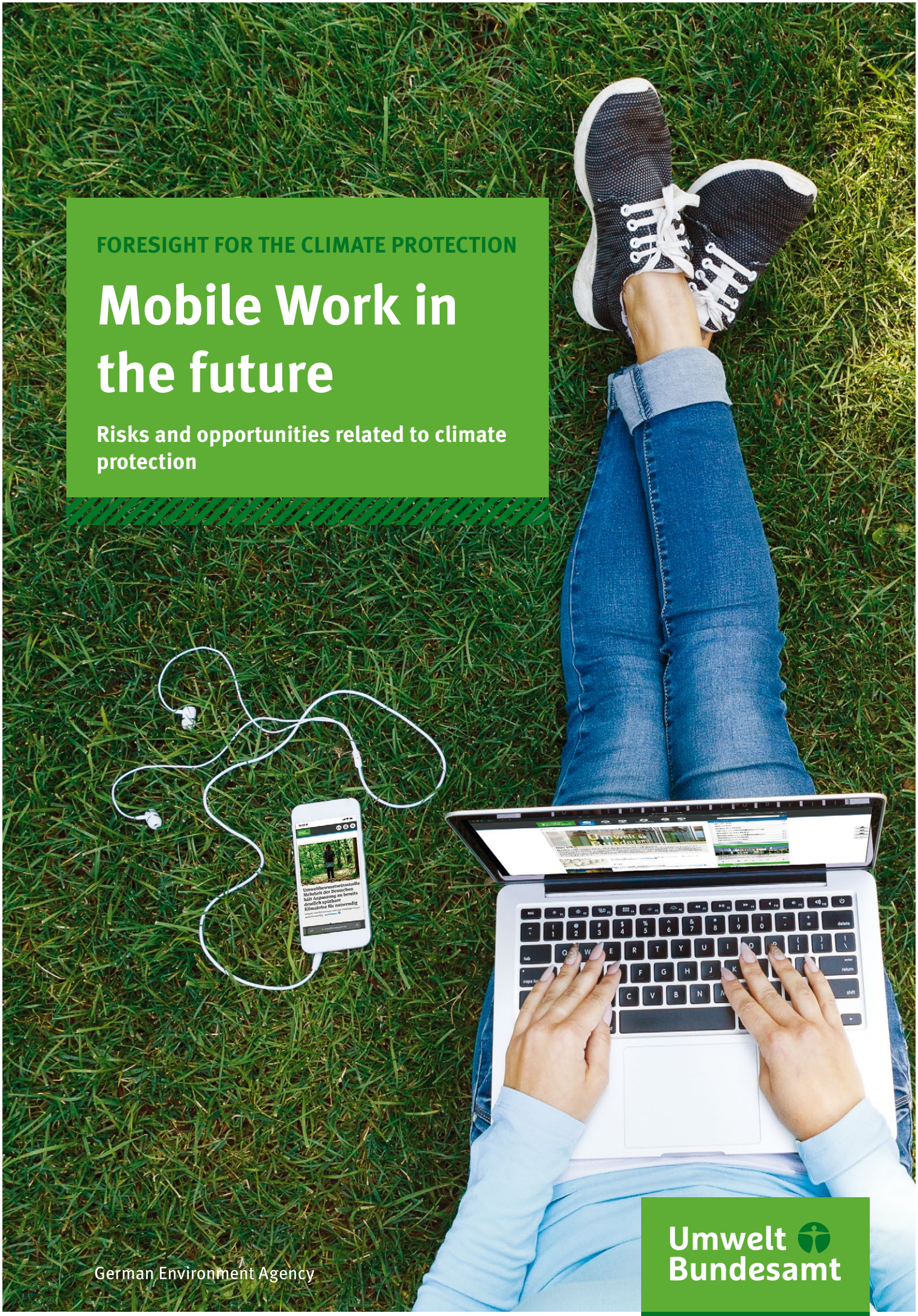
FORESIGHT FOR THE CLIMATE PROTECTION

Mobile Work in the future

Risks and opportunities related to climate protection



German Environment Agency

Umwelt Bundesamt

Imprint

Publisher:
Umweltbundesamt
Postfach 14 06
06813 Dessau-Roßlau
Tel: +49 340-2103-0
buergerservice@uba.de
Internet: www.umweltbundesamt.de

/umweltbundesamt.de
/umweltbundesamt
/umweltbundesamt
/umweltbundesamt

Study conducted by:

Fraunhofer Institute for Systems and Innovation Research ISI
Breslauer Str. 48
76133 Karlsruhe, Germany

Authors:
Simone Kimpeler, Lorenz Erdmann
Fraunhofer ISI, Karlsruhe

With the collaboration of
Frauke Röser, Aki Kachi, New Climate Institute
Katja Hünecke, Öko-Institut
Martin Kirstgen, Fraunhofer Institute for Systems and Innovation Research ISI

On behalf of the German Federal Ministry for Economic Affairs and Climate Action (BMWK), Berlin
Haushaltsmittel für die Umsetzung des Klimaschutz-programs 2030, Nr. 3.5.4.3 der übergreifenden Maßnahmen

Editors:
Sylvia Veenhoff
Section I 1.1 Fundamental aspects, Sustainability strategies and scenarios, Sustainable resource use

Design:
Jenny Habermehl

This publication can be obtained free of charge from the Federal Environment Agency. It may not be resold. A fee of EUR 15 will be charged for every copy resold in breach of this prohibition.

Publications as a pdf:
www.umweltbundesamt.de/publikationen

Completion date:
November 2023

ISSN 1862-4804

Dessau-Roßlau, November 2023

The publication's authors are solely responsible for its content.

Research number 157237

Foresight for the climate protection

MOBILE WORK IN THE FUTURE

Climate Protection Opportunities and Risks

List of figures

Figure 1 – Trends in the mobile working future issue 10
Figure 2 – Plait model “Umlandstadt” 18
Figure 3 – Relevance of the trends for climate protection 30
Figure 4 – Interactions between the trends 31
Figure 5 – Main impact areas with climate protection relevance 32

List of abbreviations

Begriff	Beschreibung
AR	Augmented reality
BMWK	German Federal Ministry for Economic Affairs and Climate Action (BMWK), Berlin
Fraunhofer ISI	Fraunhofer Institute for Systems and Innovation Research
SME	Small and medium-sized enterprises
LCA	Life cycle assessment
GHG	Greenhouse gas
UBA	Umweltbundesamt (German Environment Agency), Dessau-Roßlau
VR	Virtual reality

Table of contents

List of figures 4

List of abbreviations 4

Summary 6

1. Mobile work as a future issue for climate protection 8

2. What's new? Seven mobile work trends 10
2.1 Trend 1: More and more time working from home, less time in the office 10
2.2 Trend 2: Changing use of private space 14
2.3 Trend 3: Urban exodus – more people migrating to surrounding areas 16
2.4 Trend 4: Rise of the "workation" – work and travel combined 19
2.5 Trend 5: Coworking becoming increasingly popular 22
2.6 Trend 6: Shifting of activities to the virtual space 24
2.7 Trend 7: More consumer products and services for mobile workers 27
2.8. Interim conclusion 29

3. What are the potential courses of action for climate protection policy? 31
3.1 Impact area: mobility behaviour 32
3.2 Impact area: spatial, urban and settlement development 34
3.3 Impact area: economy and consumer behaviour 35
3.4 Impact area: technological development and work structuring 37
3.5 Overarching options for policy actions 38
3.6 Conclusion 39

List of sources 41
Literature 41
Figures 43

Summary

With the May 2021 amendment to the Federal Climate Change Act, Germany must be greenhouse-gas neutral by 2045. The measures taken so far are insufficient, and new challenges such as the war in Ukraine are further complicating the transformation. The *Klimascan – Horizon Scanning of Developments Relevant to Climate Protection* pilot project aims to identify at an early stage future topics that are suitable for cross-ministerial activities to accelerate the societal transformation. Within this framework, the future issue of "Mobile work in the future: climate protection opportunities and risks" was explored in depth, and potential policy actions were developed for promoting climate protection sustainably and across across the Federal Ministries.

The brochure's first section presents seven key trends that are contributing to an increase in mobile working and that contain both opportunities and risks for climate protection:

1. More time working from home, less time in the office
2. Changing use of private space
3. Urban exodus – more people migrating to surrounding areas
4. Rise of the "workation" – work and travel combined
5. Coworking becoming increasingly popular
6. Shifting of activities to the virtual space
7. More consumer products and services for mobile working

The core message from the trend analysis is that the future of work will see a significant increase in mobile working. The Covid-19 pandemic gave new impetus to this trend, and it is set to continue. In the long term, more people will work from home, on the move, or in coworking spaces. This change brings a different set of mobility, housing and living space requirements, which in turn will have an impact on consumer behaviour, business models and the design of inner-city and rural housing. The cumulative effect of these factors has the potential to change social structures.

Section 2 discusses the trends in terms of their relationship and relevance to and impact on climate protection. There are interactions between the trends, so that although opportunities and risks can be clearly identified for each individual trend, agglomeration effects must also be taken into account in the final overall assessment. What appears to be an opportunity in one trend may become a climate protection risk in another. The conflicting effects on energy consumption of shifting work from the office to home or to other locations are particularly evident in the potential for traffic reduction through less commuting and online meetings on the one hand, while also posing risks of increased traffic-induced emissions due to longer driving distances into the surrounding areas, changed demands on living space, increased delivery volumes as a result of online orders or greater electricity consumption from online activities.

The findings of this trend analysis were evaluated for their implications for climate protection policy as part of a of a foresight workshop involving representatives from various federal ministries and research experts. On the basis of this, potential courses of action were developed for the trends' four main areas of impact: mobility behaviour, urban and settlement development, economy and consumption, and IT equipment and work structuring. In addition, selected overarching potential courses of action are highlighted that could accelerate the transformation according to the goal of achieving climate neutrality by 2045. These are presented in Section 3. Based on current understandings, a largely mobile working world is only possible in terms of climate and sustainability if the various resulting demands on climate protection policy are adequately coordinated across the relevant policy areas. Future working models may dramatically reduce greenhouse gas emissions if they truly reduce journeys and if the declining demand for space in businesses and public institutions makes more space for climate-friendly living. Changing mobility and consumption habits will impose new requirements on

urban planning and economic development, bringing with them increased potential for climate protection. This future issue therefore offers a variety of starting points for climate protection in a triad of environmentally friendly mobility, mixed and affordable housing and sustainable consumption – together with new opportunities for integrating climate policy with economic and social policy.

The potential **policy actions** for climate protection within the mobile working future issue – for each field of action and cross-cutting – are:

Mobility behaviour

- Collection and exploitation of mobility data for a society with increased mobile working
- Greater corporate responsibility and incentives for climate-friendly mobile work structures for employees
- More effective incentives for a climate-friendly modal split

Spatial, urban and settlement development

- Create new mobile workspaces by opening up vacant properties in cities and the surrounding areas
- Use new mobile working concepts to avoid vacant properties in city centres
- Prioritise renovation over new builds
- Strategies for the climate and resource-friendly redistribution of places of residence and work
- Interior design for collaborative mobile work

Economy and consumer behaviour

- Development of local economy and trades structures to allow for more location-flexible working
- Create spaces to experiment with providing for a mobile-work society

Technological development and work structuring

- Right to climate and resource-friendly IT equipment for mobile work
- Extension of occupational health and safety regulations
- Legal requirements regarding technological innovations for mobile work

Overarching potential policy actions

- Understand mobile working as a core component of the plait model for climate-friendly spatial development
- Establish coworking as an alternative to the traditional office environment and as a place for practical sustainability
- Use mobile work as a driver of interdisciplinary innovation to shape the transformation
- In-depth analysis of the opportunities and risks of workations and adaptation of the legal framework

1. Mobile work as a future issue for climate protection

With the May 2021 amendment to the Federal Climate Change Act, Germany must be greenhouse-gas neutral by 2045. The measures taken so far are not sufficient (Expertenrat für Klimafragen 2023), and new challenges such as the war in Ukraine are further complicating implementation. The transformation of society as a whole to protect the climate must be accelerated. Alongside climate protection measures in the individual sectors of energy, industry, construction, transport and agriculture, cross-sectoral societal changes that could present climate protection opportunities and risks are also relevant.

The aim of the *Horizon Scanning of Developments Relevant to Climate Protection (Klimascan)* project is to identify through the noise of social developments to identify the trends that present new climate protection policy opportunities or challenges, condense these into future issues and develop ideas for policy actions for climate protection.

This brochure from the "Foresight for Cimate Protection" series explains which trends will drive the growth of mobile wor**k** in the coming years, how this might affect climate protection in the future, and the resulting options for shaping climate protection policy.

Mobile working future issue

In the future, more and more people will work from home, on business trips or in coworking spaces, rather than in the office at the company premises or public institution. This development is being influenced by the interaction of various trends, such as the establishment of homeworking within companies, a shift in the use of private spaces, the expansion of settlements in the areas surrounding cities, workations combining work and travel, more coworking spaces and increased consumption at home. These developments, and the proliferation of homeworking, have gained momentum in the wake of the coronavirus pandemic.

The Klimascan project

Through the Klimascan project, the Federal Ministry for Economic Affairs and Climate Action, together with the Environment Agency (Umweltbundesamt streichen), is implementing the "Strategic Horizon Scanning of Developments Relevant to Climate Protection" measure of the previous Federal Government's Climate Action Programme 2030, adopted in 2019. The goal is to develop, test and implement a cross-ministerial horizon scanning system that continuously identifies relevant climate protection trends and provides appropriate formats for jointly analysing their interactions and the significance for climate protection from the point of view of the Federal Ministries. The project began in October 2021 and will continue until the end of 2023 as a pilot to establish a continuous scanning process. The scanning process continuously captures and selects emerging trend signals from society, technology, the environment, and the economy that may be relevant to climate protection. The future issues selected will be analyzed in the Climate Protection Foresight series in terms of their climate protection opportunities and risks. Potential policy options and needs for additional research will subsequently be examined based on discussions and foresight workshops.

