury and Neufeld, 1999; Duxbury et al., 1998; Fritz et al., 1994; Haddon and Lewis, 1994; Handy and Mokhtarian, 1995; Kurland and Bailey, 1999; Mokhtarian, 1998; Wellman et al., 1996; Zedeck, 1992).

Following the evolution of Telework, legal regulations on its use were first put into place by the State of California, the birthplace of Jack Nilles’ pioneering studies. The California Government Code §§ 14201 signed in 1990 reflects the nature of these first years. It encourages state agencies to “review its work operations to determine where in its organization telecommuting can be of practical benefit”. Similar statutes and directives exist today in several other US States.<sup>7</sup>

---

<sup>7</sup> Arizona, Montana, Connecticut, Florida, North Carolina and Oregon (Goldman, 2007).

The literature on first-generation Telework is clearly concentrated on one mode of work: the Home Office.<sup>8</sup> Workplaces in or close to the employees' homes are remote, cheap and ecological but also stationary. This in fact does not come as a surprise. Computers and telephones at that time, thus first-generation ICTs, were not yet capable of mobilising employees *while* working. Moreover, these studies have clear sectoral and geographical limits. Before Telework spread to other industries, states and countries, the main objects of study were the 1970s' and 1980s' information industries on the West Coast of the United States. There jobs were flexible, commuting costs high and access to ICTs already prevalent enough to create an inspiring new production system. The first government regulations followed these early developments and promoted telework in the public sector.

## 2.2 Mobile Office

It is in fact rather difficult to separate out the first from the second generation of Telework, the Mobile Office. Changes were incremental and took place on different stages across organizations, industries and countries. In essence, the first and second generations of Telework are separated by technological advancements. As Alvin Toffler predicted, ICTs evolved very quickly. Smaller and lighter wireless devices like laptops, notebooks and mobile phones enabled employees to work not just from home, but from basically anywhere they could or had to work. However, research on Telework remained limited. Even towards the very end of the 20<sup>th</sup> century, and thus a time when these ICTs were already powerful and cheap enough to replace many stationary workplaces, scholars still focused on the 'classic' form of Telework as home-based full-time or part-time employment (Handy and Mokhtarian,

---

<sup>8</sup> It is important to mention that "Home Office" does not necessarily mean that people work at home. The focus here is on reduction of commuting time. In most cases companies simply decentralized their organizational structure, meaning that employees could work in satellite business centers *closer* to their homes (Nilles, 1988, 1975).

1995; Kitamura et al., 1990; Mokhtarian, 1998). In one of the first cautious essays on the subject, Di Martino and Wirth (1990) extended the menu of Telework options to 'mobile work' without developing this concept in detail. Others followed with similar short, superficial and often anecdotal pieces (Kurland and Bailey, 1999). At this point indeed the image of an evolution of Telework driven by the development of ICTs seems interrupted. In a short time ICTs were getting smaller, lighter and wireless, but still the perception of Telework seemed to remain rooted in its home-based, stationary grounds.

Nevertheless, the argument for an ICT-driven evolution from the first generation of Telework to the second can be made by considering two different but connected developments. First of all, it is important to mention that Telework was constantly evolving towards a flexible work arrangement alongside, and not as a total substitute to, traditional office work (Duxbury and Neufeld, 1999; Duxbury et al., 2006; Hartman et al., 1992; Kurland and Bailey, 1999; Venkatesh and Vitalari, 1992). Second, the Mobile Office was located in a different sectoral and organizational context than the Home Office. From its early beginnings in the 1970s and 1980s, the Home Office was promoted for clerical workers across industries, while the Mobile Office instead tended to be mainly employed by managers and professionals in marketing and finance (Kurland and Bailey, 1999): 56). Scholars who focused on "traditional" Teleworkers thus overlooked the Mobile Office as a growing alternative mode of work. Yet, with more and more occasional Telework arrangements, these workers were separated from Teleworking professionals merely by the ICTs they applied. With more technological advancements towards cheaper and more powerful devices, both groups made use of the same new form of work (Bailey and Kurland, 2002).

At this point in time the legal setting for Telework changed dramatically. Government regulations were expanded from the mere promotion of the new mode of work to a more balanced perspective. Policymakers increasingly responded to the wide spread of Telework and controversial debates around working time regulations, working conditions and occupational safety and health. One example of this development is the *EU Framework Agreement on Telework* in 2002. This social partner agreement stipulates concretely how Telework is defined<sup>9</sup> and that Teleworkers are to enjoy the same working standards as their colleagues at the employer's premises.

The second generation of Telework was not accompanied by a coherent new research body like the first one, but rather by a new attitude towards working. The Mobile Office broke with the classic bipolar spatial structure of work. Increasingly scholars had to admit that work could be done at the employers' premises, at home *and* also at various locations in between. Work now became detached from space: It could be performed "here, there, anywhere and anytime" (Kurland and Bailey, 1999). Government regulations reflect this development. They respond to the changing work environments and their conditions. From this point in time, it needed only the fast growing dispersion of the Internet and World Wide Web access to take Telework to the next generation, the Virtual Office.

### **2.3 Virtual Office**

There was something important that Alvin Toffler could not foresee in his visionary book *The Third Wave*: The Internet and its effect on the use of ICTs. Toffler saw all work places of the information society relocated from the employer's premises to the employee's homes. And in the beginning of the 1990s this seemed to be a promising guess. However, towards the turn of

---

<sup>9</sup> For a discussion of this definition see section 3.2.

the 21<sup>st</sup> century it became clear that the author's vision had to be adjusted. In *Digital Nomad* (1997), Makimoto and Manners predicted that the work of the future would be neither here nor there, but rather constantly on the move. Access to the Internet via radio links and the shrinking of transistors would, according to the authors, inevitably fuse information technologies and communications technologies together and generate the "industry's ideal product":

"The industry's ideal product will be both more and less than a laptop computer. It will do more communicating and less computing. And it will be much smaller and lighter than today's laptops."

(Makimoto and Manners 1997: 30)

Makimoto and Manners' prediction came true. Smartphones and other similar products changed the use of technology so fundamentally that they allow us to describe the third generation of Telework in terms of a new type of ICTs, or "New ICTs". During the former generation work was becoming mobile, but all information still had to be carried around all the time and information technology could be kept conceptually separate from communications technology. In this new generation of ICTs, information is stored in clouds and networks and only needs a tiny device to be accessed. This ultimately changes our perception of Telework. Checking e-mails, recent trades, messages, and news can all be done instantaneously in the palm of the hand. This enables work outside of the employer's premises within a miniscule time frame.

The clearer these changes seem in retrospective, the less clear they are with regard to empirical data. Virtualized offices have been growing ever since the World Wide Web was created by Tim Berners-Lee at the *European Organization for Nuclear Research* in 1989.

Early work on ‘virtual offices’ or ‘virtual workplaces’ thus focused more on computer-supported cooperative work (CSCW) and less on the shrinking and empowerment of ICTs (Cascio, 2000; Igarria and Tan, 1998; Orlikowski and Barley, 2001; Wellman et al., 1996). The first empirical studies that clearly pinpoint the value of New ICTs for the Virtual Office are based on surveys conducted within the industry that fed this evolution since the very beginning: the information industry (Hill et al., 2003, 2001). Here the Virtual Office, accessible through portable devices, is described as an “emerging work form” (Hill et al., 2001), but not yet conceptualized in a coherent way. The major interest in New ICTs as a tool for work outside of the employer’s premises came into play with a broad and still ongoing discussion about work intensification (Chesley, 2005; Dery et al., 2014; Duxbury et al., 2006; Green and McIntosh, 2001; Green, 2004, 2002; Mahler, 2012; Richardson and Benbunan-Fich, 2011; Towers et al., 2006; Tu et al., 2005; Van Yperen et al., 2014). This debate is focused on the re-organization of work towards mostly informal work arrangements outside of regular working hours. The character of the Virtual Office, mainly the accessibility anywhere at any time, lies at the heart of this debate.

