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Hintergrundstudie

Assessment report: Impacts of the digital transformation on consumption and their implications for implementing the German Development Strategy in, with and by Germany

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In Kooperation mit:

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Im Auftrag der Wissenschaftsplattform Nachhaltigkeit 2030 2019

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Zur Studie

Hintergrund

Wie können Produktions- und Konsummuster nachaltiger gestaltet werden, insbesondere im Rahmen der Deutschen Nachhaltigkeitsstrategie: Unter anderem diese Frage bearbeitet die Wissenschaftsplattform Nachhaltigkeit 2030 mit dem Ziel, wissenschaftlich basierte Handlungsempfehlungen für politische Akteure zu entwickeln. Zu diesem Zweck hat sich 2017 über die Plattform die Arbeitsgruppe „Nachhaltiger Konsum" formiert, geleitet von Prof. Joachim von Braun (Zentrum für Entwicklungsforschung). In diesem Rahmen wurden unter anderem zwei Hintergrundstudien von der Plattform in Auftrag gegeben. Das vorliegende Papier „Assessment report: Impacts of the digital transformation on consumption and their impacts for implementing the German Sustainable Development Strategy in, with and by Germany" ist eine von ihnen. Maßgeblich für die weitere AG-Arbeit ist ein breiter interdisziplinärer Austausch mit der Wissenschaft sowie ein transdisziplinärer Austausch mit Politik, Wirtschaft und Zivilgesellschaft in mehreren Schritten.

Zitierhinweis

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Contents

Executive Summary

This assessment report identifies and discusses three key trends in the field of digitalization that impact sustainable consumption, namely increased and simplified access to products, increased access to information and collaborative and shared consumption. There are opportunities and risks associated with each trend, calling for increased political action and a digitally-sensitive update of the German Sustainable Development Strategy.

In particular, policy-makers should consider to

1) **Support the "good" sharing economy and set more ambitious goals for sustainable consumption,** e.g. by establishing an **Office of Social Innovation and Civic Participation, living labs to test and further expand best practices** and by monitoring and evaluating the existing sharing economy regarding rebound effects, extending the current goals in the section on SDG 12 implementation in the *German Sustainable Development Strategy.*

2) **Monitor and encourage sustainable e-procurement,** e.g. by setting a goal for the percentage of sustainable ICT appliances purchased by public authorities in the next update of the *German Sustainable Development Strategy*.

3) **Address consumers, enhance competences and establish Green standards for internet use, including raising** awareness of the possible impacts of digital consumption and taking insights from behavioural economics and social psychology into account. The next update of the *German Sustainable Development Strategy* should address these points even stronger.

4) **Strengthen product labelling and Green standards for ICT-products,** e.g. by establishing a public institution that oversees obligatory product labelling.

5) **Finance research in the field of digitalization and sustainable consumption,** e. g. on alternative less-toxic materials, strategies for avoiding loss of materials and digital equity. This would also support some of the principles set in the *German Sustainable Development Strategy* such as to strengthen the natural resource base on which life depends.

In addition, policy makers should **consider to raise the bar**, implementing **more ambitious changes in a digitally sensitive update of the current regulations and laws**. These would involve to reform antitrust and monopoly law, to reform tax law to create a digitally sensitive tax in accordance with the proposal of the European Commission and to regulate the use of algorithms (commercial use, sponsored content).

1 Introduction

Digitalization is disrupting business practices worldwide and transforms consumption patterns. The amplitude of the phenomenon becomes clear when considering that by 2025 global e-commerce is expected to generate $4.3 trillion sales (Frost & Sullivan, 2014). While global increase in wealth is leading to higher consumption rates, consumption related decisions are increasingly based on digital information and marketing; furthermore, shopping increasingly takes place online and products and services are more and more digitalized (vor dem Esche and Hennig-Thurau, 2014).

The transformative character of digitalization calls for political action in order to ensure sustainable consumption in a new and dynamically changing context. Focusing on consumption is imperative in combatting many global challenges. Take climate change: consumption-based emissions (i.e. emissions from domestic final consumption and emissions caused by the production of imports), are rising more rapidly than production-based emissions in high-income countries (Stockholm Environment Institute, 2017). Meanwhile most of the political measures target production based emissions (i.e. territorial emissions).