- Relevance for climate protection

Each of these trends presents specific opportunities and risks for climate protection. These include, among others, ambivalent effects on energy consumption due to shifting the place of work from the office to home or other locations, the potential for traffic reduction due to less commuting and online meetings, as well as the risk of increased traffic-induced emissions due to longer driving distances into the surrounding area, increased delivery volumes due to online orders, or greater electricity consumption from online activities.

- Starting points for potential policy actions

Analysing the opportunities and risks of individual trends and the overall picture of their interactions has enabled the identification of four main impact areas, and hence fields of action, for climate protection: mobility behaviour, urban and settlement development, economy and consumption, and IT equipment and work structuring. There are starting points for potential policy actions within each field of action that should be coordinated across the various departments. In addition, there are overarching potential actions that could accelerate the transformation in line with the climate change goal of achieving climate neutrality by 2045. Based on current understandings, a largely mobile working world is only possible in terms of climate and sustainability if the various resulting demands on climate protection policy are adequately coordinated across the relevant policy areas. The mobile working model has the potential to make an important contribution to reducing greenhouse gas emissions in the future. This requires journeys to be truly reduced and the declining demand for space in businesses and public institutions to make more room for climate-friendly living. Changing mobility and consumption habits will impose new requirements on urban planning and economic development, bringing with them increased potential for climate protection. This future issue of mobile working thus offers a variety of starting points for climate protection within the triad of environmentally friendly mobility, mixed and affordable housing and sustainable consumption – and opens a window to new opportunities for integrating climate policy with economic and social policy.

2. What's new? Seven mobile work trends

Our society is undergoing a digitalisation-driven transformation of living spaces (BMWK 2023), with one result being an increase in mobile work. This encompasses various forms of working outside the company workplace, such as internet-based working from home or mobile working. In the future, an increasing number of people will work from home, on business trips or in coworking spaces rather than in the office.

This section sets out the trends that will have a significant impact on this future issue over the coming years. *Figure 1* shows an overview of the trends.

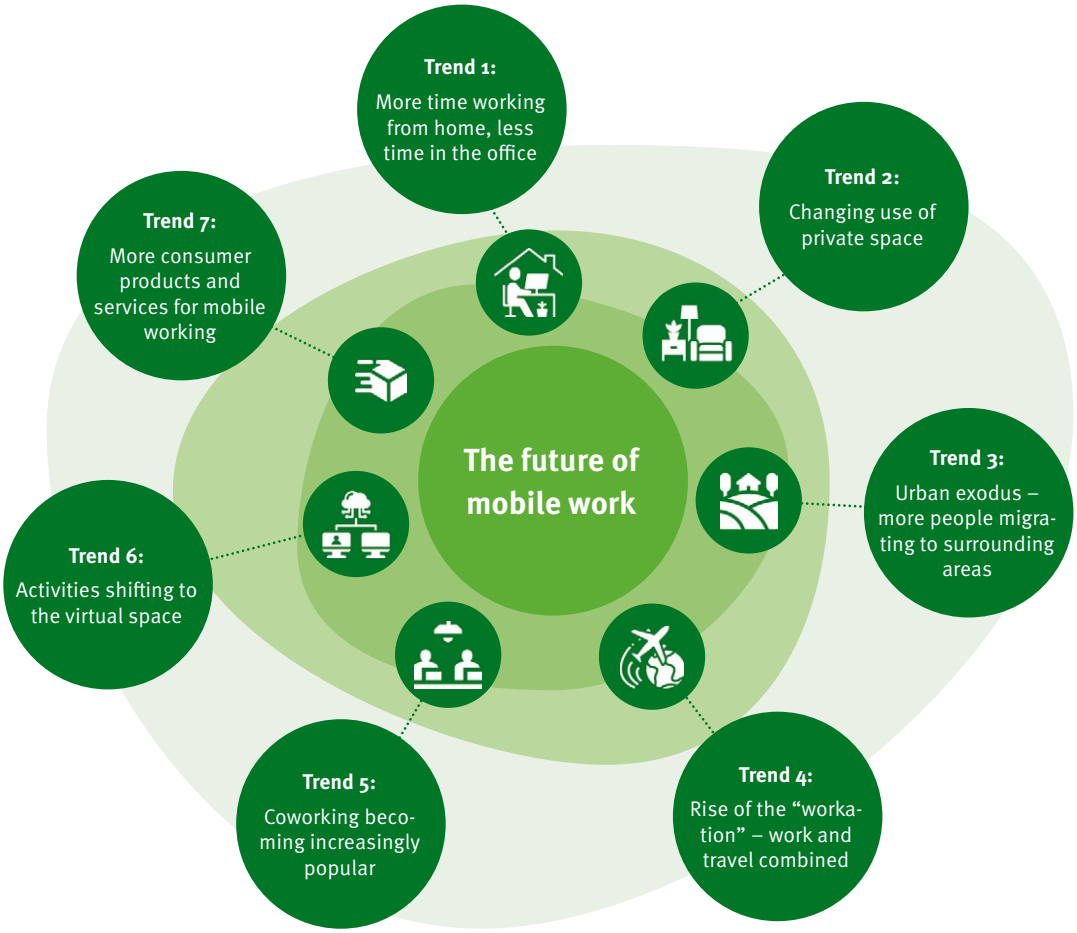
2.1 Trend 1: More and more time working from home, less time in the office

Homeworking has increased dramatically since the pandemic. This is influenced by improved technical infrastructure and applications, the willingness – or pressure in times where there is a skills shortage – on the part of companies to offer substantial homeworking, and the opportunities, depending on profession, for implementation.

Current facts and figures

Since the Covid-19 lockdowns, most companies, government organisations and educational and cultural institutions have quickly adopted homeworking and virtual meetings and events (Eurofound 2020). The potential for work that can be performed from home

Figure 1: Trends in the mobile working future issue



Source: Fraunhofer ISI, in-house graphic

varies greatly depending on the industry and company size (Demmelhuber et al. 2020) and is influenced regionally by industry structure (Alipour et al. 2021). Currently, the proportion of homeworkers is highest in the service sector (36%) and lowest in the retail and construction sectors (just under 6%). Since the end of the pandemic, the proportion of homeworkers in the economy as a whole has remained unchanged at approximately 25% of employees (ifo Institut 2023b).

Homeworking is particularly prevalent among higher-income "creative knowledge workers" (ver.di 2022). In southern and western Germany, the proportion of homeworkers is marginally higher than in other regions (OECD 2022). It is also higher in urban areas than in rural ones.

More potential for homeworking still remains, however. During the pandemic, 60 per cent of employees of German companies worked from home, compared with 40 per cent before the pandemic, according to a survey (ifo Institut et al. 2020). However, 80 per cent of the workforce have the option (ibid.). In fact, more than 70 per cent of Germans would welcome a legal right to work from home (Möhring et al. 2020).

What's changing?

The trend is reflected in the socio-economic structure of the working environment. As a result, existing differences may become more pronounced in the future. As shown in the subsequent sections, homeworking also influences the demand for office space and the mobility and consumption behaviour of employees.

- Socio-economic structure and homeworking

Despite the challenges of homeworking, such as the loss of personal and social interaction with colleagues and the difficulty of separating work and private life, almost half of all employees with experience of homeworking would like to continue working remotely after the pandemic (Ahlers et al. 2021). The trend is on the rise, as younger people in particular want more homeworking and are therefore challenging working cultures within companies.

Flexible homeworking in terms of location and time allows more people to be integrated into the labour market, such as single parents for example, because less time is needed for commuting, meaning childcare opening hours can be kept to. Many less knowledge-intensive fields of work, like production or personal services, are not (yet) suitable for mobile working, while other activities with low qualification requirements, such as gig or clickworking[1], pose risks of exploitation (Hoffmann et al. 2019).

As a result, there is a risk of a social divide based on the technical and socio-economic prerequisites for working from home, particularly based on the variables of age, gender, education, and net household income. (Bürger et al. 2021; Kohlrausch et al. 2019). Jobs that are unsuitable for homeworking may become unappealing. Creating a level playing field for everyone in the use of homeworking will thus be a major challenge in the coming years.

- Demand for space

There are already three times as many vacant offices as there were before Covid, meaning on-site workplaces are not being used to their full potential because of homeworking (ifo Institut 2023a). When workplaces, offices and communal areas become deserted, companies have to recalculate their space requirements and reduce or restructure spaces. This decreased demand for space may increase vacant property numbers in city centres and commercial districts in the long term. At the same time, private living space is being repurposed for working. Larger homes or additional premises may even be rented out for homeworking in the future.

- Mobility and consumer behaviour

If more people regularly work from home, commuting should decrease. More homeworking also has a negative impact on shops and services for everyday needs near offices, such as restaurants, hotels, hairdressers or supermarkets, which lose customers (Alipour et al. 2022). While homeworking may increase the demand for restaurants and supermarkets in residential areas, online ordering, meal delivery services and cooking

1 Clickworking and cloudworking mean work that is offered or provided via web-based platforms and performed either locally (gig work) or online (cloud work). The boundaries between online and offline work are fluid, cf. (Bertelsmann Stiftung).

at home run counter to this. In addition, the demand for home office equipment continues to rise. Many workplaces are now being equipped with resource-intensive technology in duplicate, both for the office and for homeworking.

What might homeworking look like in 2040?

There is no longer a distinction between work locations or physical and virtual presence. Work has become spatially hybrid. This applies not only to knowledge work but also to sales and assembly work or healthcare and education. Most companies have digital workspaces and only a few flexible on-site workspaces for creative group work and social interaction. These are located at the companies' satellite sites scattered in conveniently accessible urban centres, often with sports facilities and care services for children, for people needing care or for pets, and with temporary accommodation nearby. The company has become a campus. Employees who live in the surrounding area and work from home can choose from various locations for their office days, thus enhancing companies' appeal as employers and boosting employee retention.

What is the relevance for climate protection?

What does it mean for climate protection if more and more people start working from home, shifting resource consumption from the company to employees, or if social disparities increase due to homeworking, and city centre offices or entire office buildings are no longer used to their full potential or become abandoned altogether?

- Less demand for space, more for energy

The demand for office space is declining without a corresponding reduction in the demand for electricity and heat in company buildings. Homeworking could reduce company energy consumption by reducing the use of heating, ventilation, air-conditioning systems and office equipment if these are used appropriately in terms of energy consumption based on demand. However, empty offices still need to be air-conditioned and heated to a moderate degree. Sufficient air-conditioned workplaces are needed for all staff on agreed office days.

Homeworking increases household heat and electricity demand. This is especially true the more permanently and therefore comprehensively a home office is equipped with IT. Employers are already required to provide homeworkers with a laptop or desktop computer with a monitor and, if necessary, office equipment. Despite IT supply limitations, many companies met their obligations during the pandemic, but resource efficiency and energy consumption have generally taken a back seat so far (Bertelsmann Stiftung et al. 2022).

- Increasing property vacancies make climate-neutral urban development more difficult

Office space is a significant cost factor for companies and public institutions. This means that companies will try to reduce their space as the proportion of homeworking increases. As a result, more and more commercial and office buildings will become vacant, negatively impacting both the implementation of climate protection measures within urban planning as well as residential densification.

- Less commuting but no less mobility

A greater proportion of homeworking reduces commuting but does not necessarily reduce traffic and, therefore, traffic emissions. Shopping journeys that were previously made in tandem with commuting will still take place, for example. So homeworking has inverse effects on mobility. In addition, the cars being driven are becoming ever larger and heavier, and some people are opting to live further away from their workplace due to homeworking opportunities, resulting in fewer but longer commutes.

- Social inequality around homeworking, too

Important structural conditions for homeworking include disposable income and housing availability, household size and composition, home office equipment provided by companies, homeworker or commuter rates and, in addition, wrap-around offerings from nurseries, schools or care services. There are interactions between social disparities and participation in digitalisation that may be reinforced by

homeworking (Kohlrausch et al. 2019). A sense of disadvantage in relation to the opportunities and benefits of homeworking may increase political dissatisfaction and widen a social divide. This would make it more difficult for climate protection measures to be accepted in the context of mobile work.

What are the starting points for climate protection policy?

Climate protection impacts depend on the specific circumstances under which homeworking is implemented and how energy and resource consumption are managed. According to a study, resource consumption and pollutant and greenhouse gas emissions will initially continue to rise in the coming years due to the increase in homeworking (Climate Impact Partners 2021). Reductions in pollutant and greenhouse gas emissions and resource consumption can only be achieved if office and residential buildings are set up to be more energy-efficient and workplaces are operated in a more environmentally conscious manner (Öko-Institut 2022).

More time working from home, less time working in the office: opportunities & risks for climate protection

Opportunities

- Long-term reduction in companies' demand for office space and communal areas
- Innovative concepts to boost the appeal of office-based working, and therefore greater use of office spaces, through the development of New Work concepts such as coworking, spaces for social interaction ("third places") or silent work, green spaces, etc.
- Less energy consumption due to less use of heating, ventilation and air-conditioning systems and office equipment in companies
- Heating and electricity pricing increases the pressure to save energy in the workplace
- Innovative, sustainable strategies to reuse/repurpose vacant buildings in a climate-friendly manner
- Decrease in commuting

Risks

- The baseload in terms of heating and electricity demands for company premises remains virtually the same since the indoor climate within empty offices still needs to be controlled
- Increased demand for heat and electricity at home with greater and more permanent proportions of homeworking
- More vacant properties, making it more challenging for municipalities to implement climate protection measures and densification in urban planning
- Despite a decline in commuting, emissions remain high due to new shopping journeys, more delivery traffic, heavier vehicles and longer journeys

2.2 Trend 2: Changing use of private space

Using homes for working or learning has ramifications for long-term requirements for private space, investments in room set-up and technology, and on the cultural significance of space and location within society.

Current facts and figures

In Germany, household sizes are shrinking while living space per person is increasing. Increasing numbers of single-occupant households, changes in family structures, and an increase in living space with age are the primary causes (Destatis 2023a). In addition, more and larger homes are being built in Germany, so the living area per person will continue to increase (Destatis 2023b). This trend will grow as more and more people work from home.

What's changing?