New ICTs enabled the mobile virtual connection of workers. And as in the previous generations, it is precisely this technological advancement that triggered the further evolution of Telework. Telework evolved constantly over three decades from the crude initial desire to reduce commuting costs to the mobilization of office work and finally virtualization to a whole new mode of work. Nowadays it has grown into any possible aspect of life: It has become omnipresent. An evolution-based view of Telework leads us to acknowledge that, in essence, every current debate about the effects of ICT use for paid work outside of the employer’s premises is implicitly or explicitly a debate about Telework in one form or

another. This in turn creates the need to discuss the enigmatic diversity of definitions of this phenomenon that are spread across the literature and to put them into perspective.

### 3 New technologies, new concepts?

Literature on New ICTs and Telework is dealing with a rapidly changing technological environment; effects discussed in one publication are often outdated and inapplicable in another. This review will thus focus mainly on literature during roughly the last decade. This time period is characterized by an explosive dispersion of neologisms, definitions and concepts all struggling to cope with the many advantages and drawbacks of Telework and the work with New ICTs. This proliferation profoundly hampers comparability between studies, a problem that has always accompanied research on work with ICTs. In times when scholars more commonly used the term *Telework*, different definitions led to confusion and to a large variation of results. As pointed out by Kraut (1989) and more recently by Bailey and Kurland (2002), different studies reported different shares of employees who Telework regularly simply because they worked with different definitions of the term. Hence, to identify different forms of Telework today, it is necessary to consider a basic categorization which allows us to classify and compare definitions.

Already at the beginning of research on Telework, scholars were concerned with three key elements: **technology**, **location** and **organization** (see e.g., Beer, 1985; Di Martino and Wirth, 1990). We can use these three elements to create a categorization of the whole spectrum of changes in Telework up to the latest developments. Technology is the driving force behind the evolutionary process of Telework, rapidly developing from Old to New

ICTs. This development extended workplaces from the traditional office at the employer's premises to the employee's homes and places like cars and train stations to now basically anyplace one can imagine. Something similar can be said for the organization of work. Initially, Telework was meant to be a total substitute for traditional office work. Over time, however, it was more and more employed on a partial basis, with employees only taking a few days a month for Telework parallel to their main work at the employer's premises. Nowadays, with the technological possibilities of instantaneous Teleworking, more occasional forms were added to the menu of options.

This categorization helps us to identify basic patterns among the chaotic diffusion of new terms and definitions and leads us to a choice of the specific definition that best suits our purpose of synthesizing the literature on this topic. Studies focused on Telework and/or work with New ICTs are discussed in regard to their terms (3.1) and attributes (3.2). The results of these discussions are the building blocks for a conceptual framework of Telework (3.3), which in turn is used to analyze the incidence of Telework (3.3) and its effects on a range of work-related outcomes (4).

### **3.1 Terms**

As was already explained in section 2, the fast-shrinking and powerful New ICTs have led to the emergence of new studies that are to a large extent detached from the origins of Jack Nilles' early work on the first generation of Telework in the 1970s and 1980s. This detachment is reflected by the many neologisms that have been created in sharp contrast to the term Telework. A first example was Makimoto and Manners' *digital nomad*. This term is

frequently repeated in public and academic discourse, since it pinpoints the turn from “Old” to “New” ICTs. It has inspired the creation of a wide range of other neologisms, such as “e-nomad” (Parent-Thirion et al., 2012), “Job 2.0” (Williams, 2010), “New Ways of Work (New WoW)” (Popma, 2013), “Workscapes” (Felstead et al., 2005), “Work Extending Technologies” (Duxbury et al., 2006), “Location Independent Living (LIP living)”<sup>10</sup>, “e-work” (Lister et al., 2009) etc. In these terms we can already identify the three conceptual key elements of Telework. Technology is reflected by the term “digital”, the prefix “e-“ and the upgrade indicator “2.0”. The location of workplaces is described with terms such as “nomadism”, “location independency” etc. New forms of work organization are given with the “New Ways”, the “-scapes” and work extensions.

One could argue that the terms Telework and Telecommuting may have lost their importance because they only emphasized “tele”, the Latin prefix for “far”, and thus the location element. To conclude that this is the only reason why these terms are often avoided nowadays would, however, be incomplete. Research on work with New ICTs is still in its infancy, and most probably has been influenced by the *Zeitgeist* of the 21<sup>st</sup> Century. Contemporary scholars, along with authors of popular books, bloggers and journalists, may hesitate to use the term “Telework” simply because it does not seem to resonate with a 21<sup>st</sup> Century perception of technology.

### 3.2 Attributes

Terms by themselves do not give complete information. It is in combination with attributes that a definition is constituted. In the case of ICT-based work, these attributes mostly follow

---

<sup>10</sup> <http://locationindependent.com/about/>

the focus of the term to the extent that they cover the same key elements. For example, in their report for the 5<sup>th</sup> wave of the *European Working Conditions Survey*, Parent-Thirion and colleagues follow the focus of Makimoto and Manners (1997) on nomadism with their definition of “e-nomads”: “[...] individuals who use ICT at least sometimes and do not have their employer’s premises (or their own premises if self-employed) as their main place of work, or, if they do, they have worked in another location in the three months prior to the survey” (Parent-Thirion et al., 2012). These attributes reflect the focus of the term: location and technology.

A different take on the subject is to extend the perspective from a focus only on flexible workplaces to flexible working time arrangements, and thus to work organization as well. As Duxbury et al. (2006) conclude, in their study of Canadian knowledge workers, New ICTs are often used as “Work Extending Technologies” or “WETs”. Not only the traditional workplace is altered by the new technologies, but also standard working time policies, work schedules, and, consequentially, work-life balance, too. The main point for the conceptual aspect is the consideration of working time as, perhaps not the main, but another crucial aspect of the use of New ICTs at work. In a similar vein, Popma (2013) reviews the literature on ‘New Ways of Work’ or ‘New WoW’, which the author defines briefly as “place- and time-independent working” (Popma, 2013). The attributes in these approaches cover the key element of work organization as well. However, this comes with a cost. Both terms and attributes are broadened in comparison with other definitions to make them fit the breadth of the phenomenon. This in turn leads to less precise and less informative definitions.

A very frequently applied definition that covers all three key elements is the one used in the *European Framework Agreement on Telework* of 2002:

“Telework is a form of organising and/or performing work, using information technology, in the context of an employment contract/relationship, where work, which could also be performed at the employer’s premises, is carried out away from those premises on a regular basis.”

(Agreement, 2002, p. 15)

In this definition, location is included as work away from the employer’s premises. Work organization is mentioned explicitly and also specified with Telework being carried out away from those premises on a regular basis. In addition the attribute of technology is covered with “information technology”. Given the breadth of such a definition, with it Telework can be defined across all three generations.

Essentially, and in contrast to many other definitions, the *European Framework Agreement on Telework* definition covers the third generation of Telework as well. New ICTs, especially Smartphones, enable employees to check their e-mails and receive phone calls “on a regular basis”, away from the employer’s premises. Nowadays work with New ICTs is done to an extent that it can be considered a separate form of work. Hence, working ‘occasionally’ with New ICTs outside of the employer’s premises does not imply that Telework is done ad hoc, but rather as an integral part of one’s regular work pattern. A typical example is the checking of e-mails on the Smartphone as one’s first morning task (Maier et al., 2010).