Several strategies already address digitalization. The *National Programme for Sustainable Consumption* highlights that the digital life is now one of the megatrends that changed the context in which sustainable consumption is taking place (The Federal Government, 2016, p. 17). The *German Sustainable Development Strategy*[1] subsumes digitalization under the current national challenges and argues that "many innovation processes, such as digitisation … have considerable potential for supporting the goals of the *Sustainable Development Strategy*" (The Federal Government, 2018, p. 15).

Also, the *digital agenda 2014-2017* of the German federal government sets guidelines for digital policies and contains measures in order to accompany and shape the digital change. The *Digital Strategy 2025* of the *Federal Ministry of Economics and Energy* focuses on digital infrastructure, networked factories, data sovereignty, needs-based education, new business models and technologies. The Federal Government's AI Strategy aims to bring research, development and application of artificial intelligence in Germany to a globally leading level. In 2019, the *Federal Ministry for the Environment, Nature Conservation and Nuclear Safety* (*BMU*) presented its position paper for an environmental policy digital agenda ("*Eckpunktepapier für umweltpolitische Digitalagenda*") which contains initial proposals as to how to envisage environmentally, climate- and nature-friendly digitisation. In its position paper on digitisation and development, the *Federal Ministry for Economic Cooperation and Development* (*BMZ*) describes that global sustainability goals can only be achieved through the use of new digital technologies.

The German council for sustainable development (*Rat für Nachhaltige Entwicklung*) has called for the "principle of sustainable development [to] serve as the political framework for digital transformation" as "digitalisation has the potential to engender disruptive developments in the business world as well as society as a whole that carry both great opportunities and significant risks" (German Council for Sustainable Development, 2018). Thus, to implement the *2030 Agenda*, in particular *SDG 12*, and the *National Program for*

[1] Reference point is the 2018 update of the *German Sustainable Development Strategy*.

Sustainable Consumption, it is key to seize the opportunities that digitalization presents for sustainable consumption and tackle the challenges. Therefore this assessment report examines the following key question: "***What are the implications of the digital transformation of consumption patterns for the implementation of the German sustainability strategy in, by and with Germany?"***

This question is answered in four steps following the methodology presented in Chapter 2. In the first step relevant key trends in the field of digitalization are identified and presented (Chapter 3). In the second step the actors that shape the presented trends in the field of digitalization are identified (Chapter 4). In the third step the risks and opportunities for sustainable consumption of these key trends are discussed and entry points for political action are derived (Chapter 5). In the fourth step policy recommendations for a digitally sensitive update of the *German Sustainable Development Strategy* are outlined (Chapter 6).

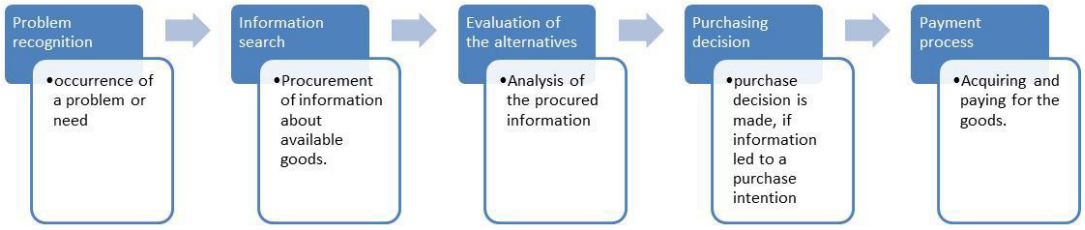
2 Methodology

The interplay between digitization and sustainable consumption

The consumption of goods and services is subject to various internal and external conditions. At the individual level, i.e. at the private demand level, income, social status or education play an important role. In public procurement, the purchasing process is determined by guidelines/requirements or strategies for procurement, contract obligations and the competencies of the procurers themselves. The systemic level, i.e. the side of the supply (the marketplace), influences the purchasing process through various factors and thus enables more rational or more irrational purchasing decisions.

To understand such consumption processes and the interactions between individual/procurer and systemic level as well as digitalization the application of the model of the customer journey is suitable (see figure 1). Digitalization is understood as "the development and application of digital and digitalized technologies that augment and dovetail with all other technologies and methods [and] has a profound effect on all economic, social and societal systems" (WBGU, 2019, p. 1).

Figure 1: Customer Journey



Source: (Kahlenborn *et al.*, 2019)

Identifying key trends

The core step in understanding the impacts of the digital transformation on consumption was to identify the dynamics that are currently shaping e-commerce, and then to conclude which trends are the most important. This process helped identify which factors are worthy of being addressed in the update of the *German Sustainable Development Strategy*.