Many people converted part of their homes into workplaces during the lockdowns. This gradual shift in usage has become a habit, meaning working and learning in private spaces has become the norm for an increasing number of people. People now work and study in the kitchen, living room or bedroom in addition to cooking, eating and sleeping there. Colleagues and clients gain opportunities to see into private spaces, furthering the shift in society's attitude towards privacy. Inspired by social media, homeworking is becoming increasingly professionalised in terms of choice of background decor, camera position and IT equipment. As a result, private demand for attractive office furniture, lamps and IT equipment is rising sharply (Die Presse 2020; Forschung und Wissen 2020) and more and more furniture manufacturers are incorporating homeworking into their product lines.

Like industrialisation in its era, which had far-reaching effects on housing construction, settlement development and transport and support infrastructures due to the work-life separation (Häußermann et al. 2000), the integration or separation of working and living due to the establishment of location-flexible working may have long-lasting effects on the arrangement of living spaces by function and on settlement composition and infrastructure.

What might the use of private (living) spaces look like in 2040?

For the majority of people, the once-common spatial divide between work and private life has disappeared, since they frequently work from home. They have set up an extensive home office with professional equipment and meet with coworkers and project partners via video or as avatars in the virtual 3D workspace. This trend is also reflected in how living spaces are furnished and designed. Rooms have movable partitions and living islands for relaxation, socialising or focused work. With the advent of homeworking, existing living spaces were reorganised or subsequently extended so people could feel comfortable while working at home.

What is the relevance for climate protection?

The long-term change in the demand for and use of space due to mobile working is relevant for climate protection because it will continue to change the energy demand in homes, the demand for resource-intensive technology and facilities, and the demand for living space in general, in addition to bringing about socio-demographic changes.

- Increasing land use for housing

The increasing integration of workspaces into private homes results in either an increase in land use density (if the space remains the same) or an increase in the space requirements per person (if the space is expanded, e.g. by renting additional premises), thereby exacerbating the already increasing land use for housing.

- Increasing energy demand for IT, heating and air-conditioning

As the expansion of space per person continues, more space and land will need to be supplied with energy. In the short-term, the population's energy-saving behaviour due to the price changes for electricity and heating and potential supply bottlenecks caused by the Ukraine war may reduce the climate impact of homeworking, but in the long-term, the energy demand will continue to rise due the development of ever-more-powerful IT.

- More investment in IT and equipment

For more and more people, setting up their home office is becoming part of their lifestyle. More money is being invested in home office furnishings, IT equipment and comfort. These investments in living and working spaces influence private resource and energy efficiency many years ahead, and poor purchases of inefficient devices with long service lives negatively impact environmental footprint. This demand may, however, also drive innovation towards sustainable products, for example, climate-neutral IT, electrical appliances or multi-functional furniture.

- Housing and urban planning for an increasingly mobile workforce

In future years, huge investments will be needed in housing construction to repurpose and renovate existing buildings. In addition to socio-demographic trends, the increase in mobile work, especially homeworking, will also drive change in the demand for private space.

What are the starting points for climate protection policy?

Mobile working can only have long-term positive effects if the demand for space does not continue to increase as it is currently or to even double, but is instead reduced through new room design concepts and if the living spaces and buildings are fitted out in a manner that respects the climate.

Changing use of private space: opoortunities & risks for enviroment protection

Opportunities

- Private investment and consumption may spur innovation in the sustainable products sector, particularly in the areas of low-emission IT, electrical appliances and multi-functional furniture.
- Engage urban planning, construction and real estate management ahead of time in long-term changes in the demand for (private) space
- If home offices can be run professionally and efficiently, it could reduce the demand for office space.

Risks

- Purchasing new home office furniture and IT equipment to improve comfort and convenience increases resource and energy consumption (for production, distribution and use)
- Danger of companies and employees setting up duplicate offices both at home and in the workplace
- Residential construction using more resources and space due to the rising demand for home office space
- Rising household energy consumption and environmental footprints as a result of increased use of electricity for IT, heating and air conditioning due to homeworking

2.3 Trend 3: Urban exodus – more people migrating to surrounding areas

There is a growing correlation between the increasing urban-to-rural migration in many parts of Germany and the rise of mobile work. Many small and medium-sized cities and rural communities on the periphery, especially those struggling with structural change, are seeing their populations decline (BBSR 2020; Hollbach-Grömig et al. 2012). This further exacerbates the existing regional disparities in German settlement patterns. However, there are indications that life "in the countryside" is once again gaining appeal, as more people are leaving inner city neighbourhoods for those on the outskirts or for surrounding rural areas (Kollenbroich et al. 2016; Schubert et al. 2021). This is due to a combination of factors, including socio-economic changes like the rising cost of living in inner cities or the desire for a life closer to nature, and the opportunities presented by mobile working. Urban exodus trends have an impact on the existing causal relationships behind ongoing rural population decline (rural exodus) and may even present opportunities for rural areas.

There is a trend in affluent communities towards having a weekend bolthole in the countryside and thus living across two (or more) locations. However, due to rising housing prices, this so-called multi-local living will likely remain limited to a smaller group in the future.

Current facts and figures

If homeworking means fewer people having to commute every day, this will also influence where individuals choose to live. For example, 21% of professionals would relocate if they could work primarily from home in the future, with this desire being strongest among younger professionals (Bitkom). Contributing factors to the increased migration to the countryside, alongside temporary relocation during the lockdowns, include in particular the rising cost of living in inner cities, as well as the desire for a life closer to nature for the family, and a better work-life balance through working from home (ebd.; Schroeder 1991).

What's changing?

The longer the commute, the more appealing homeworking becomes. The growing popularity of working from home and of relocating to the suburbs and rural areas are thus mutually reinforcing trends. Despite a reduction in commuting to work due to homeworking, individual transportation will increase at first if more people live on the outskirts of the city or in the surrounding areas. This is especially true in areas with inadequate or non-existent supporting infrastructure such as shops, services or doctors' surgeries.

More people relocating to the outskirts or surrounding areas may help revitalise these areas or settlements that have been declining in population. Infrastructure and services for mobile working, such as coworking spaces, can make areas surrounding the city more appealing as places to live and work. This may in turn benefit local shops and services. Taken together, this could reverse the rural exodus trend prevalent in certain regions of Germany.

What might living in the areas surrounding the city look like in 2040?

Some cities have successfully implemented the urban development "plait model" to combat urban decay. From the heart of the city to the surrounding areas, the plait model seamlessly integrates living, work, mobility and recreation. City centres here are transformed into neighbourhoods for climate-neutral living. City museums, libraries and civic centres provide public spaces for learning, working, culture and entertainment. A climate-neutral, multimodal transport network connects the city's neighbourhoods to the settlements and recreational facilities in the surrounding areas. Everyone can afford to live close to nature on the outskirts of the city, where there are plenty of jobs, shops and activities to choose from. Living outside of cities has become increasingly appealing but also more expensive. Attempts to integrate the living spaces within cities have failed, so people are leaving for the nearby surrounding areas due to high rents and living costs. Supporting structures and services go with them. These cities complain about deteriorating city centres, unmanageable infrastructure costs, huge commuter flows between the suburbs and social disparities.

What is the relevance for climate protection?

Population growth in the suburbs and surrounding areas affects the use and state of the environment,

energy consumption, and greenhouse gas emissions (UBA 2022). Energy consumption and greenhouse gas emissions can be greatly reduced in dense, mixed-use settlements that are connected to public transport and cycling networks, feature energy-efficient buildings, and use renewable energy sources. However, the opposite is true for sprawling, low-density settlements that rely heavily on private motor vehicles for transportation. This is why environmentally sound and climate-friendly urban and spatial development is essential for achieving the climate goals.

- Increased mobility due to longer journeys

The further away from cities people move, the longer their journeys become and the more they rely on private vehicles for shopping and commuting. This is due to the generally inadequate public transport connections in rural areas and the high value placed on private transport in many communities. Over the coming years, ageing combustion vehicles are predicted to continue to be used as second cars alongside newly acquired electric vehicles (Expertenrat für Klimafragen 2022). This would undermine climate protection efforts, and the quality of life for those living near the roads into and out of cities would suffer.

- Increasing social disparities due to differences in environmental footprint

If individuals who can afford it prefer to live further and further away and work from home, and have to drive longer and longer distances in their cars for errands, this increases their consumption-related environmental footprint. This widens existing social disparities in the area of climate protection, too.

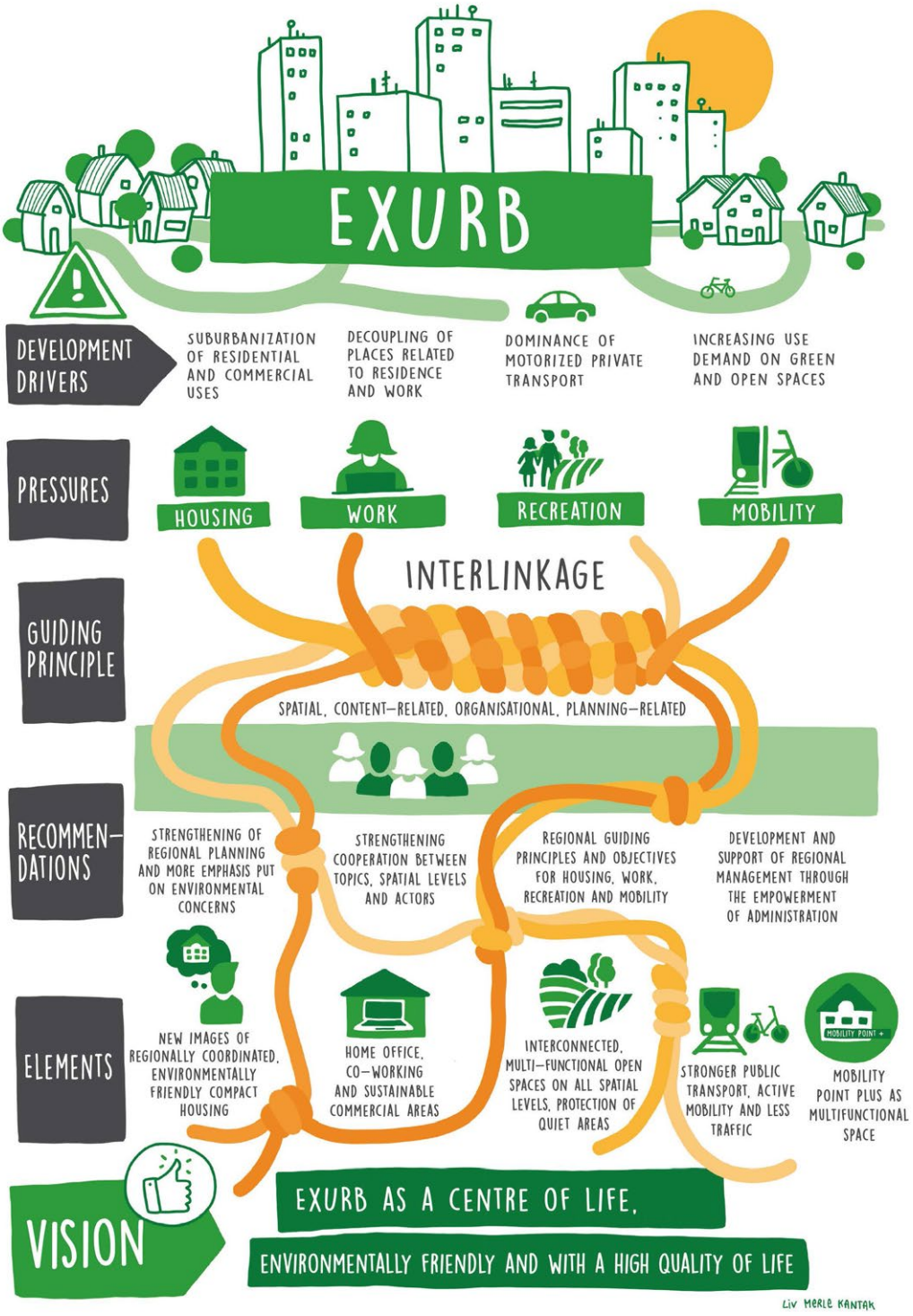
- Increased pressure on ecosystems

The trend towards choosing a primary or secondary residence in the countryside increases land consumption, overdevelopment of the landscape, soil sealing and traffic emissions. The impact on natural ecosystems, which are desperately needed for (natural) climate protection, is compounded by the concurrent rising popularity of outdoor leisure activities.

What are the starting points for climate protection policy?

The plait model (Schubert et al. 2021) represents settlement structures that link the areas surrounding the city to the city centre in the form of a three-stranded plait *(Fig. 2)*. In this model, environmentally friendly transport services are created to connect the city centre's supporting and cultural services to the residential settlements, business districts and recreational areas on the outskirts of the city. This enables cities and municipalities to lower their residents' carbon footprints while maintaining quality of life. The options for living, working, recreation, leisure and mobility are developed in a climate-friendly, socially sustainable manner in partnership with residents.

Figure 2: Plait model “Umlandstadt”



Source: UBA (Schubert et al. 2021)

Urban exodus - more people migrating to sourrounding areas: opportunities & risks

Opportunities

- Mobile working as a means of reducing commuting and increasing the appeal of the surrounding area as a place to live
- Greater demand for dense, mixed-use settlements connected to public transport, more energy-efficient buildings and renewable energy sources (plait model)
- Develop, test, and adapt climate-neutral and socially sustainable solutions for living, working, recreation, leisure, and mobility in partnership with citizens and local businesses and more in keeping with needs and demands (e.g. by creating discussion forums or implementing cross-disciplinary research projects in settlements and residential neighbourhoods)

Risks

- The further away people live from urban centres, the longer their journeys are for essential errands and doctor's appointments and so on, and the more frequently they use their cars.
- More sprawling, low-density settlements that rely heavily on private vehicles for transportation result in increased energy consumption and emissions
- Second homes in rural areas increase land consumption, overdevelopment of the landscape and traffic emissions
- Spatial expansion and soil sealing increase pressure on natural ecosystems
- If living in the surrounding areas grows more expensive and exclusive, it could exacerbate existing inequalities. This would make implementing community-based approaches that rely on cooperation and solidarity more challenging.