Another important character of the above definition is its precision for the kind of work that is performed. Often Telework is confused with similar-sounding work arrangements. For example, some authors treat pre-industrial *home work* as a predecessor of Telework (see for

example Kaufman-Scarborough, 2006). In this setting production is run at home, often in form of an independent business and not based on an employment contract. Similar confusion can be created if work is outsourced or offshored with the help of ICTs<sup>11</sup>, which is commonly known as *remote work*. Here employees perform work remotely from their *customers* and not remotely from the employer's premises (Messenger and Ghosheh, 2010).

Essentially, the definition in the European Framework Agreement on Telework covers all the forms of Telework that emerged over the last four decades. And even if the term itself does not resonate with the perception of current technologies, it is still worth keeping. It stipulates a crucial element that still characterizes the new work arrangements: the location. With a small alteration, the addition of communications technology, Telework can be defined in terms of all three key elements without descending into vagueness.

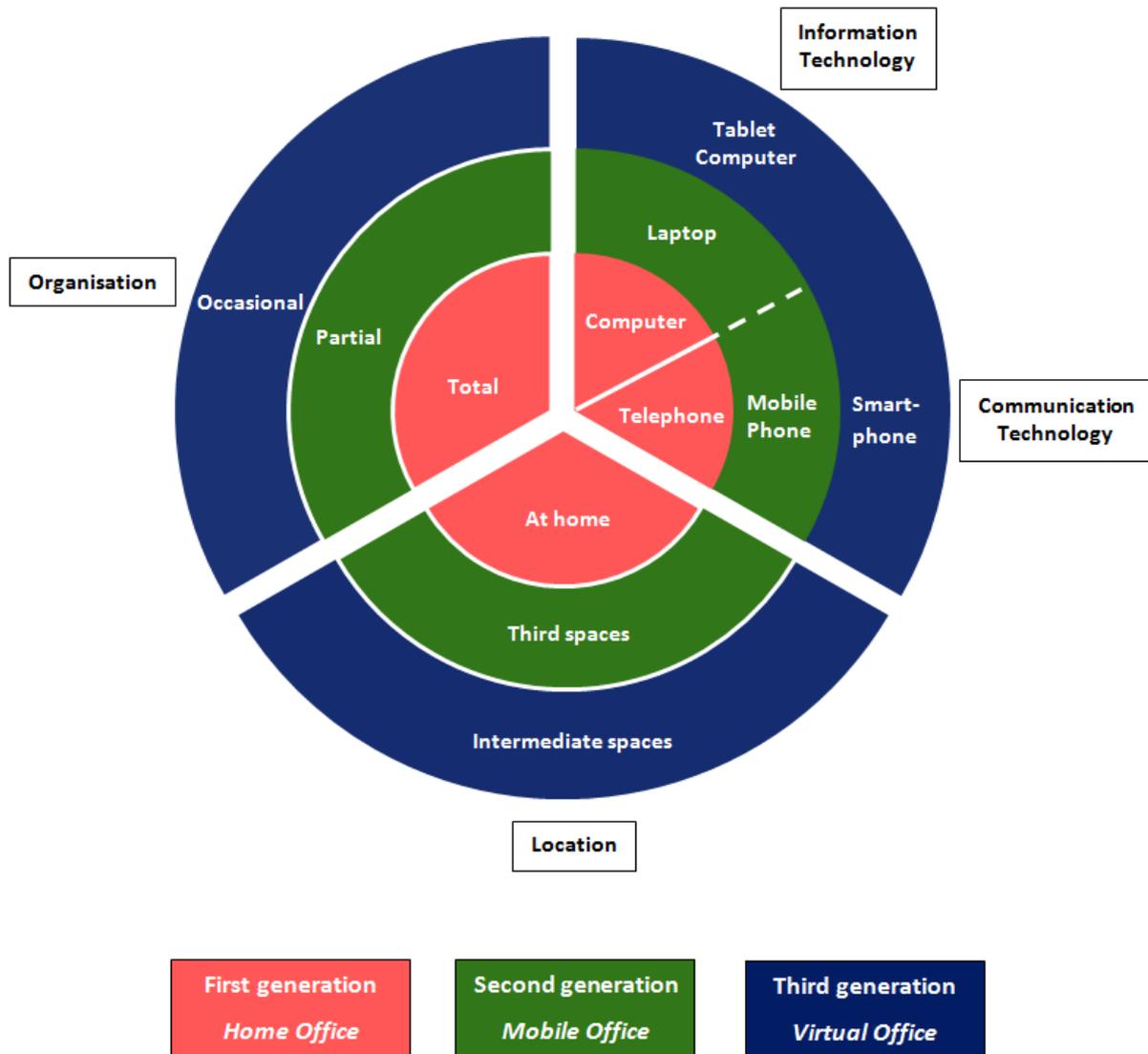
### **3.3 Conceptual Framework**

Based on this evolutionary perspective on Telework and the discussions of terms and attributes in the preceding subsections, a conceptual framework of Telework can be created that encompasses the entire evolution of Telework from the 1970's until today. The entire framework with its segmentation into the three generations of Telework (Home Office, Mobile Office and Virtual Office) and the three key elements (technology, location and organization) is illustrated in Figure 1 and discussed in the following paragraphs.

---

<sup>11</sup> As it is done, for example, with call centres (Messenger and Ghosheh, 2010)

Figure 1. Conceptual Framework of Telework (Messenger and Gschwind)



As Figure 1 illustrates, our conceptual framework covers studies on the latest developments, namely work with New ICTs outside of the employer’s premises, along with those that capture more “traditional”, still existing forms of Telework. The **first generation** constitutes the core of the framework split into the three key elements—technology, location and organization. It is the ‘model’ of Telework as it was pictured by Jack Nilles in the 1970s: use of **computers** and **telephones**, thus stationary Old ICTs, at or close to the employee’s **home** as a **total** substitute to traditional office work. Studies rarely deal exclusively with this form

of Telework, mainly due to a relatively scarce use of Telework as one's total and thus only work arrangement.<sup>12</sup> However, some operational definitions include Telework as “the main employment” (see, e.g., Parent-Thirion et al., 2012). In these cases it comes down to a determination of whether or not Telework is *de facto* used as a full replacement of traditional office work.

The **second generation** of Telework is layered around the core described above: **Partial** Telework with *mobile* Old ICTs, like **laptops** and **mobile phones**, in **third spaces**. “Partial” in this case means that a share of working hours at the employer's premises is replaced by Telework. Additionally, the term indicates that work can be arranged more flexibly, including working hours in the evenings and on week-ends. These observations are mirrored in the measurement of partial Telework as a share of working time. Characteristic locations of the second generation are spaces such as vehicles, cafés, airports, train stations and the client's premises—basically any place where work can be done regularly with the help of ICTs and which is neither the employee's home nor the employer's premises. For the purpose of efficient discussion, we call these locations *third spaces*.