When considering technological and sociological dynamics and trends in such a quick moving field, it is often difficult to judge which trends will have continued importance over the years to come. However, research on future trends continually emphasizes the importance of being prepared for disruptive trends. In the same vein, the prioritization of dynamics and trends depends heavily on the perception of the respective assessor. This sometimes leads to a self-fulfilling prophecy, meaning that the trends that e. g. economic advisors found to be the most pertinent end up shaping the discussions and actions on an economic and political level.

Therefore, opinion from more varied fields, specifically from leaders of science, politics and civil society, were included, in particular studies on digitalization and consumption (for instance (Kahlenborn *et al.*, 2019; Lange and Santarius, 2018; WBGU, 2019; Ternès *et al.*, 2015; Sühlmann-Faul and Rammler, 2018; Osburg and Lohrmann, 2017; Wallaschkowski

and Niehuis, 2017; Stengel *et al.*, 2017), studies focusing on consumer and retail trends (for instance (Euromonitor International, 2017; PWC, 2017; Handelsverband Deutschland, 2019b; EHI Retail Institute, 2019), specific consumption related studies, and reports of the current market research.

It should be noted that a clear prioritization of consumption trends or dynamics is not available in the aforementioned literature. Kahlenborn *et al.* (2019) observe that more products and stages of the customer journey are affected by digitalization. Lange and Santarius (2018), WBGU (2019) as well as Kahlenborn *et al.* (2019) showcase a myriad of areas where digitalization and changing consumption patterns are deeply intertwined, and they examine the possible effects on sustainability. Wallaschkowski and Niehuis (2017) summarize the different facets of digitalization and consumerism into three main dynamics:

1. Increased and simplified access to products
2. Access to information contributing to consumption decisions
3. Collaborative/ shared consumption

This report follows the grouping of Wallaschkowski and Niehuis (2017) as it covers a wide array of aspects and explains how digitalization reinforces these three dynamics and thus gives momentum and importance to the subject. In other words, this grouping presents a synthesis of the current discussion on consumption and digitalization. Other studies support this synthesis and their respective findings can also be sub-summarized into the above main dynamics (e.g. the customer journey used to highlight the significance of each key trend). Building on this classification, this report also integrates studies analysing specific sub-phenomena (e.g. collaborative platforms, e-procurement etc.) in more detail.

3 Contextualization of key trends and their relevance for consumption patterns

This chapter describes three key trends that shape the increasing digital transformation of consumption patterns. The trends are: Increased and simplified access to products; increased access to information; collaborative and shared consumption. These trends are contextualized by highlighting supporting trends for their realization. Determining supporting trends is important in order to understand the scope of the changes, as well as to comprehend the interdependency between the trends, both digitized and non-digitized.

Supporting trend: consumption as end in itself

Consumption patterns are always evolving and changing. While the main purpose of consumption before the industrial revolution was to cover basic material needs (by purchasing goods such as basic cooking equipment, furniture and clothes), the trends have been shifting. Currently, there is a change towards shopping experiences and self-realization, and thus, psychological and social motives become a part of the deciding factors for consumption. For instance, in developed countries and within affluent milieus it is no longer relevant whether someone has food on their plate, or not. Rather, important is what kind of food it is or how much pleasure and prestige is associated with its consumption. Another example is private transport – it is now in some instances more important which kind of car someone drives rather than the fact that someone owns a car (Wallaschkowski and Niehuis, 2017).

Shopping has thus become an activity in and of itself. This trend in shopping behavior is a supporting trend for increased consumption, since it exceeds the coverage of the basic needs. It should be underscored that merely looking at sales rates – which are increasing – does not prove that digitalization brought about a higher consumption level as this change could be caused by factors other than the digital transformation. There are also no empirical studies available on the degree to which overall consumption has increased due to digitalization. However, there are reasons to believe that digitalization reinforces and catalyzes the increasing consumption level in three dimensions, namely the increased access to products, the increasing availability of information and the nature of the products that are consumed (Wallaschkowski and Niehuis, 2017).