2.4 Trend 4: Rise of the "workation" – work and travel combined

The term "workation" is a neologism formed as an amalgam of the words "work" and "vacation". The expression signifies the trend of combining work and travel, frequently long-distance travel abroad, and is related to so-called digital nomadism. It was this phenomenon that gave rise to the workation during the lockdowns, and the trend has continued since (Gontek 2023). Other influencing factors include the digitalisation and virtualisation of work processes, low-cost air travel and package deals, and social media campaigns featuring influencers in workation destinations. Consequently, although some people travel less due to Covid constraints or prefer to avoid long-distance travel for environmental reasons, another group of primarily young individuals without family ties increasingly combines travelling the world with working.

Current facts and figures

Popular workation destinations, according to providers and online forums such as Nomad List and Workation.de, include Canggu in Bali, Mexico City and Lisbon, where the current increase in the monthly influx of up to 12,000 foreigners is attributed to this trend (Hemmersmeier 2022) and the local population is already protesting against it (Hindelang 2023). Working from abroad is subject to income tax, VAT and insurance constraints, meaning it is not available to all employees and is not permitted in all locations or countries. Workations are not yet regulated by German labour law either (Fiebelkorn et al. 2023).

What's changing?

The workation is a fast-moving trend with different destinations hyped in different seasons. This can exacerbate gentrification in affected cities and the displacement of locals in smaller towns due to short-term rentals (Airbnbs, etc.), thus increasing rents and the cost of living. Cities like Barcelona and Lisbon have already taken steps to curb the trend. Other locations, particularly holiday destinations, have adopted the workation for their resort marketing and use suitable infrastructure and package offers to advertise. Indonesia offers a visa with tax exemption for digital nomads and justifies this as encouraging a shift towards more sustainable long-term tourism (Hughes 2022). Travel companies have also recently discovered the workation market, and there are coworking providers that allow their users to switch between spaces in different cities. Over the next two to three years, the workation market for various target groups is expected to become differentiated based on travel budget and lifestyle. Offerings boasting sustainability certification for environmentally conscious employees or workation chains offering childcare services for families are also conceivable. Whether the workation is simply a niche trend or an early sign of a long-term shift in the structure of work remains to be seen. These first commercial offerings are, however, a sign of the travel industry's optimism.

As the workation gains in popularity among younger people, more companies will seek to boost their appeal as employers by providing workation opportunities. This means that the workation has the potential to attract skilled international workers to German companies.

What might the workation look like in 2040?

In 2040, the workation option is an important criterion for many employees when choosing a job, and not just for younger people without children. If the salary is sufficient, then a round-the-world working trip "chasing the sun" begins. At the same time, the costs of flights and living in safe workation destinations have skyrocketed. Many families with school-age children use the school holidays to take workation trips, allowing them to continue working remotely while on holiday. Consequently, there are numerous specialist workation providers, depending on travel budget, supporting programme and location. Workations are legally regulated, imposing labour law and tax limits on working from abroad. As a result, the workation has emerged as an important business area for Germany's tourist regions to ensure year-round occupancy and skilled worker recruitment. The regions have expanded their infrastructures to include digital offerings and virtual worlds, making them more desirable places to reside permanently.

What is the relevance for climate protection?

What does it mean for climate protection when a growing number of employees, particularly younger ones, prefer to work temporarily or permanently away from their company's headquarters or even travel the world to do so? The trend is based on pronounced mobility and rapidly commercialised tourism offerings in the global competition between destinations.

- Gentrification and the exacerbation of social disparities

The danger of gentrification in cities due to the workation is significant, including in German cities. The displacement of people to the outskirts of cities and towns as a result of rising living costs (particularly for housing) exacerbates social disparities in housing conditions and, by extension, attitudes toward climate change and acceptance of climate protection measures.

- Air travel-related emissions

Extreme forms of mobile working across varying sites are a cause for concern in terms of climate-damaging transport emissions, particularly if travel to the destinations is by air. Greenhouse gas emissions from flights are particularly detrimental, and their proportion will continue to climb due to the escalating volume of air travel (EEA 2022). Long-haul trips are more harmful than flights within Europe. There are also alternative, lower-emission modes of transport between European cities, e.g. trains rather than short flights. Consequently, both long-distance and short-distance flights have a comparatively large environmental footprint.

- Expansion of transport infrastructure and local settlements

Fitting the profile as a workation destination requires roads, airports, motorways and settlements developed to a high standard, with the resulting long-term environmental consequences and implications. Forests are cut down and natural habitats destroyed.

What are the starting points for climate protection policy?

More workations means more traffic emissions and social and environmental burdens on destinations, and increasing risk of a two-tier society comprising people whose jobs and contracts allow them to take a workation and those whose job, contract or travel budget does not permit it. The workation concept also, however, opens up opportunities for sustainable innovations in tourism and in settlement and transport policy.

Workation: opportunities and risks for climate protection

Opportunities

- Sustainable business models for climate-neutral workations create sources of income for residents
- More sustainable mobility offers for workations
- The sustainable workation as a location factor for holiday destinations, including in Germany
- Offers designed to boost the appeal of companies to skilled workers

Risks

- Risk of gentrification of districts, in other words, the displacement of residents to the outskirts of the city or town due to rising living costs
- Reinforcement of local and global social inequality and its impact on climate protection
- Climate-damaging emissions from air travel
- Environmental and climate impact due to new transport infrastructures and settlements
- Umwelt- und Klimafolgen durch neue Verkehrsinfrastrukturen und Siedlungen

2.5 Trend 5: Coworking becoming increasingly popular

New Work refers to flexible and decentralised working structures and models such as homeworking or hot-desking along with the design of corresponding workplaces. One characteristic of the New Work model is flexible working with the temporary use of spaces alone or in groups. At the core of coworking lies the fact that numerous individuals from different disciplines and sectors work together with one another but not alongside with one another. Coworking spaces address this need. They enable flexible working in terms of time and location outside of a company and one's own home, along with opportunities for social exchange and project-related collaboration (BMWi 2017; Coworking Guide).

The digitalisation of knowledge-based activities such as office work, design, research, development, and consultancy, and the accompanying flexibility in terms of working hours and location, are driving the coworking trend. Coworking spaces are becoming increasingly popular as urban workspaces for open innovation, open interaction, and inspiration for start-ups and creatives. They also profit from the growing need for a better work-life balance. The trend's implications include, on the one hand, the spread of mobile working as a result of the availability of new, distributed work locations and, on the other, new options for individual work structuring as well as co-working offerings as a location factor.

Current facts and figures

Many, especially younger, people are rebalancing the time and location flexibility of their jobs. A shift in priorities is emerging here (Bertelsmann Stiftung et al. 2022). Coworking spaces provide flexible, temporary offices for rent with a shared infrastructure that typically includes IT and office equipment, a reception, and communal amenities such as a kitchen, café, and meeting rooms. There are presently around 600 such locations in Germany, predominantly in major cities, with the largest supplier alone operating 92 spaces in 23 cities (BVCS; Schoppe et al. 2022). However, the majority of renters in Germany are still large corporations (Breuer 2019), followed by start-ups and self-employed individuals, particularly from the software and games sectors or the creative industries, and, occasionally, employees and students who rent private workspaces (Grevenstein 2020).

What's changing?

Coworking space users are regarded as mobile work pioneers. If the trend continues, an increasing number of people may use a coworking space instead of a home office (BMEL et al. 2022), for example if they do not want to work at home or if they miss the social contact and interaction that occurs at work. Coworking spaces benefit from structural changes in city centres by providing an opportunity to revitalise and thereby boost the appeal of city districts. Coworking can foster innovation by allowing people with different knowledge to connect and discuss ideas across disciplinary boundaries. On the other hand, there is the risk of gentrification, which occurs when an influx of wealthy investors causes rents to rise, making them unaffordable for established companies or residents. However, there are also an increasing number of coworking offerings in rural areas. These are often self-organised, for example, as cooperatives for the shared use of infrastructures (ibid.). One risk is the eroding of the boundaries around work as it becomes more flexible, since many of these sites can be used late at night or around the clock. This makes it difficult to separate working and non-working time.

What might coworking spaces look like in 2040?

Many employees work permanently or predominantly in coworking spaces in their neighbourhood, either in free public coworking spaces such as libraries, theatres, or museums or in commercial co-working facilities. Because of shared infrastructures and resources, working there is less expensive than renting your own office space on a daily, weekly, or monthly basis. The self-employed, employees on workations, pupils, students, and those in mobile employment all come together from their many different backgrounds in a creative environment with attractive surroundings. They can expect powerful IT equipment, versatile furniture and workspaces, a canteen and shopping facilities with local suppliers, and creative interactions with other users, including in the courtyard beer garden after work. The majority of companies now have workstations in leading coworking providers' spaces across various regions, in addition to a few workstations at their main site. They benefit from lower costs due to the density of workstations and shared infrastructure and energy supply, and

can offer their employees workspaces close to home or even abroad. Most coworking providers are committed to sustainability and meet the required standards, including the provision of certified organic food and drinks. Many coworking spaces also view themselves as communal experimental spaces for sustainable living and working, with juxtaposed agriculture and kitchen gardens.

What is the relevance for climate protection?

The impact of coworking spaces on climate protection depends on the energy efficiency of the workspace equipment and the building and the energy consumption habits of the coworking space users.

- More efficient use of building energy

Compared to homeworking or partially used office space, the high density resulting from the concentration of more workspaces and the shared use of rooms and infrastructure holds significant potential for energy savings. This lowers the carbon footprint of the work – both for self-employed and private individuals who see coworking as an alternative to homeworking, as well as for businesses, which have to keep and consume energy for fewer premises.

- More energy-efficient workspace equipment

A broadband internet connection and WLAN are essential components of coworking spaces. Because of the increasing performance of the technology, the resource needs for end devices and the energy requirements for their use will continue to climb. Therefore, energy and resource-saving products are crucial for cost-effective operation.

- Alternative to vacant city centre properties

The demand among coworking providers for large, flexible spaces can present municipalities with an opportunity to address vacant properties in city-centre commercial spaces and the decline in the demand for offices from businesses. This includes the possibility of creating supporting offerings, for example, grocery stores, cafés and canteens, or childcare or sports facilities near the coworking spaces. Since coworking will not be limited to office work but will also offer attractive opportunities for trades and small manufacturing businesses, creating coworking locations also represents an opportunity to implement local solutions for climate-neutral business and work, in which different parties, including local residents, can participate.

- Coworking spaces as hubs for practical climate protection

Some coworking spaces have already positioned themselves as a hub for practical climate protection by consistently adopting sustainable solutions, ranging from their construction and energy supply to catering and further training opportunities for sustainable business models and lifestyles (Dammann 2022).

What are the starting points for climate protection policy?

Coworking spaces are business models for mobile working and, at the same time, places for collaboration and innovation – and climate protection. Given their potential for sustainable repurposing of vacant properties, they provide excellent starting points for climate protection in both urban and rural areas.

Co-working: opportunities & risks for climate protection

Opportunities

- High office density and shared infrastructure use have the potential to cut energy consumption and reduce commuting times. The carbon footprint of working is reduced as a result.
- Spaces need to be equipped with resource-intensive IT and network infrastructure. However, due to the density of workspaces, this can be more efficient at full capacity.
- During repurposing for coworking, the conversion and renovation can be done in accordance with the latest climate protection standards, for example with storage heaters, a renewable energy supply and insulation.
- Coworking providers have the autonomy to set their own climate protection and sustainability standards, e.g. in terms of interior design, electricity, heating and mobility options.
- As hubs for practical climate protection and sustainability, coworking spaces are hives of creativity, inspiration and experimentation and contribute to knowledge sharing.
- City centres can be revitalised and the tide of vacant properties turned by the provision of supporting and entertainment facilities, shops, cafés and childcare services, etc., that residents, too, can be involved in.
- The coworking approach is also ideal for industries such as trades and small-scale manufacturing, with considerable potential for climate friendly use of space and land.

Risks

- Excess coworking spaces may result in new vacant properties.
- Long-lasting coworking new builds and renovated properties do not meet rising climate protection standards in the future.

2.6 Trend 6: Shifting of activities to the virtual space

Digitalisation, with its increasingly interconnected virtual platforms and services, is the driving force behind the rise of mobile work. In the next two to three years, we may see a new level of virtualisation thanks to cross-application platforms and mass-market technologies for virtual and augmented reality (VR/AR). Along with the spread of VR/AR technologies, other factors such as the necessary user skills, societal needs, power struggles between platform operators, and structural conditions such as market regulation, data protection, and data security are all factors influencing realisation of this. The trend has implications for the development of business models in the virtual world, the need for physical office and floor space for companies, the energy and resource needs of the digital economy and society, and the cohesiveness of a society increasingly divided between the physical and the virtual.

Current facts and figures

The range of applications in virtual and augmented reality will increase in the coming years. The mass market for online games, e-sports and AR-capable consoles will be one driver of this (Rixecker 2021). As more and more people become accustomed to the technology, new areas of application will emerge, such as trying on clothes virtually, machine maintenance or medical procedures. The major platform providers are currently jockeying for the position of becoming the go-to for connecting previously separate platforms and services into a seamless virtual ecosystem. Familiar examples include Microsoft's Teams, Google Drive, and the Facebook group's attempt to rebrand itself as a cyberspace company by changing its name to Meta (Shen et al. 2020).

The popularity of 3D games and the rapid spread of virtual tools during the pandemic indicate that people may be open to doing more of their work virtually in the future, in other words, not just at home or

on the go but also within a virtual 3D environment. Whether and when the technologies will become widely available, how this market will be regulated and which companies will be able to establish a long-term presence in the market are all open questions.

What's changing?

The corporations are trying to create a digital, three-dimensional environment where people can come together to play, shop, work, meet up or even attend concerts (NVIDIA). The companies' visions here are similar to the virtual worlds in online games (Criteo 2022), with the key difference being that instead of multiple fictitious worlds that exist today, ultimately there will be only one, with real people, processes and activities "moving in" over time (Höfler et al. 2023). High-end fashion and automobile companies are among the first to test their presence in virtual game worlds for market research and marketing purposes.