In the **third generation** of Telework, New ICTs such as **smartphones** and **tablet computers** enable **occasional** Telework in **intermediate spaces** as well. It is important to keep *intermediate spaces* conceptually separate from *third spaces*, the location of the second generation. Intermediate spaces lie in between the employer's premises, third spaces and the

---

<sup>12</sup> As mentioned in section 2.2, from the early 1990s on most studies reported that Telework is used alongside traditional office work and not as a total substitute to it. More recent studies support these findings (e.g. Welz and Wolf, 2010).

employees' homes (e.g., elevators, parking lots, and even the sidewalk). They are made available for work activities by the special features of New ICTs—the fusion of information technology and communications technology, and the remote access to information. Intermediate spaces complete the coverage of workplaces made available by ICTs to basically anywhere one can imagine. The typical mode of organization in this case is occasional Telework. As for other forms, this term also describes organization beyond the mere amount of time spent Teleworking. Occasional Telework is a less formal and less regulated work arrangement than the others. It is mostly measured in frequency (e.g., “How often do you ... ?”), rather than as a share of working time (e.g.: “How much of your regular working time do you ...?”). Typical forms of occasional Telework, like responding to phone calls or e-mails from colleagues or supervisors, are also less of a voluntary arrangement set up by the employee themselves.<sup>13</sup>

The evolution of Telework serves as the conceptual “backbone” that leads us to categorize and compare the many forms of Telework that exist today. However, to apply our framework to the most recent studies and developments, we need to acknowledge the blurred boundaries between the segments for technology, and thus between Old and New ICTs, in today's reality. Old ICTs, especially stationary computers, now share many of their features with those of the latest generation, such as Internet connections and the fusion of information and communications technology. Furthermore, New ICTs are nowadays powerful enough to fulfill highly complex tasks, a characteristic which was once unique for stationary computers. The blurring of boundaries between technologies is illustrated in Figure 1. The segments of

---

<sup>13</sup> The conceptualization of partial and occasional Telework beyond the mere amount of working time largely embraces the differentiation between formal and informal Telework made by Kossek and Lautsch (2007). However, the focus remains on *time* since partial Telework also often lacks a formal agreement (Kelliher and Anderson, 2008)

technology overlap and the separation between information technology and communications technology fades away towards the outer circles.

The hybrid character of technology leads, among other factors, to a whole new set of possible combinations with segments across the key elements and the generations of Telework. Today, powerful smartphones and tablets, for example, are also used for partial Telework at home and in third spaces (Yun et al., 2012) and stationary computers for occasional e-mail correspondence with colleagues, clients or supervisors (see e.g. Chesley, 2010). Furthermore and quite intuitively, New ICTs can be used anywhere and not only in intermediate spaces (see e.g., Bittman et al., 2009), and partial Telework is done to an even larger extent at home than in third spaces (Pfisterer et al., 2013). Such combinations are an integral part of the evolution of Telework. New technologies, and consequentially new forms of Telework, did not fully replace old ones but rather changed and complemented them. Hence, much like with any other generation-based conceptualization, we need to interpret the different circles of our framework as a typical rather than exclusive combination of segments. The analysis of the direct and indirect effects of Telework in section 4 will thus be guided by a discussion of Telework “forms” as flexible combinations of segments informed by a generation-based perspective.

### **3.4 Descriptive Analyses**

Derived from the discussions in the last section, Telework is conceptualized as a multifaceted phenomenon. It ranges from the full-time employment of a sales person who works exclusively in a car or at the client’s premises to the occasional weekend phone call between

an employee and her/his supervisor. With this broad scope, Telework can be explored in many different ways. To our knowledge there is no dataset available today which would provide enough breadth and depth to cover our conceptual framework completely. Especially data on the third generation is lacking or not integrated in the same data sources as the earlier generations. The data used for descriptive analyses in this paper come from the 5<sup>th</sup> wave of the European Working Conditions Survey (EWCS), which was conducted in 2010 with a total number of 43,816 interviews across 34 European countries (Parent-Thirion et al. 2012: 141). The analyses of Teleworkers in this paper follow in principle those of “e-nomads” by Parent-Thirion et al. 2012<sup>14</sup>, with an adaption to the conceptual framework introduced in subsection 3.3. Employees<sup>15</sup> are categorized into three groups: total, partial and no Telework (see the box below for details).

#### **Identification of Teleworkers in the EWCS data**

No question in the 5<sup>th</sup> wave of the EWCS addresses Telework directly. The categorization is thus based on separate information about i) the main place of work ii) work in other locations in the past 3 months before the interview iii) work with computers, internet or email for professional purposes.

**Total (and “main”) Telework:** Employees who always work away from their employer’s premises or report having any other than their employer’s premises as their main place of work. Individuals are excluded from this category if they never/almost never use computers, internet or email for work.

**Partial Telework:** Employees who have their employer’s premises as their main place of work and report that they work at least sometimes outside of these premises. Individuals are excluded from this category if they never/almost never use computers, internet or email for work.

**No Telework:** Employees who always work at their employer’s premises or who never/almost never use computers, internet or email for work.

---

<sup>14</sup> The sample is thus restricted to the Member States of the EU27.

<sup>15</sup> Self-employed workers are excluded since it is difficult to capture work outside of “the employer’s”, i.e. their own premises.

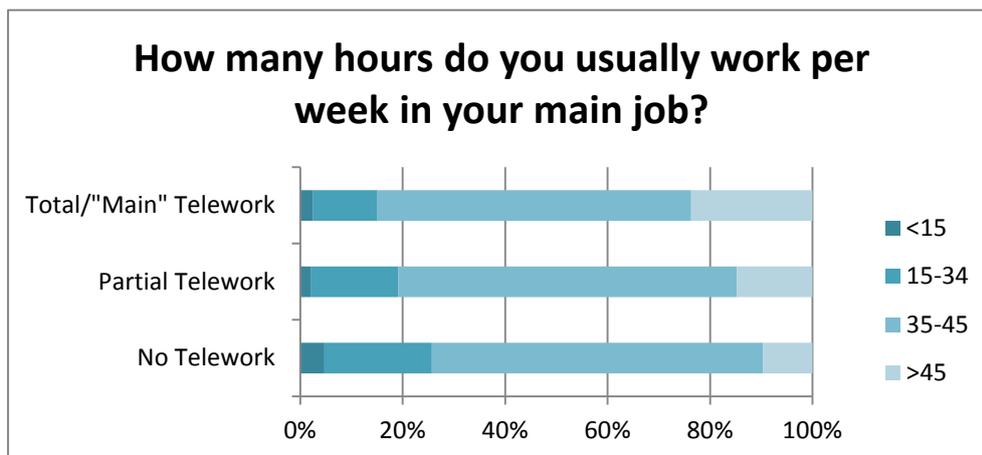
The EWCS dataset allows for an analysis of the core of our framework. Unfortunately, occasional Telework cannot be captured. An overview of descriptive results for the incidence of Telework across different socio-economic characteristics is given in Appendix 1. The results indicate that 20% of all employees in the European Union are Teleworkers, with around 15% partial and around 5% total Teleworkers. The share of Teleworkers is significantly higher among men, among employees who are between 34 and 50 years old, and among those with tertiary education. Managers are the occupation group, with the highest share of partial Teleworkers (40%), Technicians and associate professionals have the highest share of total Teleworkers (10%). The variation across sectors is determined by partial Telework with financial services and education at the top (both 32%) and wholesale, retail, food and accommodation at the bottom (8%). Total Telework is more evenly distributed across sectors, with a very low share in education as an exception (1%). The countries that stand out with the highest shares of partial and total Telework are Denmark (36% partial, 7% total), Finland (35% partial, 8% total), Sweden (32% partial, 9% total), and the Netherlands (27% partial, 8% total). Again it is partial Telework that determines the variation while total Telework seems to be spread more evenly across these countries.

The descriptive analyses reveal large differences not only across socio-economic characteristics and countries, but also across segments of the conceptual framework. Partial Telework is, as expected, more common than total Telework and accounts to a large extent for the variation across characteristics. Furthermore, some occupations and sectors rely more on total and others more on partial Telework. All these results highlight the importance of differentiating between forms of Telework as proposed with the conceptual framework in 3.3.

## 4 Direct and indirect effects of Telework

To explore the potential of the conceptual framework of Telework beyond its incidence, we can use the EWCS dataset to attempt to replicate central findings of Telework and ICT research. One central theme that has already been mentioned is the effect of Telework on working hours and work schedules. Ever since Telework started to grow and establish itself, researchers discovered that it is often used as a supplement rather than substitute for regular office work (Duxbury et al., 2014, 2006, 1998; Hill et al. 2010; Noonan and Glass, 2012). This finding is supported by the results of our analyses.<sup>16</sup> Reported working hours are illustrated in Figure 2 for total, partial, and non-Teleworkers.