Supporting trend: Increased availability and use of smartphones

Additionally, the smartphone is an increasingly prevalent factor in consumption. While only 6.3. million people in Germany used a smartphone in 2010, in 2015 almost one in two Germans utilized it (41 million people) (Sühlmann-Faul and Rammler, 2018). In 2018, the majority of Germans used a smartphone (57 million people) (Statista, 2019b). The penetration rate of the smartphone is likely to increase due to the broad range of functions it provides.

This supporting trend reinforces all the three identified key trends. First, the prevalence of the smartphone supports ***the trend of increased and simplified access to products;*** smartphones enable consumers to shop online without hassle and to easily use digitized payment methods (Lange and Santarius, 2018; Sühlmann-Faul and Rammler, 2018; Kahlenborn *et al.*, 2019). Second, the ***increasing use of the smartphone allows for more information to be sent directly to the user*** *(e.g.* personalized online advertisements), which in turn potentially influences his/her decision to consume. Social media usage (*Facebook*, *Instagram*, *Pinterest* etc.) has been found to have a particular influence on

consumption patterns. Via social media, products are advertised according to previously collected data and the consumption patterns of peer groups; individualized products are presented and connected to a specific lifestyle. Additionally, ***collaborative and shared consumption is largely enabled by the smartphone***. Many sharing platforms rely on apps to render the offered service more convenient for the user - e.g. locating and unlocking a car when using a car sharing platform, lending a product or home or accessing repairing, upcycling and other do it yourself (DIY) tutorials.

In the following, the three key trends will be described briefly. Their importance for consumption patterns is outlined.

3.1 Increased and simplified access to products: Anything, anytime, anywhere

Digitalization simplifies access to products. It thus affects the alternatives available for purchase in the customer journey as well as the purchase intention and payment process.

3.1.1 Online Commerce

E-commerce is defined "as a transaction in which the internet is used first as a platform to establish the terms of trade (e.g. price, availability, order processing time to delivery) among the participants in a marketing channel, and second, to sell goods and services that can be delivered offline (i.e., the services can be 'digitised') and delivered online" (Saridakis *et al.*, 2018). E-commerce is rising quickly. In the short time-span of only 6 years, the sales doubled: in 2011, 24 billion euro sales were generated online; in 2016 sales reached already 44 billion euros (Lange and Santarius, 2018).

The growth in e-commerce sales is also observable in the high percentage of online shoppers: 65,7% of the German population shops online (Handelsverband Deutschland, 2019a). Additionally, 80% of the "Millenials", also known as "Generation Z", are shopping online. Also, the generation 60+ is starting to shop online, with an 11% increase from 2017 to 2018 (Handelsverband Deutschland, 2019b).

The home and office (consumer electronics) sectors hold the biggest share of e-commerce with 31%, which is followed by fashion and accessories with 28% and leisure and tourism with 27% (Handelsverband Deutschland, 2019a). Fast moving consumer goods (FMCG) hold lower shares, but are rising as well, notably the online grocery shopping or delivery of prepared foods.

E-commerce rendered shopping more convenient and ensured that products are continuously available. In the past, consumers needed to physically go to a store in order to purchase a product, which is time consuming. In addition, they would need to respect the specific opening hours of each shop. Today, online shopping is possible 24 hours a day, 7 days a week (Wallaschkowski and Niehuis, 2017). Online shopping has also become even more mobile and is not only possible via websites or specific market places but also on social media (e.g. through the "*Facebook Marketplace*"). In addition, e-commerce is also appealing to consumers since almost every product has become available online: *Amazon.de* alone offers 229 million products (Statista, 2017). Further, the increase of e-commerce is enabled by efficient logistics and increased availability of goods via anticipated customer demand based on artificial intelligence (PWC, 2017).

Another trend that is supporting e-commerce is that not only singular products are sold but an entire “eco-system” (i.e. a product, connected market places and services). These lock-in mechanisms were already in place in the electronics sector: e.g. a printer only accepted printer cartridges of a specific brand and rejected all other. *Apple* and its specific software, chargers etc. is another example of product and brand eco-systems. However, through digitalization, this growing trend has been reinforced in many products and sectors. Krisch and Plank (2018) demonstrate how lock-in mechanisms in internet platforms (growing dependence of and integration into a system which leads to growing costs to switch to another system) bring about growing potential for monopolization.

Simultaneously, the speed of consumption has increased due to enabling technologies and tools such as instant shopping devices and automated ordering (e.g. smart household devices with shopping lists) (EHI Retail Institute, 2019), seamless ordering via speaker devices, and easy one-click digitized payment (Kahlenborn *et al.*, 2019). Moreover, subscription shopping boosts the speed of consumption, and thus, the volume of products that are sold.