Due to the massive demand for computing power and costly equipment required for virtual realities, such as VR glasses, experts do not anticipate a highly developed digital world until 20 years from now at the earliest (ibid.).

What might living and working in the virtual world look like in 2040?

The world of work in 2040 is a hybrid one, where the physical and virtual levels overlap, expanding the physical realm of experience and adventure. People wear data glasses to work in virtual worlds, for example to attend conferences and develop products in teams. Working life is simulated within the virtual space, making it possible to visit the virtual version of a neighbouring business partner, conduct official business, or travel to other places. Large corporations and technology companies maintain virtual premises where employees can check in from any physical location with their avatars. The building is rented in a virtual world where the majority of the company's clients, suppliers and partners can be met. Employees do not all enjoy a 3D experience because devices such as 3D glasses, which are costly due to the shortage of raw materials, are not available to everyone, and the energy costs of IT and 3D applications place a significant burden on household budgets. With so much focus on virtual worlds, fewer resources are invested in equipping the analogue world, meaning the traditional office has all but disappeared.

What is the relevance for climate protection?

Climate protection relevance is evident in the demand for raw materials for VR and AR technologies, the energy requirements to use and operate the platforms and the required infrastructure. The trend furthers the spread of mobile work, with all its associated climate implications and social inequality risks. The long-term physical effects of immersion in virtual worlds and the abstraction of experiential environments, e.g. on the perception of real threats such as climate change and the willingness for collective action, remain largely unexplored. Nevertheless, there are opportunities to leverage VR technologies and simulations to reduce physical mobility and promote the understanding and implementation of climate protection.

- Greater consumption of raw materials and energy to manufacture the hardware

For virtual worlds to become suitable for everyday use, the technical equipment to use them needs to become increasingly powerful and comprehensive in the coming years. VR and AR technologies rely on a number of critical raw materials. Mining and distributing these has a negative impact on the environment and climate in various regions of the world. There is also evidence to suggest that, in the next few years, geopolitical conflicts will increasingly limit the availability of raw materials for manufacturing. It is therefore crucial to consider the environmental and climate impact of VR/AR technologies across their whole life cycle.

- Increasing energy requirements for use

The operation and use of virtual world platforms are expected to be extremely energy intensive. As people use online services for longer periods and at a higher intensity, their energy requirements will also rise. This is true both for personal and business use.

- Investments in maintaining a virtual-world presence

If ever more companies and public institutions want to establish a presence in virtual worlds, they will need to invest in the relevant technical infrastructure and in virtual design and architecture to show themselves competitive and provide their employees (and, in some cases, customers) with the necessary IT and software. In terms of resource consumption and opportunity costs, this will pose major challenges for small and medium-sized enterprises (SMEs) in particular if investments in virtualisation are prioritised over the climate protection transformation.

- Opportunity to promote climate-friendly behaviour

VR and AR technologies provide an opportunity to promote climate-friendly behaviour. Awareness of the consequences of people's own actions can be increased through "experiencing" and seeing those effects in serious games. However, there is also the argument that engaging in too many virtual experiences can limit people's ability to relate directly to the real world ("nudging", cf. (Hentsch 2020; iwd 2022).

- Simulation within the construction industry, urban and spatial planning and design for greater climate protection

In industries such as architecture and design or engineering and construction, simulation can be used to

Shifting of activities to the virtual space: opportunities & risks for climate protection

Opportunities

- 3D applications boost the spread of mobile work in industry and other sectors. This may lead to the creation of new jobs and greater integration in the labour market.
- The long-term migration of activities into 3D worlds could reduce the demand for physical space and consequently lower resource and energy demands, with implications for the construction sector, urban and settlement planning, mobility and housing (over the long term, 2050+).
- Use of serious games to promote climate awareness and climate-friendly behaviour.
- Support of the development of sustainable buildings and urban, settlement and transport planning via simulation, thereby preventing planning and investment errors.
- If mobile working is in the future established as equivalent to analogue working, then there will be no need to maintain physical office space, and mobility can truly be reduced.

Risks

- The need for increasingly powerful technologies increases the requirement for critical raw materials. Mining and distributing these is harmful to the environment, and their availability is limited due to geopolitical conflicts.
- The operation of virtual-world platforms is extremely energy intensive and associated with high emissions.
- Users' energy consumption rises as their time spent using online services grows in both duration and intensity.
- Expensive equipment reduces equal opportunities to access and participate in the virtual world.
- High capital expenditure requirements bolster the market dominance of global corporations.
- Potential effects of immersion in virtual worlds and the abstraction of experiential environments on the perception of real threats such as climate change.

help develop sustainable buildings and urban environments that take into consideration the future mobile working world, thereby preventing planning and investment errors.

What are the starting points for climate protection policy?

The trend towards a massive increase in virtual 3D applications acts as a driver of the mobile working trend and thus also of the change in demand for office space with effects on the real estate market, urban and settlement planning, mobility behaviour and the choice of where to live.

2.7 Trend 7: More consumer products and services for mobile workers

The pandemic has caused a general shift toward consumption at home (HDE 2022). This is especially true of consumer behaviour during lunch breaks, meals at lunchtime and shopping trips before or after work (Der Spiegel 2023). Apart from the digitalisation of all areas of society, the increase in delivery and streaming services and homeworking are key factors influencing this trend. This has long-term financial implications for retail, catering, art and culture and social repercussions as fewer people meet each other in breaks or after work in restaurants or at events.

Current facts and figures

Homeworking reduces commuting and therefore shopping opportunities on the way to or from work. It also eliminates eating in the canteen or at restaurants near the office. Shopping, once done on the way to work or during breaks, is increasingly done from home and online, e.g. via meal delivery or streaming services. The increase in delivery services, the establishment of homeworking and the reduction in business trips are stabilising the trend. This consumer behaviour was trialled during the lockdowns when eating out and shopping elsewhere were no longer possible. Around 90% of online shoppers anticipate ordering even more online in the future (Bitkom 2020).

What's changing?

The transition to working from home is having various impacts on consumption. There are no indications of a decline in consumption overall. On the contrary, it may continue to rise due to the convenience of ordering online.

Delivery traffic continues to increase globally for value chains and consumer goods ordering, and locally for shopping, food ordering and services.

Local businesses, service providers and restaurants in office districts and city centres will be forced to close unless they can adapt their business models and retain their customers. Restaurants are shifting to delivery services, and service providers are offering home visits or video calls instead of practice appointments during lunch breaks. Other suppliers are responding to this trend by experimenting with multi-channel concepts that use shopper profile data to personalise products and allow users to search for and try out them online and pay for them and have them delivered in just a few clicks, whether at home or in store. If the trend for increased orders to the home office or other changing workplaces continues in the long term, then both businesses in office districts and shops in urban residential areas will be affected. This will lead to more vacant properties in city districts and a decrease in quality of life. Furthermore, the space required by the remaining shops will decrease, further reducing local customer footfall.

What might consumption look like in 2040?

Many services such as city or village nurseries, snack bars, cafés and restaurants serving lunch are provided directly in residential districts and settlements which are just a stone's throw away from the home office or coworking space. Popular family restaurants, small artisan shops and service providers are adopting socially and environmentally sustainable business models within a minimal-radius circular economy. This also includes the widespread use of 3D printing at home or in nearby coworking spaces. Most people place a high value on local products and fair prices. Shoppers use reliable circular economy and climate neutrality quality seals for guidance. Working alone from home is monotonous and unhealthy in the long term. For many people, then, it is important to be actively involved in their neighbourhood, associations and other communities in order to keep up social connections and participation. Despite this, many people are lonely and struggling with health-related and social repercussions. Even after working hours, the virtual worlds in 2040 entice users to lose themselves in gaming, consumer or holiday worlds. The sustainability transition is hampered by the fragmentation of society due to filter bubbles in social media and poor physical and mental health across all segments of the population. Promoting climate-friendly consumption habits remains a major challenge for local and federal policy.

What is the relevance for climate protection?

- Emissions and packaging waste from the transportation of goods

It is not only the production of goods and services that releases significant quantities of climate-damaging greenhouse gases into the atmosphere, but also their transportation. Furthermore, the amount of packaging needed for individual home delivery is higher than for delivery in bulk to physical retailers. Currently, most packaging is made from cardboard and plastic, causing harm to the environment.

- Shifting patterns of energy use and waste generation

Energy consumption, emissions and packaging waste shift to the home when goods are ordered from home instead of being purchased in store or when meals are delivered or prepared at home instead of being eaten in the canteen.

- Opportunity for local, sustainable consumption

Consumers influence sustainability and environmental protection through their purchasing decisions, particularly by selecting products made from sustainable materials manufactured in accordance with circular economy principles, in other words, which strive for a reduction in resource consumption and waste, and for durability, repairability and recyclability (reduce, reuse, recycle). For the transition to a circular economy to be successful, it must be implemented on a large scale, especially locally and regionally, to support local businesses and keep transport distances short. However, consciously sustainable, climate-friendly consumption is frequently accompanied by greater initial costs, making it considerably more challenging for those with lower incomes to implement. The higher purchase costs of durable products can only be financially amortised across their whole life cycle.

- New circular business models for mobile workers

The circular economy entails minimising resource consumption, avoiding waste, and the durability of products and materials. This is not consistent with conventional business models based on increasing sales. Instead, concepts such as swapping and sharing, repair services, product-as-a-service, remanufacturing, upcycling or recycling are needed (Ballinger et al. 2020; EEA 2023; Gillabel et al. 2021). There is significant potential for circular business models across all industries, particularly in climate-sensitive trades and small businesses.

What are the starting points for climate protection policy?

As one of the main trends within the mobile working future issue, greater consumption at home is closely linked with the other trends, such as increased individual transport due to suburbanisation or equipping multiple workplaces as a result of more frequent homeworking. All of these require more circular business models for climate protection (PwC).

More consumer products and services for mobile workers: opportunities & risks

Opportunities

- Huge long-term need and potential for circular economy business models across all sectors and industries, particularly trades and manufacturing
- (Re)activating local economies due to the focus on short delivery routes and regional products
- New business models for local climate-friendly consumption within homeworking, particularly a preference for local or regional producers and reusable packaging for products made from sustainable materials with a long service life

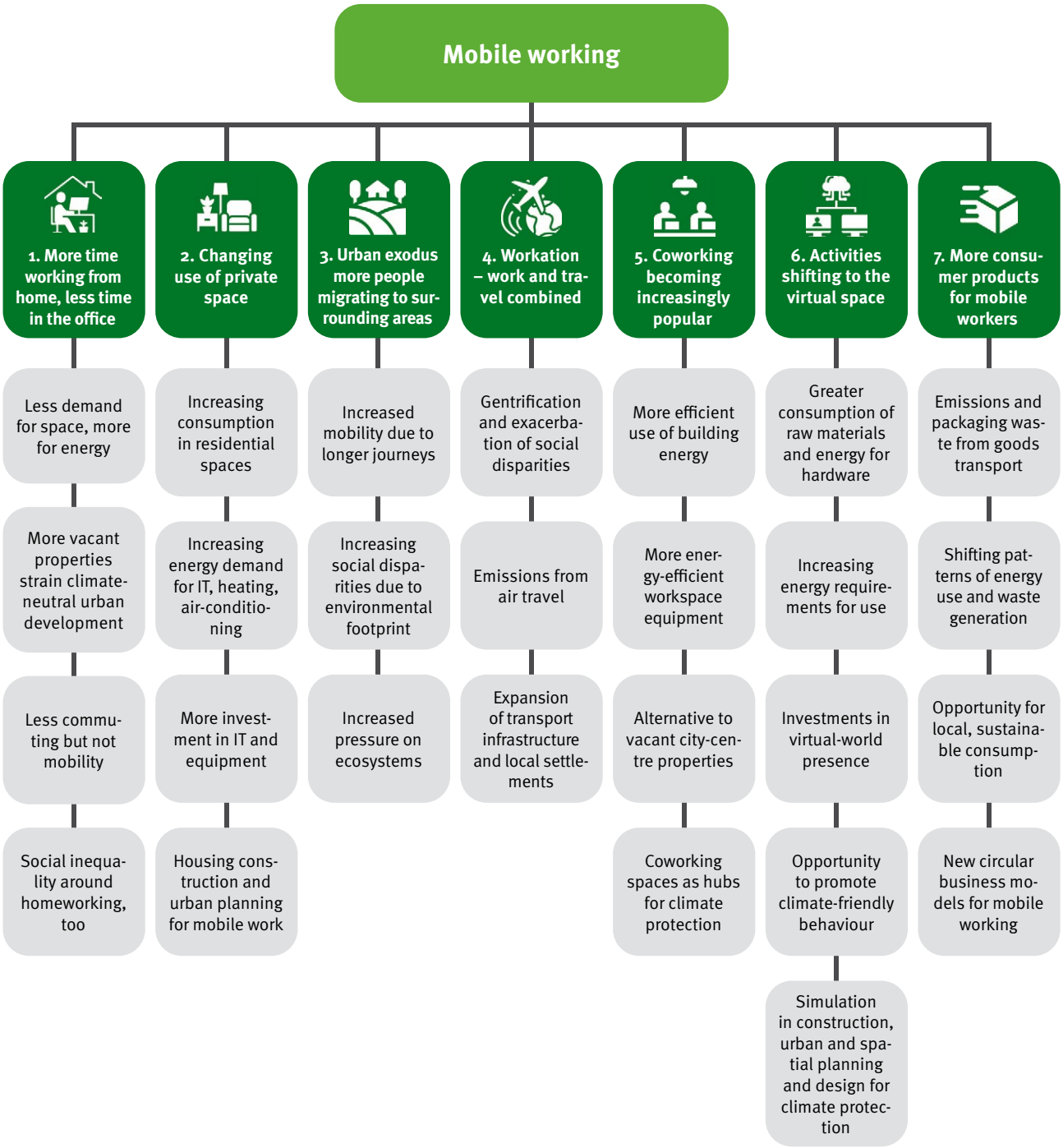
Risks

- Greater consumption due to the quick and convenient availability of products
- More unsustainable delivery traffic with high emissions and more packaging waste
- The production and transportation of goods and services contribute to greenhouse gas emissions, global warming and climate change.
- The consumption of natural resources in production can result in their depletion, exacerbating environmental and societal problems.
- Waste in manufacturing and the disposal of goods

2.8. Interim conclusion

Based on current trend signals, major growth in mobile work is not yet anticipated, but its establishment in more and more fields is conceivable. In the coming years, the seven trends outlined above will shape the structure of mobile work and, by extension, the potential effects on climate protection. The spread of mobile work is dependent on the expansion and use of digital infrastructure and will lead to changes in space requirements for companies and homes, in mobility habits and in the choice of where to live. It will also shift consumption to homes. *Figure 3* summarises the relationships between the future issue and climate protection for the success of the societal transformation.