Figure 2. Working hours of Teleworkers



A substantially higher share of partial Teleworkers (15%) and total Teleworkers (24%) report more than 45 working hours a week, compared with those who always work at their employer's premises (10%). Working hours in evenings are reported by 56% of all partial Teleworkers and by 60% of all total Teleworkers. Only 26% of those who never Telework report the same amount of evening hours. Even larger differences between the groups can be

<sup>16</sup> Detailed results are given in Appendix 2.

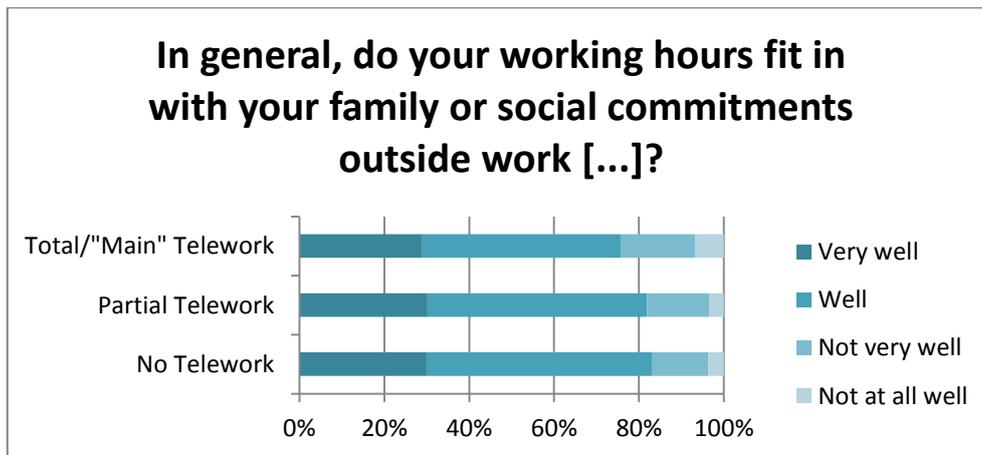
detected when comparing work schedules. Total Teleworkers have the most autonomy in setting their working hours: 21% of them determine their work schedules themselves. Only 10% of all partial Teleworkers can do so and only 3% of those who never Telework. In contrast, flexible working hours within certain limits are reported by 34% of all partial Teleworkers and 21% of all total Teleworkers, but only by 13% of those who never Telework.

The combination of more working hours and more autonomy leads to highly ambiguous results for Teleworkers' reported balance between paid work and personal life (Boswell and Olson-Buchanan, 2007; Duxbury et al. 2014; Fenner and Renn, 2010; Gallhofer et al., 2011; Heijstra and Rafnsdottir, 2010). This result is supported by data from the EWCS.<sup>17</sup> Around 35% of all Teleworkers report that they can easily take time off for personal matters during regular working hours - compared to 27% among those who never Telework. In contrast, they perform paid work much more often in their "free time" to meet work demands. Around 42% of all total Teleworkers, but only 20% of the non-Teleworkers, say they do so at least once or twice a month. This share is even higher among partial Teleworkers (54%). The results suggest that Telework *itself* is the paid work that extends into personal life. Such ambiguity between more autonomy to arrange paid work with personal life and more interference of paid work with personal life is reflected in the results for the overall fit between working hours and personal life. As can be seen in Figure 3, these factors appear to offset each other, such that no notable differences can be found across the groups.

---

<sup>17</sup> Detailed results are given in Appendix 3.

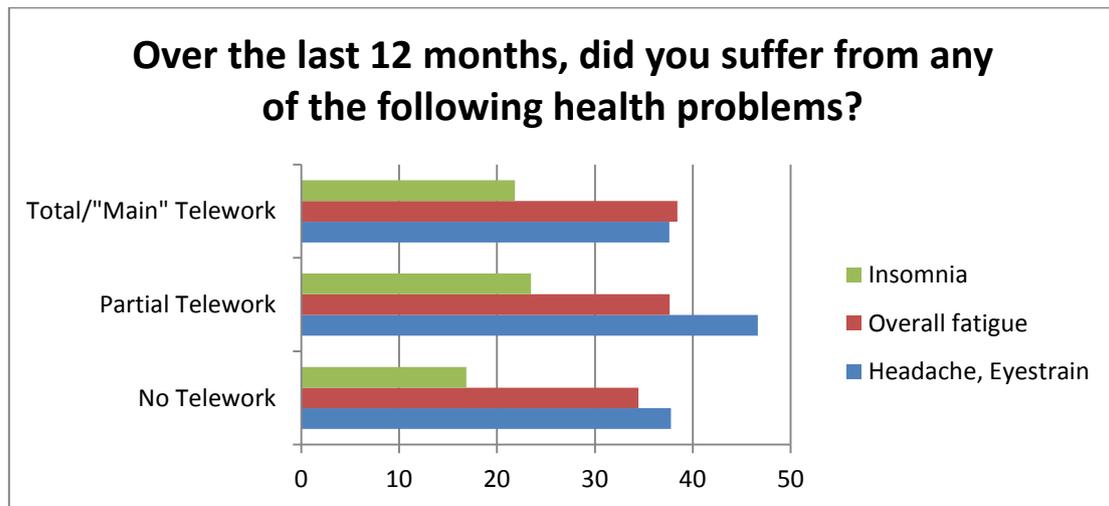
Figure 3. Fit between for paid work and personal life of Teleworkers



Extending paid working hours into personal life not only alters perceived work-life balance, it also has notable effects on the health of employees (Sardeshmukh et al., 2012; Jones et al. 2008; Guerts and Sonnentag, 2006). Results from analyses with EWCS data<sup>18</sup> show that among all Teleworkers, 33% say they are stressed most of the time or always, while only 25% within the no Telework group do so. The higher stress levels are problematic particularly for partial Teleworkers. As Figure 4 illustrates, the share of Teleworkers who suffer from health impairments such as insomnia, overall fatigue, headaches or eyestrain is significantly higher compared to the group of employees who do not Telework.

<sup>18</sup> Detailed results are given in Appendix 4.

Figure 4. Health impairments of Teleworkers



## 5. Conclusion

New Information and Communications Technologies (New ICTs), like smartphones and tablet computers, have revolutionized everyday work and life in the 21<sup>st</sup> Century. On the one hand, they enable us to constantly connect with friends and family as well as with work colleagues and supervisors; on the other hand, paid work becomes increasingly intrusive into the time and space normally reserved for personal life. Crucial to this development is the detachment of work from the traditional office spaces. Today's office work is largely supported by Internet connections, and can thus be done from basically anywhere at any time. This new spatial independence changes the role of technology in the work environment dramatically, offering both new opportunities and new challenges. Scholars are increasingly concerned with the advantages and drawbacks of New ICTs for aspects like working time, workplace relations, individual and organizational performance, work-life balance and occupational safety and health.

A close analysis of the relevant literature reveals that research on the detachment of work from the employer's premises and its effects actually dates back to the previous century. In the 1970s and 1980s, visionaries like Jack Nilles and Alvin Toffler predicted that the work of the future would be entirely relocated into, or close to, the employee's homes with help of modern technology – so-called “Telecommuting” or “Telework”. What remains from these original visions is a plethora of new technologies, workplaces and work arrangements that revolve around the use of ICTs to perform paid work outside of the employer's premises.