3.1.2 Digitized stationary retail

The increase of online sales does not translate into a decrease of stationary retail sales. Marketing experts assume that through the use of the smartphone customers are not only motivated to buy online, but are also incentivized to shop in physical stores (Lange and Santarius, 2018). Only 14% of purchases are pure online purchases, 42% are pure stationary retail purchases and 44% are online prepared stationary retail purchases (Handelsverband Deutschland, 2019b). As a result, the distinction between stationary retail and e-commerce becomes increasingly blurry with stationary retail becoming more and more digitized (EHI Retail Institute, 2019). In fact, hybrid forms of consumption are on the rise (Lange and Santarius, 2018) such as omni-channel shopping, where customers order online & collect at a stationary shop later (EHI Retail Institute, 2019). Furthermore, digital interfaces are integrated in shops and allow greater transparency of the availability of products in partner shops.

3.1.3 Mass customization, personalization and prosumption

The personalization of products is on the rise, among others as a result of the phenomenon that consumption in developed countries and in more affluent milieus no longer only serves to satisfy basic needs, but to provide specific and singular “experiences”.

The relationship between product volume, product variety, demand and societal need changed over time (Boër *et al.*, 2018). Prior to the industrial revolution, the variety in products was large but their volume small. The variety of products decreased when mass production became widespread; at the same time the volume of production skyrocketed. During the economic boom, after the Second World War, societies needs were at first homogenous and the product demand was stable with a prevailing interest in low-cost options. Around 1955, when people’s basic needs were generally covered, the interest in product variety increased and the demand became more fluctuant.

In the mid-1950s, demand for customized products became more widespread; product variety increased, e.g. goods were sold with different colours and in more sizes etc. This meant increasing markets for personalized products, and thus, a shift from a forecast-based mass production system into a business model that focused on demand and mass customization. E-commerce is especially suited to adapt to this personalised demand and

many companies already offer online tools to their customers for product personalisation (e.g. for shoes, cars and even shower gels) (Wallaschkowski and Niehuis, 2017). Through these tools, consumers are involved in the design of a company's product. Ultimately, they may become prosumers – producer and consumer in one person.

Digitalization also enables direct trade. Online marketplaces allow individuals to sell products without commercial intermediaries. This allows for niche products to gain access to the market, which on the one hand may increase consumption due to the wider availability of products, and on the other hand may be an opportunity for re-regionalization of production, consumption and enhanced sustainability (Lange and Santarius, 2018).

In addition to consumers actively personalizing products, companies can also sell them personalized products. Artificial intelligence personalization for example may allow products to be automatically designed and customized based on user behavior, preferences, feedback, and characteristics (PWC, 2017).

3.2 Increased access to information: The new transparency

Digitalization facilitates access to information. It thus influences the problem recognition, information search and evaluation phase of the customer journey. Online forums, blogs, social media profiles of influencers, consumer review websites etc. empower the consumer to make more informed decisions (Wallaschkowski and Niehuis, 2017). However, the digital age also renders the consumer more transparent vis-à-vis companies. GPS location, preferences, comments, likes, products researched etc. are valuable information for businesses enabling personalized online advertisement (Wallaschkowski and Niehuis, 2017) and manipulation of the consumer by artificially creating more needs (Lange and Santarius, 2018).

3.2.1 The empowered consumer

Consumers actively seek information for online and offline purchases: In the non-food sector for example, 68% of purchases are based on online information (Handelsverband Deutschland, 2019a). The anonymous online community has become the in-store shopping assistant (Wallaschkowski and Niehuis, 2017). Marketplaces allow users to rate and comment on products. For example, according to (PWC, 2017) 45 % of consumers start their information research on Amazon. Information is readily available and can be easily accessed on the web. Platforms and search engines help to navigate the existing knowledge. Information relevant for consumption decisions is also channeled through social media. In Germany, the Youtuber *Rezo* became widely known with his video underscoring the urgency for climate mitigation. In addition, various green apps are available. While they are currently rarely used (Kahlenborn *et al.*, 2019) they have large potential to aid in increasing transparency, creating incentives (via rewards or gamification) and providing platforms for sustainable consumption (Brauer *et al.*, 2016; Kahlenborn *et al.*, 2019).