Figure 3: Relevance of the trends for climate protection



Source: In-house graphic

3. What are the potential courses of action for climate protection policy?

The seven main trends analysed in relation to mobile work span a broad range of both opportunities and risks for climate protection, providing cross-ministerial political scope for climate protection policy and accelerating the societal transformation. The resulting ideas for new measures or changes to existing measures must be properly coordinated across policy domains as the trends described above are interdependent (*Fig. 4*):

- More time spent working from home is changing the use of private spaces. This then has an impact on space and energy requirements .
- Without the need for daily commuting, rural locations become more appealing. However, this also means longer driving distances.
- The popularity of coworking and workations demonstrates alternatives to mobile working and hints at a possible change in values. However, there is also a risk of societal disparities in connection with the environmental footprint.
- The increasing shift of work into the virtual space is affecting consumer behaviour as more and more people order online and have products shipped to their homes, etc.

Figure 4: Interactions between the trends

Source: Fraunhofer ISI, in-house graphicng

An interaction analysis was conducted to assess the future climate protection potential of mobile working. This showed that the trends can be condensed into four core impact areas that take into account the dynamics and interactions between the individual topics. The four impact areas include changes in mobility behaviour, urban and settlement development, the economy and consumer behaviour and technological development and work structuring *(Fig. 5)*.

Figure 5: Main impact areas with climate protection relevance

Source: In-house graphic

There is a risk of a further rise in energy and resource consumption in all four areas due to increased mobile working, which could jeopardise the success of current climate protection measures. At the same time, each of the fields of action also offers opportunities to mould and provide the necessary acceleration of the societal transformation. These must be identified and acted upon at an early stage. Whether the opportunities or risks prevail depends on potential shifts in transportation, urban and settlement development, individual consumer preferences and consumption patterns, technological advances and the interaction of current climate policy initiatives across the various policy domains. Policy measures can therefore influence whether the changes lead to an increase in greenhouse gas emissions or better climate protection overall. The impact areas must therefore be considered holistically, and the potential courses of action for climate protection in the individual policy domains must be closely coordinated.

The following sections identify potential courses of policy action for climate protection for each impact area and across the board. These are either touchpoints and necessary changes for current federal goverment initiatives or suggestions for new cross-ministerial activities. Those potential courses of action that address multiple impact areas for mobile working and require cross-ministerial action are highlighted at the end. The impact analysis also considered the results of a foresight workshop to identify touchpoints with ongoing climate protection initiatives. Research experts and representatives from various federal ministries took part in the foresight workshop.

3.1 Impact area: mobility behaviour

Despite an anticipated reduction in rush-hour traffic due to greater homeworking, an increase is expected in traffic emissions, particularly as a result of more and longer personal journeys to obtain supplies and make trips and due to delivery services and the trend toward heavier and more powerful motor vehicles. Reduced commuting will challenge mobility routines and may increase openness to new mobility options.

The opportunities based on less traffic due to homeworking can decrease rapidly if the volume of individual non-work-related traffic increases. In addition to less frequent but lengthier journeys between places of residence and company premises, individual trips to shopping centres that would previously have been made on the way home from work are one of the reasons for this. Where there is a lack of mobility options, these additional journeys are more likely to be made by car. For this reason, adequate mobility options to reduce individual motorised traffic, such as better car sharing and cycling infrastructure, are crucial for climate protection.

Another important aspect for mobility behaviour is the trend towards more workations, where travel for its own sake becomes the primary motivation. This trend threatens to negate supposed reductions in transport emissions if workation opportunities are not consciously implemented in a climate-friendly manner. The increasing attraction of workations, in

part because of destinations further away from home, means the negative effects of more long-distance travel may make the climate footprint of mobile work worse overall.

In light of this, potential policy courses of action in the mobility behaviour impact area include the collection and analysis of mobility data and mobility needs in order to provide climate-friendly mobility options, increase employers' shared responsibility for the mobility behaviour of their employees and ensure more effective incentives for a more climate-friendly modal split. Climate protection incentives and eliminating subsidies that are harmful to the environment would be beneficial measures if they took mobility behaviour changes into consideration.

Impact area mobility behaviour: options for policy actions

Collection and use of mobility data for a society with increased mobile working
The availability of reliable mobility data and needs is an essential prerequisite for climate-friendly mobility options in the event of increased mobile working. Since this is sensitive personal data that will be used by municipalities and regional mobility providers, its collection and use must be regulated by law. A national mobility data law is being drafted. It could pave the way for the coordination of data use for regional and commercial providers nationwide, thereby aligning it more consistently with climate protection.

Greater corporate responsibility and incentives for climate-friendly structuring of mobile work for employees
Motorised private transportation currently dominates the commuter travel modal split. Employers should be held considerably more accountable for their employees' mobility, particularly where they work from home, in coworking spaces or on workations. Based on the trends, particularly the long-term increase in homeworking and workations, companies are more appealing to employees in the long run if they allow various forms of mobile working. Increasing skills shortages bring with them the dilemma of obtaining a competitive advantage in recruiting skilled workers. This can be counterproductive to climate protection goals. A coordinated set of measures should be developed to significantly reduce work-related private motorised transportation. Since homeworking has the potential to eliminate some commuting, structural conditions are required for a climate-friendly modal split for sustainable mobility. This includes, for example, developing an attractive public transport infrastructure to include a European express and night rail network, improved rural public transport connections and policy incentives such as commuter rates. Modified commuter rates that distinguish between public transport and private vehicle use, for example, would favour more climate-friendly options. According to the trend analysis in the mobile working future issue, company car perks and financial incentives for car use are becoming less relevant and are not conducive to climate protection.

Companies should be held more accountable for designing mobile working opportunities that are climate friendly. There is already an EU directive on mobility reporting by companies, but it does not include a requirement to manage mobility for climate protection. The introduction of mobility management has already been decided upon for the highest federal authorities, and funding for municipal and corporate mobility management concepts is also available in some federal states. We could also imagine a financial contribution by companies to the transport infrastructure required by their employees for mobile working, since this would increase the organisations' appeal to skilled workers.

3.2 Impact area: spatial, urban and settlement development

If more people adopt mobile working, they can choose where to live regardless of the location of their company, for example, in the suburbs or surrounding areas. Unused offices in city centres increase the number of vacant properties there. Companies need to adapt office concepts to the remaining on-premise work, for example by implementing hot-desking or collaboration spaces.

The demand for larger homes and per capita land use will increase. Social disparities may be exacerbated as mobile working opportunities and the ability to freely choose where to live are unevenly distributed. Furthermore, with the long-term change in the use of space due to homeworking, the demand for room size and layout in homes is also changing. This should be considered early in climate-friendly urban development and when developing the areas surrounding cities or tourist areas – including when comparing with international peers.

Important potential policy courses of action are promoting innovative uses of vacant properties in city centres and the surrounding areas. In addition, the changing space requirements due to mobile working open up new options for climate-friendly office space design and opportunities for more energy-efficient renovations instead of new builds.

Impact area spatial, urban and settlement development: options for policy actions

Create new mobile workspaces by opening up vacant properties in cities and the surrounding areas
The increase in mobile work means the opportunity to redevelop vacant properties in rural areas, for example, to accommodate changing housing demand due to homeworking or for coworking spaces. This could improve city/rural disparities. Less construction is required, and more properties can be redeveloped or maintained while also reducing new-build activity in (inner) cities. Example concepts, such as “Vom Kuh-Dorf zum Co-Dorf” (“From Cow Village to Co-Village”), where regional marketing reaches out to people from different working and lifestyle backgrounds, demonstrate how digitalisation is boosting the appeal of rural life (Grautmann 2021).

Use new mobile working concepts to avoid vacant properties in city centres
The increasing number of vacant office or industrial buildings in (inner) cities due to increased mobile working can be countered by implementing new usage concepts. These should be developed swiftly. Innovative concepts for modular living or working with movable partitions and room islands could provide solutions. To ensure climate protection and resource efficiency when developing flexible repurposing or dual use of living and working spaces, legal norms, guidelines, standards and certifications must be developed and requirements and conditions must be enforced. It is important that this repurposing does not result in further soil sealing. Initial implementation measures could include the initiation of pilot projects for innovative uses of vacant office spaces and interaction with international pioneering municipalities.

Prioritise renovation over new builds
The renovation of buildings is often more complicated than building from scratch but significantly more sustainable. For this reason, renovation should take precedence over new-build plans when repurposing vacant office buildings. Breaks in use due to (temporary) vacancy provide an opportunity for energy-efficient, climate-friendly renovation before further/new use. In addition to increasing energy efficiency and implementing the required climate change adaptations, such as heat and hail protection and insulation, the renovation of buildings must also consider their suitability for mobile working. There is a need for spatial use concepts that can accommodate new demands, such as homeworking, without large (additional) space requirements. This can be addressed by the funding

scheme for energy-efficient urban renovation. New land use specifications must be set so that new construction is no longer more cost-effective than renovation. Accompanying financial incentives could be created for renovation. These might include preferential funding for renovating vacant buildings in rural areas or better rewards for planning offices involved in renovations.

Strategies for the climate and resource-friendly redistribution of places of residence and work
The increase in mobile work within society will alter the regional distribution of housing and workplaces. New spatial development strategies are needed to prevent the abandonment of seemingly unappealing locations (and vacant properties). These strategies include for example, the structurally aesthetic upgrading of public and private buildings during renovation, the energy-efficient renovation of entire districts, and the climate and resource-friendly expansion of infrastructure.

Room design for collaborative mobile work
Hot-desking models, suitable spaces for collaboration and social interaction and the absorption of workspace equipment costs by the employer must be incorporated into room design for office spaces in a mobile working world. Guidelines, standards and norms or certifications are required for equipment, devices and concepts for the dual use of living and working spaces. This calls for cross-ministerial coordination and federal regulation, for example by incorporating mobile working into labour and tax law.

3.3 Impact area: economy and consumer behaviour

If more and more people adopt homeworking or work in other changing locations, this will inevitably also lead to a shift in their consumption patterns during the course of a typical working day. Meals will be prepared at home or ordered for delivery there rather than being consumed in the canteen or city centre restaurant near the office. Partially vacant office buildings reduce consumer demand in the surrounding area[2]. Working from home shits a proportion of daily shopping to the internet if there are no shopping facilities locally. The result is more delivery traffic and packaging waste. Some cities, for example Tübingen, have banned single-use packaging. Deposit systems or biodegradable packaging materials could also potentially be viable solutions.

Sustainable economic and infrastructure remodelling requires innovative product solutions and new business models for retail and services, trades, and small manufacturing. At the same time, new shopping routines also create new opportunities for providers of sustainable products and services, particularly local producers or sharing providers.

A sustainable expansion of local structures for business and trades and the promotion of innovation through experimental spaces or by supplying mobile workers with climate-friendly products and services, for example, are potential policy courses of action for climate protection in an economy shaped by mobile work.

2 Possible strategies to combat vacant properties within the framework of mobile work are discussed in section 3.2.

Impact area economy and consumer behaviourr: options for policy actions

Expansion of local, sustainable economic and trades structures to meet mobile working needs
If mobile work poses a threat of more and more vacant properties and people move to the outskirts of the city or the surrounding areas, then new cross-disciplinary approaches are needed for a participatory redesign of the economic structures in inner cities and town centres. New circular business models are needed for the changing consumer demands and provisions required for mobile working, e.g. for food supply while homeworking or sports facilities at varying locations. Future economic structures for increased mobile work should address different needs, such as those of small towns versus metropolitan regions, and provide space for social interaction, workshops for sustainable solutions, and opportunities to trial circular business models like repair and sharing facilities. Considering the complete life cycle of a product or service using life cycle assessments (LCAs) to analyse and reduce environmental, climate, and social consequences can help in the development and testing of business models.

Municipal or regional approaches to expanding local economic structures should be bolstered by federal measures to support the transformation, such as funding schemes for the sustainable modernisation of business equipment, establishment of new companies with mobile working models, or employee development. The accompanying funding should also cover research projects on the economic opportunities and risks of mobile work and its potential impact on climate protection for the local economy and trades. Existing funding schemes, such as the “Zukunft-Bau” (“Future Building”) and “Innovative Vertragsmodelle im Bauwesen” (“Innovative Contract Models in Construction”) programmes, can focus on innovative local coworking uses in rural areas for the increasing number of vacant properties or on rethinking city centre design. The potential for mobile skilled trades work should also be identified and supported. Possible approaches could for example be a modern twist on itinerant working or coworking spaces for trades and small manufacturers to enable networking, sharing machines and promoting spin-off companies with sustainable business models.

Spaces to experiment with providing for a mobile-work society
Citizens, local companies and research institutions should be involved in developing climate-friendly solutions, for example in the form of pilot projects or living labs as experimental spaces for a mobile-work society. Living lab approaches would be particularly suitable for trialling integrated circular business models and providing for a mobile work society because they offer a sufficiently long, fixed period for experimentation in innovative solution co-creation between potential users, consumers, residents and local partners from research and development, trades and business. Existing living lab approaches to the energy transition or circular economy would need to be studied to determine the extent to which they can be applied to the structures for providing for a mobile work society and where legislative adaptations may be needed.

3.4 Impact area: technological development and work structuring

The spread of mobile work depends heavily on digitalisation of the work and, consequently, on reliable and secure IT equipment and infrastructure and innovative tools for digital work. The required equipment is becoming more and more resource intensive, and the products becoming obsolete increasingly rapidly. During the transition phase to more mobile working, there is a risk of IT equipment duplication between the office and home workspace. This must be avoided.