To fully understand the effects of New ICTs, it is thus important to create a conceptual link between the early days of Telecommuting/Telework and today. Technological advancement is the motor of change in this context. It fostered the evolution of Telework in separable stages. First, personal computers and telephones replaced costly and long commuting hours between home and the office. Next, laptop computers and mobile phones enabled wireless, portable work “on the move” (e.g., planes and trains), accompanied by a fast growing dispersion of the Internet and the World Wide Web. Finally, online connections via radio links and the shrinking of transistors triggered the development of New ICTs and their use for work anywhere at any time. Analysing the advancements of technology from the 1970s up to most recent trends sheds a new light on the term “Telework”. Today's location-independent, technology-enabled ways of work—from the mobile full-time employment of a sales person to the occasional work-related phone call or email from home--are all part of the same (r)evolution.

Drawing upon this evolutionary perspective, this paper has provided a broad, new conceptual framework of Telework over these three generations—the Home Office, the Mobile Office, and the Virtual Office. In addition, this paper has presented quantitative analyses based on data from the 5<sup>th</sup> wave of the European Working Conditions Survey (EWCS). Findings from

theses analyses support the largely ambiguous role of new technology in the work environment, as described extensively in the literature on Telework and New ICTs. The generational perspective embodied in our conceptual framework of Telework reveals, in addition, how this ambiguity developed and how different forms of the same work arrangement are nowadays intertwined in the revolution of paid work and personal life in the 21<sup>st</sup> Century.

## Bibliography

- Agreement, 2002. Implementation of the European Framework Agreement on Telework.  
Available at: <http://www.etuc.org/framework-agreement-telework> [last accessed: 27 January 2015]
- Anderson, B., Brynin, M., Raban, Y., Gershuny, J., 2007. Information and Communications Technologies in Society: E-Living in a Digital Europe. Taylor & Francis.
- Andreev, P., Salomon, I., Pliskin, N., 2010. Review: State of teleactivities. Transportation Research Part C: Emerging Technologies, Information/Communication Technologies and Travel Behaviour Agents in Traffic and Transportation 18, 3–20.
- Avery, C., Zabel, D., 2000. The Flexible Workplace: A Sourcebook of Information and Research, Auflage: New. ed. Praeger Frederick a, Westport, Conn.
- Bailey, D.E., Kurland, N.B., 2002. A review of telework research: findings, new directions, and lessons for the study of modern work. Journal of Organizational Behavior 23, 383–400.
- Beer, A.D., 1985. Le travail à distance perspectives et enjeux: une synthèse documentaire. Association Internationale Futurable.
- Bittman, M., Brown, J.E., Wajcman, J., 2009. The mobile phone, perpetual contact and time pressure. Work Employment Society 23, 673–691.
- Boswell, W.R., Olson-Buchanan, J.B., 2007. The Use of Communication Technologies After Hours: The Role of Work Attitudes and Work-Life Conflict. Journal of Management 33, 592–610.
- Brenke, K., 2014. Heimarbeit: Immer weniger Menschen in Deutschland gehen ihrem Beruf von zu Hause aus nach (No. 8), DIW Wochenbericht. Deutsches Institut für Wirtschaftsforschung e.V., Berlin.
- Cascio, W.F., 2000. Managing a virtual workplace. The Academy of Management Executive 14, 81–90.
- Chesley, N., 2005. Blurring Boundaries? Linking Technology Use, Spillover, Individual Distress, and Family Satisfaction. Journal of Marriage and Family 67, 1237–1248.
- Chesley, N., 2010. Technology Use and Employee Assessments of Work Effectiveness, Workload, and Pace of Life. Information, Communication & Society 13, 485–514.
- Clutterbuck, D., 1985. New Patterns of Work. Gower Publishing Ltd.
- Craipeau, S., 2010. Télétravail: le travail fluide. Quaderni 107–120.

- Curson, C., 1986. *Flexible Patterns of Work*. Chartered Institute of Personnel & Development.
- Daniels, P. w., 1987. Technology and Metropolitan Office Location. *Service Industries Journal* 7, 274–291.
- Dery, K., Kolb, D., MacCormick, J., 2014. Working with connective flow: how smartphone use is evolving in practice. *European Journal of Information Systems* 23, 558–570.
- Di Martino, V., Wirth, L., 1990. Telework: A New Way of Working and Living. *International Labour Review* 129, 529.
- Duxbury, L., Higgins, C., Neufeld, 1998. Telework and the balance between work and family: is telework part of the problem or part of the solution?, in: Igbaria, M., Tan, M. (Eds.), *The Virtual Workplace*. IGI Global, Hershey, USA, pp. 218–255.
- Duxbury, L., Higgins, C., Smart, R., Stevenson, M., 2014. Mobile Technology and Boundary Permeability. *Brit J Manage* 25, 570–588.
- Duxbury, L., Neufeld, D., 1999. An empirical evaluation of the impacts of telecommuting on intra-organizational communication. *Journal of Engineering and Technology Management* 16, 1–28.
- Duxbury, L., Towers, I., Higgins, C., Thomas, J.A., 2006. From 9 to 5 to 24 and 7: How Technology Redefined the Work Day, in: Law, W.K. (Ed.), *Information Resources Management: Global Challenges*. Idea Group Inc (IGI), Hershey, pp. 305–332.
- Felstead, A., Jewson, N., Walters, S., 2005. *Changing places of work*. Houndmills, Basingstoke, Hampshire.
- Fenner, G.H., Renn, R.W., 2010. Technology-assisted supplemental work and work-to-family conflict: The role of instrumentality beliefs, organizational expectations and time management. *Human Relations* 63, 63–82.
- Fritz, M.E.W., Higa, K., Narasimhan, S., 1994. Telework: exploring the borderless office, in: *Proceedings of the Twenty-Seventh Hawaii International Conference on System Sciences*, 1994. Presented at the Proceedings of the Twenty-Seventh Hawaii International Conference on System Sciences, 1994, pp. 149–158.
- Gallhofer, S., Paisey, C., Roberts, C., Tarbert, H., 2011. Preferences, constraints and work-lifestyle choices. *Acc Auditing Accountability J* 24, 440–470.
- Golden, A.G., Geisler, C., 2007. Work-life boundary management and the personal digital assistant. *Human Relations* 60, 519–551.
- Golden, T.D., Fromen, A., 2011. Does it matter where your manager works? Comparing managerial work mode (traditional,

- telework, virtual) across subordinate work experiences and outcomes. *Human Relations* 64, 1451–1475.
- Golden, T.D., Veiga, J.F., Dino, R.N., 2008. The impact of professional isolation on teleworker job performance and turnover intentions: Does time spent teleworking, interacting face-to-face, or having access to communication-enhancing technology matter? *Journal of Applied Psychology* 93, 1412–1421.
- Goldman, A.L., 2007. United States of America, in: Blanpain, R. (Ed.), *European Framework Agreements and Telework: Law and Practice: Law and Practice, a European and Comparative Study*. Kluwer Law International, pp. 245–271.
- Green, F., 2004. Why Has Work Effort Become More Intense? *Industrial Relations: A Journal of Economy and Society* 43, 709–741.
- Green, F., McIntosh, S., 2001. The intensification of work in Europe. *Labour Economics, First World Conference of Labour Economists, EALE-SOLE* 8, 291–308.
- Green, N., 2002. On the Move: Technology, Mobility, and the Mediation of Social Time and Space. *The Information Society* 18, 281–292.
- Haddon, L., Lewis, A., 1994. The experience of teleworking: an annotated review. *International Journal of Human Resource Management* 5, 193–223.
- Handy, S.L., Mokhtarian, P.L., 1995. Planning for telecommuting. *American Planning Association. Journal of the American Planning Association* 61, 99.
- Hartman, R.I., Stoner, C.R., Arora, R., 1992. Developing Successful Organizational Telecommuting Arrangements: Worker Perceptions and Managerial Prescriptions. *SAM Advanced Management Journal* (07497075) 57, 35.
- Heijstra, T.M., Rafnsdottir, G.L., 2010. The Internet and academics' workload and work–family balance. *The Internet and Higher Education* 13, 158–163.
- Hill, E.J., Erickson, J.J., Holmes, E.K., Ferris, M., 2010. Workplace flexibility, work hours, and work-life conflict: Finding an extra day or two. *Journal of Family Psychology* 24, 349–358.
- Hill, E.J., Ferris, M., Martinson, V., 2003. Does it matter where you work? A comparison of how three work venues (traditional office, virtual office, and home office) influence aspects of work and personal/family life. *Journal of Vocational Behavior, Special Issue on Technology and Careers* 63, 220–241.
- Hill, E.J., Hawkins, A.J., Ferris, M., Weitzman, M., 2001. Finding an extra day a week: The positive influence of perceived job flexibility on work and family life balance. *Family Relations* 50, 49–58.