Technological advancements in sensor systems and simulation, AI and machine learning all provide opportunities to simulate work environments, for example via production facility digital twins, as well as medical areas of application, such as remote diagnosis.

Potential policy courses of action should therefore include the right to basic equipment in energy and resource-efficient IT and digital tools, the promotion of associated working arrangements and occupational health and safety, and the establishment of any other supporting conditions necessary for the application of mobile work to more and more areas.

Impact area mobility behaviour: options for policy actions

Right to climate and resource-friendly IT work equipment
Establishing the right to a mobile (office) workspace is an important supporting condition for regulating responsibility between the employer and the employee for climate-friendly working arrangements for mobile work. Long-term targets should be set to ensure that the IT is resource and energy-efficient. Uniform regulations should be implemented across Germany regarding the assumption of costs for home-office or mobile-work equipment by employers, and regional inequalities in the desirability of places of residence for mobile workers should be reduced.

Extension of occupational health and safety regulations to include mobile working
The Policy Lab Digital Work Society and initiatives like the New Quality of Work Initiative (INQA) or the "Rat der Arbeitswelt" ("Council of the Working World") provide in-depth analyses of the potential opportunities and risks for climate protection coming from the social and health implications of mobile work. Depending on the need for policy action, necessary measures, such as including the health risks of mobile working in occupational health and safety regulations, will need addressing across departments. The Federal Ministry of Labour and Social Affairs' (BMAS) "Mobile Arbeit" ("Mobile Work") policy workshop (www.arbeit-sicher-und-gesund.de) is a perfect forum for developing and designing proe tective provisions.

Legal requirements regarding technological innovations for mobile work
To be able to use the opportunities presented by simulation, AI, and machine learning to expand mobile work into more and more areas of work, the climate protection opportunities and risks for future application fields should be investigated early on, and appropriate supporting conditions should be incorporated into policy.

3.5 Overarching options for policy actions

In addition to the options listed so far for addressing the opportunities and risks of mobile work in climate protection policy, there are other climate protection approaches that provide opportunities to shape policy across all of the above-mentioned impact areas.

Overarching options for policy actions

Mobile working as a core component of the plait model for climate-friendly spatial development

The plait model is a concept for sustainable and climate-friendly spatial and settlement development that closely combines innovative mobility, living, working and leisure solutions to connect the city centre to the surrounding areas. This includes, for example, more compact residential structures with supporting, shopping and educational facilities to reduce land use, more mobile work options to reduce commuting, sufficient open and green spaces for local recreation and agriculture, and mobility offerings to avoid motorised private transport, e.g. intermodal transport packages, car sharing and cycling. The model provides a comprehensive solution to the future climate protection challenges of mobile working. As such, its implementation warrants further research, and solutions should be developed and trialled in different regions.

Establish coworking as an alternative to the traditional office environment and as a place for practical sustainability

Coworking spaces could in future become an important alternative to homeworking for many employees if the former are available in sufficient numbers close enough to their homes – in both inner-city and rural areas. They would help reduce the risk of vacant properties and land consumption for work and commuting. In addition to office space, they can provide rooms and workshops for creative work and trades or serve as a venue for social and cross-sectoral interaction in the form of canteens, cafés or shopping facilities for supplies from local producers. This allows local residents to also be involved in the activities. It is conceivable that the social aspect of coworking spaces will be supported with appropriate funding. The use of coworking spaces as an alternative to homeworking could also be promoted through tax incentives and the right to mobile work.

When vacant properties are converted for coworking, the buildings must be converted in accordance with the latest climate protection standards and renovated in a climate-friendly manner, for example with storage heaters, renewable energy and insulation. Coworking industry associations could set their own climate neutrality and sustainability standards, e.g. in terms of interior design, electricity and heating, and mobility options such as cargo bikes or car sharing. In this way, establishing a coworking space could accelerate the transformation of city districts or town centres. In addition to the challenges posed by the sustainable design of coworking spaces, successful implementation may also prove to be a favourable location factor for municipalities, attracting coworkers and their families so the area benefits from new residents.

Mobile work as a driver of interdisciplinary innovation to shape the transformation

It is well known that including residents and local businesses in the development of local solutions and circular business models strengthens social cohesion. The federal government is already funding transformation participation research and trials. In light of it bringing together people from different disciplines with different skill sets, the mobile work future issue could also potentially be a driver of interdisciplinary communication, thereby contributing to innovation. Through continual communication that would not have arisen without innovative mobile work concepts, aspects of

sustainable climate protection and other issues of societal transformation may be examined from different professional perspectives, and solutions developed.

In-depth analysis of the opportunities and risks of workations and adaptation of the legal framework
On the one hand, the workation is becoming increasingly popular and provides new options for personalised work structuring. On the other, this increases the risk of the gentrification of districts, in other words the displacement of residents to the outskirts of the city or town due to rising living costs. It is not yet apparent how the trend will evolve or whether it is merely a passing fad that will only affect a small number of young workers. The climate protection potential for workation destinations in this country and the global impact of workations on climate protection must be investigated. The legal hurdles, in the public sector for example, are also high. A cross-ministerial commitment to developing global standards for sustainable workations, with the involvement of cities and tourism providers, would be vital. It is also important to determine the extent of Germany's potential as a destination for digital nomads from all over the world and whether this is a solution to the shortage of skilled workers in Germany as an economic centre.3.6 Conclusion

The analysis of trends and drivers for the increase in mobile working has revealed great relevance for climate protection. The emerging issue of mobile working presents a number of opportunities and touchpoints for the cross-ministerial acceleration of the societal transformation while promoting climate protection. If the interactions between the identified impact areas are considered holistically, the emerging opportunities can be exploited through policy instruments, thereby advancing climate protection. Although policy measures cannot control all the decisive factors, they can help determine whether the opportunities outweigh the risks.

The opportunities of mobile work for climate protection policy lie in the following four areas in particular and indeed across the board:

- The increase in mobile working provides the opportunity to contribute toward reducing private motorised transport via innovative mobility options.
  A holistic, cross-departmental approach incorporating innovative mobility concepts is essential to influencing transport habits and ensuring that mobile working contributes to rather than undermining national climate protection efforts.

- The increase in mobile working provides the opportunity to avoid vacant properties in cities, use vacant properties in rural areas, avoid new builds and prioritise renovation over new construction.
  The opportunities associated with the population migrations between urban and rural regions can be taken advantage of by implementing policy measures that incentivise using vacant spaces in both rural and urban locations and encourage renovation over new builds.

- The increase in mobile working provides the opportunity to support a shift in consumer behaviour and the expansion of local, sustainable economic structures.
  Pilot or model initiatives can assist in identifying innovative ways to transform local value chains and meet consumer demands sustainably.

- The increase in mobile working provides the opportunity to advance environmentally and resource-friendly work equipment and workplaces.
  Additional policies and standards for IT equipment and occupational safety regulations can bring new innovative approaches for climate-friendly healthy and productive work with energy-efficient, durable products.

The potential **policy actions** for climate protection within the mobile working future issue – for each field of action and cross-cutting – are:

Mobility behaviour

- Collection and exploitation of mobility data for a society with increased mobile working
- Greater corporate responsibility and incentives for climate-friendly mobile work structures for employees
- More effective incentives for a climate-friendly modal split

Spatial, urban and settlement development

- Create new mobile workspaces by opening up vacant properties in cities and the surrounding areas
- Use new mobile working concepts to avoid vacant properties in city centres
- Prioritise renovation over new builds
- Strategies for the climate and resource-friendly redistribution of places of residence and work
- Room design for collaborative mobile work

Economy and consumer behaviour

- Development of local economy and trades structures to allow for more location-flexible working
- Create spaces to experiment with providing for a mobile-work society

Technological development and work structuring

- Right to climate and resource-friendly IT equipment for mobile work
- Extension of occupational health and safety regulations
- Legal requirements regarding technological innovations for mobile work

Overarching potential policy actions

- Understand mobile working as a core component of the plait model for climate-friendly spatial development
- Establish coworking as an alternative to the traditional office environment and as a place for practical sustainability
- Use mobile work as a driver of interdisciplinary innovation to shape the transformation
- In-depth analysis of the opportunities and risks of workations and adaptation of the legal framework

List of sources

Literature

Ahlers, E.; Mierich, S.; Zucco, A. (2021): Homeoffice. Was wir aus der Zeit der Pandemie für die zukünftige Gestaltung von Homeoffice lernen können. Düsseldorf: Wirtschafts- und Sozialwissenschaftliches Institut. Available at https://www.boeckler.de/pdf/p_wsi_report_65_2021.pdf.

Alipour, J.-V.; Falck, O.; Krause, S.; Krolage, Carla, Wichert, Sebastian (2022): Die Innenstadt als Konsumzentrum: Ein Opfer von Corona und Homeoffice? München: ifo Institut.

Alipour, J.-V.; Falck, O.; Schüller, S. (2021): Germany's Capacity to Work from Home. München: Munich Society for the Promotion of Economic Research. Available at https://www.cesifo.org/DocDL/cesifo1_wp8227.pdf.

Ballinger, B.; Schmeda-Lopez, D.; Kefford, B.; Parkinson, B.; Stringer, M.; Greig, C.; Smart, S. (2020): The vulnerability of electric-vehicle and wind-turbine supply chains to the supply of rare-earth elements in a 2-degree scenario. In: Sustainable Production and Consumption, 22, pp. 68–76. https://doi.org/10.1016/j.spc.2020.02.005.

BBSR, Bundesinstitut für Bau-, Stadt-, und Raumforschung (2020): Wachsende und schrumpfende Städte und Gemeinden in Deutschland. Available at https://www.bbsr.bund.de/BBSR/DE/startseite/topmeldungen/2020-wachsend-schrumpfend.html, accessed 01.06.2023.

Bertelsmann Stiftung: Arbeitsort Internet. Click-Cloud-, Crowd- oder Gig-Work. Available at https://www.bertelsmann-stiftung.de/index.php?id=13024, accessed 08.04.2023.

Bertelsmann Stiftung; Münchner Kreis (Eds.) (2022): Zukunftsstudie Münchner Kreis. Sonderstudie zur Corona-Pandemie. Ergebnis-Chartsatz. Available at https://www.bertelsmann-stiftung.de/de/publikationen/publikation/did/sonderstudie-corona-all.

Bitkom (2021): Homeoffice statt Büro: Jeder Fünfte würde umziehen. 07.01.2021. Berlin. Available at https://www.bitkom.org/Presse/Presseinformation/Homeoffice-statt-Buero-Jeder-Fuenfte-wuerde-umziehen, accessed 08.04.2023

Bitkom (2020): E-Commerce und stationärer Handel: So digital shoppen die Deutschen. Ein Bitkom-Studienbericht. Bundesverband Informationswirtschaft, Telekommunikation und neue Medien e. V. Available at https://www.bitkom.org/sites/default/files/2020-07/200714_studienbericht-handel_2020.pdf, accessed 09.04.2023.

BMEL, Bundesministerium für Ernährung und Landwirtschaft; CoWorkLand (Eds.) (2022): Coworking auf dem Land. Wie es gelingt und was es dafür braucht. Bundesministerium für Ernährung und Landwirtschaft; CoWorkLand eG. Available at https://www.bmel.de/SharedDocs/Downloads/DE/Broschueren/coworking-land-bule.pdf?__blob=publicationFile&v=8.

BMWi, Bundesministerium für Wirtschaft und Energie (Ed.) (2017): Monitoringbericht Kultur und Kreativwirtschaft. Kurzfassung. Available at https://www.bmwk.de/Redaktion/DE/Publikationen/Wirtschaft/monitoringbericht-kultur-kreativwirtschaft-2017.pdf?__blob=publicationFile&v=16.

BMWK, Bundesministerium für Wirtschaft und Klimaschutz (Ed.) (2023): Digitalisierung der Wirtschaft in Deutschland. Digitalisierungsindex 2022. Available at https://www.de.digital/DIGITAL/Redaktion/DE/Digitalisierungsindex/Publikationen/publikation-digitalisierungsindex-2022-langfassung.pdf?__blob=publicationFile&v=3.

Breuer, S. (2019): Coworking – Zwischen schöner Wohnen und besser Arbeiten. Available at https://www.haufe.de/immobilien/wirtschaft-politik/coworking-zwischen-schoener-wohnen-und-besser-arbeiten_84342_500530.html, accessed 22.03.2023.

Bürger, T.; Grau, A. (2021): Digital Souverän 2021: Aufbruch in die digitale Post-Coronawelt? Available at https://www.bertelsmann-stiftung.de/de/publikationen/publikation/did/digital-souveraen-2021-aufbruch-in-die-digitale-post-coronawelt-all, accessed 23.11.2022.

BVCS, Bundesverband Coworking Spaces (2023): Coworking Spaces in Deutschland. Available at https://www.bundesverband-coworking.de/, accessed 04.04.2023.

Climate Impact Partners (2021): The Carbon Footprint of the Internet. Available at https://www.climateimpact.com/news-insights/insights/infographic-carbon-footprint-internet/, accessed 01.06.2023.

Coworking Guide: Mehr als nur ein geteiltes Büro: Was ist Coworking? Coworking Guide. Available at https://coworkingguide.de/coworking, accessed 04.04.2023.

Criteo (2022): Unternehmen im Metaverse: Goldgrube oder Zeitverschwendung? Available at https://www.criteo.com/de/blog/unternehmen-im-metaverse-goldgrube-oder-zeitverschwendung/, accessed 04.04.2023.

Dammann, T. (2022): Coworking Spaces – die neue Art des Arbeitens. Available at https://www.jobverde.de/magazin/news-tipps/im-miteinander-fuer-eine-bessere-welt-nachhaltige-coworking-spaces-in-deutschland, accessed 08.04.2023.

Demmelhuber, K.; Englmaier, F.; Leiss, F.; Möhrle, S.; Peichl, A.; Schröter, T. (2020): Home-office vor und nach Corona: Auswirkungen und Geschlechterbetroffenheit. München: Leibniz Institut für Wissenschaftsforschung an der Universität münchen e.v. Available at https://www.ifo.de/DocDL/sd-2020-digital-14-demmelhuber-etal-homeoffice-vor-nach-corona.pdf.

Der Spiegel (2023): Einbruch der Lunch-Ausgaben: Homeoffice kostet Manhattan zwölf Milliarden Dollar. Available at https://www.spiegel.de/wirtschaft/soziales/new-york-city-homeoffice-kostet-manhattan-12-milliarden-dollar-a-0c6e441e-b78a-41b5-98f1-b54347a47c37, accessed 04.04.2023.

Destatis (2023a): Bevölkerung, demografischer Wandel und Familien. Available at https://www.destatis.de/DE/Themen/Querschnitt/Demografischer-Wandel/Hintergruende-Auswirkungen/demografie-familien.html?nn=238640, accessed 02.06.2023.

Destatis (2023b): Fachserie Bauen und Wohnen. Available at https://www.destatis.de/DE/Service/Bibliothek/_publikationen-fachserienliste-5.html, accessed 01.06.2023.

Die Presse (2020): Plötzliche Nachfrage nach Büromöbeln verlängert Lieferzeiten teils bis Mai, 2020. Online. Available at https://www.diepresse.com/5789767/ploetzliche-nachfrage-nach-bueromoebeln-verlaengert-lieferzeiten-teils-bis-mai, accessed 04.04.2023.

EEA, European Environmental Agency (2022): Greenhouse gas emissions from transport in Europe. Available at https://www.eea.europa.eu/ims/greenhouse-gas-emissions-from-transport, accessed 04.04.2023.

EEA, European Environmental Agency (2023): A framework for enabling circular business models in Europe. Copenhagen: European Environment Agency. Available at https://www.eea.europa.eu/publications/a-framework-for-enabling-circular, accessed 04.04.2023.

Eurofound (2020): Living, working and COVID-19. Covid 19 series. Luxembourg: Publications Office of the European Union. Available at https://www.eurofound.europa.eu/en/publications/2020/living-working-and-covid-19, accessed 25.11.2022.

Expertenrat für Klimafragen (2022): Zweijahresgutachten. Gutachten zu bisherigen Entwicklungen der Treibhausgasemissionen, Trends der Jahresemissionsmengen und Wirksamkeit von Maßnahmen (gemäß § 12 Abs. 4 Bundes-Klimaschutzgesetz). Availa-ble at https://expertenrat-klima.de/content/uploads/2022/11/ERK2022_Zweijahresgutachten.pdf.

Expertenrat für Klimafragen (2023): Prüfbericht zur Berechnung der deutschen Treibhaus-gasemissionen für das Jahr 2022. Prüfung und Bewertung der Emissionsdaten gemäß § 12 Abs. 1 Bundes-Klimaschutzgesetz. Expertenrat für Klimafragen. Available at https://expertenrat-klima.de/content/uploads/2023/05/ERK2023_Pruefbericht-Emissionsdaten-des-Jahres-2022.pdf.

Fiebelkorn, L.; Dotou, O. (2023): Workation und Homeoffice im Ausland: Das müssen Arbeitgeber beachten. Online: Haufe. Available at https://www.haufe.de/personal/hr-management/homeoffice-im-ausland-was-arbeitgeber-wissen-muessen_80_536748.html, accessed 01.06.2023.

Forschung und Wissen (2020): Deutsche Möbelbranche. Nachfrage nach Büromöbeln weiterhin ungebrochen. Available at https://www.forschung-und-wissen.de/nachrichten/oekonomie/nachfrage-nach-bueromoebeln-weiterhin-ungebrochen-13374164, accessed 04.04.2023.

Gillabel, J.; Manshoven, S.; Grossi, F. (2021): Business Models in a Circular Economy. Copenhagen: European Topic Centre on Waste and Materials in a Green Economy.

Gontek, F. (2023): Workation: »Die Menschen wollen Arbeit und Urlaub nicht mehr trennen«. Available at https://www.spiegel.de/karriere/workation-die-menschen-wollen-arbeit-und-urlaub-nicht-mehr-trennen-a-4ef127ce-5698-4518-a765-e41e269a1e0d, accessed 04.04.2023.

Grautmann, S. (2021): Stadtlandlust - ein Kuhdorf wird -Kodorf. In: Tagesspiegel. Available at https://www.tagesspiegel.de/gesellschaft/stadtlandlust-ein-kuhdorf-wird-kodorf-297667.html.

Grevenstein, I. (2020): Nutzer im Coworking Space: Wen man beim Coworking trifft. In: CoworkingMag. Available at https://www.tagesspiegel.de/gesellschaft/stadtlandlust-ein-kuhdorf-wird-kodorf-297667.html, accessed 04.04.2023.

Häußermann, H.; Siebel, W. (2000): Soziologie des Wohnens. Eine Einführung in Wandel und Ausdifferenzierung des Wohnens. Weinheim: Juventa-Verlag. ISBN: 3779903954.

HDE, Handelsverband Deutschland (2022): Zahlenspiegel 2022. Berlin: Handelsverband Deutschland e.V. Available at https://einzelhandel.de/index.php?option=com_attachments&task=download&id=10681.

Hemmersmeier, J. (2022): Digitale Nomaden in Lissabon: »Sie gehen in Cafés, in denen ein Cappuccino vier Euro kostet«. In: DER SPIEGEL, 3/2022. Available at https://www.spiegel.de/start/digitale-nomaden-in-lissabon-wem-gehoert-die-stadt-a-1372e1fa-0002-0001-0000-000207062801, accessed 04.04.2023.

Hentsch, A.-K. (2020): Kleiner Schubs ins Grüne: Kann Nudging die Umwelt retten?: Ein Experte erklärt, was die sanfte Methode aus der Verhaltensökonomie für unsere Um-welt tun kann. In: National Geographic, (2).

Hindelang, L. (2023): Digital Nomads verdrängen Portugiesen an den Stadtrand – in selbstgebaute Blechhütten. Wohnungsnot in Lissabon. Available at https://www.stern.de/panorama/lissabon--digital-nomads-verdraengen-einheimische---in-blechhuetten-33339790.html, accessed 08.04.2023.

Hoffmann, A.; Wintermann, O.; Boberach, M.; Baethge, C. B. (2019): Plattformarbeit in Deutschland - Freies und flexibles Arbeiten ohne soziale Sicherung. https://doi.org/10.11586/2019056.

Höfler, N.; Krolle, H. (2023): Was hinter dem Metaverse-Hype steckt. In: Handelsblatt. Available at https://www.handelsblatt.com/technik/metaverse-was-hinter-dem-metaverse-hype-steckt/28073180.html, accessed 04.04.2023.

Hollbach-Grömig, B.; Langel, N.; Göll, E.; Henseling, C. (2012): Demographischer Wandel – Herausforderungen und Handlungsempfehlungen für Umwelt- und Naturschutz. Teil II. Umweltbundesamt. Available at https://www.umweltbundesamt.de/sites/default/files/medien/378/publikationen/texte_79_2013_demographiser_wandel_teil_2_iyimen-schwarz.pdf.

Hughes, R. A. (2022): Arbeiten auf Bali und keine Steuern zahlen: Ein neues Visum für Digital Nomads macht's möglich. Available at https://de.euronews.com/reise/2022/06/27/neues-visum-digital-nomads-bali, accessed 04.04.2023.

ifo Institut (2023a): Drei von vier Beschäftigten bei IT-Dienstleistern nutzen Homeoffice. Pressemitteilung, 02.03.2023. Available at https://www.ifo.de/pressemitteilung/2023-03-02/drei-von-vier-beschaeftigten-bei-it-dienstleistern-nutzen-homeoffice, accessed 08.04.2023.

ifo Institut (2023b): ifo Konjunkturperskektiven. München. Available at https://www.ifo.de/publikationen/2023/zeitschrift-einzelheft/ifo-konjunkturperspektiven-042023, accessed 08.04.2023.

ifo Institut; Randstad (2020): Homeoffice und Digitalisierung unter Corona. Randstad-ifo-Personalleiterbefragung 2. Quartal 2020. Leibniz-Institut für Wirtschaftsforschung an der Universität München e.V.; Randstad Deutschland GmbH & Co. KG. Available at https://www.randstad.de/s3fs-media/de/public/2020-08/randstad-ifo-personalleiterbefragung_q2_2020.pdf, accessed 04.04.2023.

iwd, Informationsdienst des Instituts der deutschen Wirtschaft (2022): Nudging für mehr Klimaschutz. Verhaltensökonomie. Available at https://www.iwd.de/artikel/nudging-fuer-mehr-klimaschutz-534405/, accessed 08.04.2023.

Kohlrausch, B.; Schildmann, C.; Voss, D. (Eds.) (2019): Neue Arbeit - neue Ungleichheiten? Folgen der Digitalisierung. Beltz Verlag. Available at https://www.beltz.de/fachmedien/soziologie/produkte/details/37343-neue-arbeit-neue-ungleichheiten.html.

Kollenbroich, B.; Teevs, C.; Kaiser, R. (2016): Wo die Deutschen leben wollen: Stadt, Land, Flucht. Available at https://www.spiegel.de/wirtschaft/soziales/wohnen-in-deutschland-immer-mehr-menschen-zieht-es-aufs-land-a-1109484.html, accessed 01.06.2023.

Möhring, K.; Neumann, E.; Reifenscheid, M.; Weiland, A.; Blom, A. G.; Wenz, A.; Rettig, T.; Lehrer, R.; Krieger, U.; Juhl, S.; Friedel, S.; Fikel, M.; Cornesse, C. (2020): Die Mannheimer Corona-Studie. Schwerpunktbericht zur Nutzung und Akzeptanz von Homeoffice in Deutschland während des Corona-Lockdowns. Mannheim. Available at https://madoc.bib.uni-mannheim.de/55628/1/MannheimerCoronaStudie_Homeoffice_2020-07-09.pdf.

NVIDIA: Nvidia Omniverse. Available at https://www.nvidia.com/de-de/omniverse/, ac-cessed 23.11.2022.

OECD (2022): OECD Regions and Cities at a Glance 2022. Paris. https://doi.org/10.1787/14108660-en.

Öko-Institut (2022): Arbeiten im Homeoffice – gut für die Umwelt und die Mitarbeiter:innen? Analyse der potenziellen ökologischen und sozialen Auswirkungen mobilen Arbeitens. Available at https://www.oeko.de/fileadmin/oekodoc/compan-e_Homeoffice.pdf.

PwC: Was Circular Economy für Unternehmen bedeutet. Available at https://www.pwc.de/de/nachhaltigkeit/was-circular-econoo my-fuer-unternehmen-bedeutet.html, accessed 23.03.2023.

Rixecker, K. (11/2/2021): Microsoft goes Metaverse: Teams bekommt Avatare und virtuelle Meetingräume. In: t3n. Available at https://t3n.de/news/mesh-microsoft-teams-metaverse-avaa tare-1423109/, accessed 04.04.2023.

Schoppe, I.; Färber, L. (2022): Coworking Spaces in Deutschland: Die größten und beliebtesten Anbieter. Available at https://www.gruender.de/hr-office/coworking-spaces-in-deutschland/, accessed 04.04.2023.

Schroeder, H. W. (1991): Preference and meaning of arboretum landscapes: Combining quantitative and qualitative data. In: Journal of Environmental Psychology, 11 (3), pp. 231–248. https://doi.org/10.1016/S0272-4944(05)80185-9.

Schubert, S.; Büttner, A.; Lindmaier, J.; Schröder, A.; Dross, M.; Reißmann, D.; Janitzek, T.; Schmied, M. (2021): Umlandstadt umweltschonend. Nachhaltige Verflechtung von Wohnen, Arbeiten, Erholung und Mobilität. Umweltbundesamt. Available at https://www.umweltbundesamt.de/sites/default/files/medien/376/publikationen/broschuere_uba_umlandstadt_final_barrierefrei_20211215.pdf.

Shen, H.; Faklaris, C.; Jin, H.; Dabbish, L.; Hong, J. I. (2020): 'I Can't Even Buy Apples If I Don't Use Mobile Pay?'. In: Proceedings of the ACM on Human-Computer Interaction, 4 (CSCW2), pp. 1–26. https://doi.org/10.1145/3415241.

UBA, Umweltbundesamt (2022): Demographischer Wandel. Wie belasten die privaten Haushalte und der Konsum die Umwelt? Available at https://www.umweltbundesamt.de/daten/private-haushalte-konsum/strukturdaten-privater-haushalte/demografischer-wandel#entwicklung-der-bevolkerung-in-den-bundeslandern, accessed 04.04.2023.

ver.di (2022): Handbuch Homeoffice. Perspektiven, Daten, Ansätze dür die Gestaltung des Neuen Normal. Berlin: Vereinte Dienstleistungsgewerkschaft. Available at https://innovas tion-gute-ar-beit.verdi.de/++file++633467032ce574314acoc6e3/download/Handbuch_Homeoffice.pdf, accessed 04.04.2023.

Figures

Cover:

iStockphoto by Prostock-Studio

Figure 3:

Living room icons created by kerismaker – Flaticon

Rural icons created by Freepik – Flaticon

Travel icons created by Smashicons – Flaticon

Colleague icons created by Freepik – Flaticon

Coworking icons created by Freepik – Flaticon

Delivery icons created by Uniconlabs – Flaticon

https://www.flaticon.com

Figure 5:

City icons created by Eucalyp – Flaticon

Restaurant icons created by fjstudio – Flaticon

Cars icons created by Lizel Arina – Flaticon

Remote access icons created by Uniconlabs – Flaticon

Brain icons created by Design Circle – Flaticon

Bus icons created by Pixel perfect – Flaticon

Retail icons created by Frey Wazza – Flaticon

Work from home icons created by KP Arts – Flaticon

https://www.flaticon.com

▸ **This brochure as download**
Shortlink: bit.ly/2dowYYI

www.facebook.com/umweltbundesamt.de
www.twitter.com/umweltbundesamt
www.youtube.com/user/umweltbundesamt
www.instagram.com/umweltbundesamt/