- Hjorthol, R.J., 2006. Teleworking in Some Norwegian Urban Areas—Motives and Transport Effects. *Urban Geography* 27, 610–627.
- Igbaria, M., Tan, M. (Eds.), 1998. *The virtual workplace*, Series in information technology management. Idea Group Pub, Hershey, USA.
- ITU, 2014. *ICT - Facts and Figures*. International Telecommunication Union, Geneva.
- Jones, B.L., Scoville, D.P., Hill, E.J., Childs, G., Leishman, J.M., Nally, K.S., 2008. Perceived versus used workplace flexibility in Singapore: Predicting work-family fit. *Journal of Family Psychology* 22, 774–783.
- Kaufman-Scarborough, C., 2006. Time Use and the Impact of Technology: Examining workspaces in the home. *Time & Society* 15, 57–80.
- Kelliher, C., Anderson, D., 2008. For better or for worse? An analysis of how flexible working practices influence employees' perceptions of job quality. *The International Journal of Human Resource Management* 19, 419–431.
- Kitamura, R., Nilles, J.M., Conroy, P., Fleming, D.M., 1990. Telecommuting as a Transportation Planning Measure: Initial Results of California Pilot Project.
- Kossek, E.E., Lautsch, B.A., 2007. *CEO of Me: Creating a Life That Works in the Flexible Job Age*, 1 edition. ed. FT Press.
- Kossek, E.E., Michel, J.S., 2011. Flexible work schedules, in: *APA Handbook of Industrial and Organizational Psychology, Vol 1: Building and Developing the Organization*, APA Handbooks in Psychology. American Psychological Association, Washington, DC, US, pp. 535–572.
- Kraut, R.E., 1989. Telecommuting: The Trade-offs of Home Work. *Journal of Communication* 39, 19–47.
- Kurland, N.B., Bailey, D.E., 1999. The advantages and challenges of working here, there anywhere, and anytime. *Organizational Dynamics* 28, 53–68.
- Lister, K., Harnish, T., Nilles, J.M., 2009. *Undress for Success: The Naked Truth about Making Money at Home*, 1 edition. ed. Wiley, Hoboken, N.J.
- Mahler, J., 2012. The Telework Divide Managerial and Personnel Challenges of Telework. *Review of Public Personnel Administration* 32, 407–418.
- Maier, G., Schneider, F., Feldmann, A., 2010. A First Look at Mobile Hand-Held Device Traffic, in: Krishnamurthy, A., Plattner, B. (Eds.), *Passive and Active Measurement*, Lecture Notes in Computer Science. Springer Berlin Heidelberg, pp. 161–170.
- Makimoto, T., Manners, D., 1997. *Digital nomad*. Chichester, England.

- Messenger, J., Ghosheh, N., 2010. *Offshoring and Working Conditions in Remote Work*. Palgrave MacMillan and International Labour Office, Houndmills, Basingstoke, Hampshire, UK.
- Miller, M., 2008. *Cloud Computing: Web-Based Applications That Change the Way You Work and Collaborate Online*. Que Publishing.
- Mokhtarian, P.L., 1998. A synthetic approach to estimating the impacts of telecommuting on travel. *Urban Studies* 35, 215–241.
- Nilles, J.M., 1975. Telecommunications and Organizational Decentralization. *IEEE Transactions on Communications* 23, 1142–1147.
- Nilles, J.M., 1988. Traffic reduction by telecommuting: A status review and selected bibliography. *Transportation Research Part A: General* 22, 301–317.
- Noonan, M.C., Glass, J.L., 2012. Hard Truth about Telecommuting, *The Monthly Lab. Rev.* 135, 38.
- Olson, M.H., 1982. New Information Technology and Organizational Culture. *MIS Quarterly* 6, 71–92.
- Olson-Buchanan, J.B., Boswell, W.R., 2006. Blurring boundaries: Correlates of integration and segmentation between work and nonwork. *Journal of Vocational Behavior* 68, 432–445.
- Orlikowski, W.J., Barley, S.R., 2001. Technology and institutions: What can research on information technology and research on organizations learn from each other? *MIS Quarterly* 25, 145–165.
- Parent-Thirion, A., Vermeulen, G., van Houten, G., Lyly-Yrjänäinen, M., Biletta, I., Cabrita, J., 2012. Fifth European Working Conditions Survey. Available at: <http://www.eurofound.europa.eu/publications/htmlfiles/ef1182.htm> [last accessed: 27 January 2015].
- Pfisterer, S., Streim, A., Hampe, K., 2013. *Arbeit 3.0 - Arbeiten in der digitalen Welt*. Bundesverband Informationswirtschaft, Telekommunikation und neue Medien e.V., Berlin.
- Popma, J., 2013. The Janus face of the “New ways of Work” : rise, risks and regulation of nomadic work.
- Richardson, K., Benbunan-Fich, R., 2011. Examining the antecedents of work connectivity behavior during non-work time. *Information and Organization* 21, 142–160.
- Sardeshmukh, S.R., Sharma, D., Golden, T.D., 2012. Impact of telework on exhaustion and job engagement: a job demands and job resources model. *New Technology, Work & Employment* 27, 193–207.

- Stavrou, E., Kilaniotis, C., 2010. Flexible Work and Turnover: an Empirical Investigation across Cultures. *British Journal of Management* 21, 541–554.
- Stavrou, E.T., 2005. Flexible Work Bundles and Organizational Competitiveness: A Cross-National Study of the European Work Context. *Journal of Organizational Behavior* 26, 923–947.
- Toffler A, 1980. *Third wave*. Bantam : New York.
- Towers, I., Duxbury, L., Higgins, C., Thomas, J., 2006. Time thieves and space invaders: technology, work and the organization. *Journal of Organizational Change Management* 19, 593–618.
- Tu, Q., Wang, K., Shu, Q., 2005. Computer-related Technostress in China. *Commun. ACM* 48, 77–81.
- Van Yperen, N.W., Rietzschel, E.F., De Jonge, K.M.M., 2014. Blended Working: For Whom It May (Not) Work. *PLoS ONE* 9, e102921.
- Venkatesh, A., Vitalari, N.P., 1992. An Emerging Distributed Work Arrangement: An Investigation of Computer-Based Supplemental Work at Home. *Management Science* 38, 1687–1706.
- Wajcman, J., Bittman, M., Brown, J.E., 2008. Families without Borders: Mobile Phones, Connectedness and Work-Home Divisions. *Sociology* 42, 635–652.
- Wellman, B., Salaff, J., Dimitrova, D., Garton, L., et al, 1996. Computer networks as social networks: Collaborative work, telework, and virtual community. *Annual Review of Sociology* 22, 213–238.
- Welz, C., Wolf, F., 2010. *Telework in the European Union*. European Foundation for the Improvement of Living and Working Conditions, Dublin.
- Williams, J., 2010. *Screw Work, Let's Play: How to Do What You Love and Get Paid for it*, 1 edition. ed. Pearson Business, Harlow, England ; New York.
- Yun, H., Kettinger, W.J., Lee, C.C., 2012. A New Open Door: The Smartphone's Impact on Work-to-Life Conflict, Stress, and Resistance. *International Journal of Electronic Commerce* 16, 121–152.
- Zedeck, S., 1992. *Work, families, and organizations*, *Frontiers of industrial and organizational psychology*, Vol. 5; The Jossey-Bass management series and The Jossey-Bass social and behavioral science series. Jossey-Bass, San Francisco, CA, US.

Appendix 1. Descriptive Analyses of socio-economic characteristics and countries

	<b>Telework in %</b>	<b>Partial in %</b>	<b>Total and “Main” in %</b>
<b>Total</b>	<b>20</b>	<b>15</b>	<b>5</b>
<b>Gender</b>			
Men (Ref.)	24 -	17 -	7 -
Women	16**	13**	3**
<b>Age</b>			
<35	18**	13**	5
35-49 (Ref.)	23 -	17 -	6 -
>49	20**	15	5**
<b>Highest Education</b>			
Primary	3**	1**	2**
Secondary (Ref.)	14 -	9 -	5 -
Tertiary	38**	32**	7**
<b>Occupation</b>			
Managers	48**	40**	8
Professionals	41**	36**	6**
Technicians and associate professionals (Ref.)	30 -	21 -	10 -
Agricultural workers	14**	7**	7
Clerical support workers	13**	11**	2**
Service and sales workers	10**	6**	4**
Craft and related trades workers	9**	5**	4**
Plant and machine operators	8**	3**	5**
Elementary occupations	4**	1**	2**
<b>Sector</b>			
Financial Services	40**	32**	8*
Education	33**	32**	1**
Public administration and defence	29**	23**	6*
Other services	27**	19**	8**
Health	20**	15**	5
Industry (Ref.)	16 -	11 -	5 -
Transport	16	8**	8**
Construction	15	8**	7*
Agriculture	11	5**	6
Wholesale, retail, food and accommodation	11**	8**	3*

<b>Country</b>			
Denmark	43**	36**	7**
Finland	43**	35**	8*
Sweden	41**	32**	9**
Netherlands	35**	27**	8*
Slovenia	25	21	4
Luxembourg	25	21	4
Belgium	25	18	7
Austria	25	18	7
Germany (Ref.)	24 -	19 -	5 -
France	23	17	6
United Kingdom	22	16	6
Estonia	21	16	5
Ireland	19**	13**	6
Czech Republic	18**	14*	4
Spain	17**	11**	6
Cyprus	17**	13**	4
Portugal	17**	12**	5
Slovakia	16**	12**	4
Latvia	15**	11**	4
Malta	15**	11**	4
Greece	15**	11**	4
Lithuania	14**	11**	4
Poland	12**	8**	4
Hungary	12**	8**	4
Italy	10**	7**	3
Bulgaria	8**	5**	3
Romania	7**	5**	2

Significance levels for test of differences to reference category: \*p<0.05, \*\*p<0.01

## Appendix 2. Descriptive Analyses of Telework and Working Time

	Working hours per week (shares in %)				Hours worked in evenings per month (shares in %)				Work schedules (shares in %)			
	<15	15-34	35-45	>45	0	1-4	5-10	>10	A	B	C	D
<b>All employees</b>												
No Telework (Ref.)	5	21	65	10	64	15	12	10	75	8	13	3
Partial Telework	2 **	17 **	66	15 **	44 **	32 **	12	12 **	46 **	10 *	34 **	10 **
Total/"Main" Telework	3 **	13 **	61	24 **	40 **	27 **	17 **	16 **	49 **	9	21 **	21 **
<b>Managers and Professionals</b>												
No Telework (Ref.)	3	28	60	9	66	18	8	8	67	9	20	5
Partial Telework	2 *	20 **	59	19 **	39 **	33 **	13 **	15 **	41 **	10	36 **	13 **
Total/"Main" Telework	4	14 **	55	26 **	42 **	27 *	13 *	18 **	36 **	7	26	32 **
<b>Technicians and associate professionals</b>												
No Telework (Ref.)	3	20	72	6	66	16	11	7	66	8	22	3
Partial Telework	1 **	14 **	76 *	9 *	51 **	33 **	10	6	43 **	7	41 **	9 **
Total/"Main" Telework	2	9 **	64 *	24 **	39 **	27 **	17 *	17 **	37 **	8	27	29 **

Significance levels for test of differences to reference category: \*p<0.05, \*\*p<0.01; Forms of work schedules: A - They are set by the company/organisation with no possibility of changes; B - You can choose between several fixed working schedules determined by the company/organization; C - You can adapt your working hours within certain limits (e.g. flexi-time); D - Your working hours are entirely determined by yourself

Appendix 3. Descriptive Analyses of Telework and Work-Life Balance

	Fit of working hours with personal life (shares in %)				Paid work in “free time” to meet work demands (shares in %)				Taking an hour or two of for personal matters (shares in %)			
	Very well	Well	Not very well	Not at all well	Nearly every day	Once or twice a week	Once or twice a month	Less often or never	Not difficult at all	Not too difficult	Some-what difficult	Very difficult
<b>All employees</b>												
No Telework (Ref.)	30	53	13	4	3	5	12	79	27	33	23	17
Partial Telework	30	52	15	3	9 **	20 **	24 **	47 **	36 **	31 *	20 *	13 **
Total/“Main” Telework	29	47 **	18 **	7 **	7 **	14 **	21 **	57 **	35 **	33	19 *	13 **
<b>Managers and Professionals</b>												
No Telework (Ref.)	34	53	11	2	6	12	17	66	29	32	23	16
Partial Telework	30	50	16 **	3	13 **	25 **	27 **	36 **	36 **	28 *	20	16
Total/“Main” Telework	38	42 *	14	6	8	20 *	15	58	48 **	27	17	8 **
<b>Technicians and associate professionals</b>												
No Telework (Ref.)	31	54	12	2	2	6	14	77	29	35	22	14
Partial Telework	31	56	11	2	4 *	17 **	23 **	55 **	37 **	36	20	7 **
Total/“Main” Telework	30	51	15	5 *	10 **	15 **	25 **	50 **	30	46 **	17	8 **

Significance levels for test of differences to reference category: \*p<0.05, \*\*p<0.01

Appendix 4. Descriptive Analyses of Telework and Health

	Stress experienced at work (shares in %)					Reported health problems (shares in %)		
	Always	Most of the time	Sometimes	Rarely	Never	Head-ache or Eye-strain	Overall fatigue	Insomnia
<b>All employees</b>								
No Telework (Ref.)	9	16	40	19	17	38	34	17
Partial Telework	14 **	20 **	45 **	14 **	7 **	47 **	38 **	23 **
Total/"Main" Telework	13 **	20 *	39	17	11 **	38	38 *	22 **
<b>Managers and Professionals</b>								
No Telework (Ref.)	11	19	42	19	9	42	35	18
Partial Telework	16 **	20	47 *	13 **	5 **	50 **	42 **	26 **
Total/"Main" Telework	14	14	43	19	10	38	39	24
<b>Technicians and associate professionals</b>								
No Telework (Ref.)	10	18	43	18	12	43	33	19
Partial Telework	10	20	47 *	15	7 **	43	31	19
Total/"Main" Telework	11	26 *	35 *	18	10	38	35	19

Significance levels for test of differences to reference category: \*p<0.05, \*\*p<0.01

|