Consumers have economic power and can reward companies by purchasing their products or punish them by boycotting their products, thus allowing users to "vote with their wallet" based e.g. on reviews (Gazzola *et al.*, 2017). Consequently, digitalization may be a quantum leap for sustainable consumption in the long run (Lange and Santarius, 2018; Labrecque *et al.*, 2013).

3.2.2 The manipulated consumer

While consumers are able to better access information on products and services, still, an asymmetry of information persists. Profiling in form of massive collection of user data is common online. Data collection provides businesses with information on e.g. location, preferences, purchasing power, interests, habits, shopping habits etc. Prime tool is the smartphone which enables extensive data collection through GPS coordinates, mobile payment services, motion sensors, calendars and personalized assistants.

User data is valuable in e-commerce as it helps influencing the user's purchasing decisions, e.g. with targeted online advertisements, automatically-created, individualized designs of products and dynamic pricing. Dynamic pricing involves adapting the price of a good or service to external factors such as the prices of competitors, weather conditions, time of day or day of the week. For example, Amazon changes the prices of 3 million products on a daily basis (Lange and Santarius, 2018). Personalized pricing goes beyond that and bases the price on user data, consumption habits and income information (SVRV, 2016). It thus assesses a consumer's willingness to pay a certain price for a product and offer exactly that price to the consumer. This practice is likely to influence consumption patterns, since a good's and service's price continues to be a strong deciding factor for purchasing decisions.

For these reasons the *SVRV* (*German Advisory Council for Consumer Affairs*) calls for consumer-friendly scoring (SVRV, 2018) and highlights the need to address the issue of personalized pricing (SVRV, 2016).

3.3 Collaborative and shared consumption: Goodbye ownership, hello access

Digitalization enables the sharing economy. It thus influences the alternatives (goods and services) available in the customer journey.

3.3.1 Availing digital goods: Streaming and subscriptions

In the digital and connected world, access to goods is becoming increasingly more important than ownership (Wallaschkowski and Niehuis, 2017). This trend has already disrupted the business of publishing houses and newspapers, where most of the revenue is now generated through online subscriptions. The German encyclopaedia Brockhaus for example stopped producing hard copies in 2014 and is now exclusively available in its e-version (Lange and Santarius, 2018). In 2015 e-books were the third most demanded product category in e-commerce generating revenues of over 3.600 billion Euro.

Digitalization also disrupted the entertainment and cultural industry with the availability of streaming services for music and movies. Music streaming platforms are extremely popular; Spotify alone counts 40 million paying subscribers (Kahlenborn *et al.*, 2019). Video streaming grew substantially with one billion hours of YouTube watched per day by users. In 2015, 63% of private internet use consisted of video streaming and is predicted to rise to 79% by 2020 (Sühlmann-Faul and Rammler, 2018). Video on demand is also rapidly increasing: *Netflix*, *Hulu*, *Amazon Prime* have more than 250 million subscribers worldwide and this number is expected to double by 2020 (Sühlmann-Faul and Rammler, 2018). Music, videos, images and audio files roughly generated 1.800 billion Euro in 2015 (Kahlenborn *et al.*, 2019).

3.3.2 Sharing economy & collaborative consumption

The sharing economy challenges the established economy. In the sharing economy, individuals and groups come together and organize themselves in distributive networks, and intend to transform the way we produce, consume, finance and learn (Botsman, 2013). Sharing economy activities fall into four broad categories: "recirculation of goods, increased utilization of durable assets, exchange of services, and sharing of productive assets" (Schor, 2014). While sharing is a basic concept of human interactions, goods and services are now shared with strangers, people outside of your own social network (Frenken and Schor, 2017). This form of sharing is largely enabled through online platforms which lower transaction costs and perceived risks (Benkler, 2004; Sparks and Browning, 2011). By enabling reviews, platforms seek to build trust among strangers. The *Flash Eurobarometer 467* on *The use of collaborative economy* from April 2018 demonstrates that in Germany 20% have used a service offered by collaborative platforms and 5% have offered a service themselves (European Commission, 2018).

Collaborative or sharing platforms can be divided along the lines of profit-vs. nonprofit and peer to peer (also known as consumer to consumer C2C) vs. Business to peer (also known as Business to Consumer B2C).

The term "sharing economy" has been criticized by different authors. For example, Frenken *et al.* (2015) point out that many platforms (especially for-profit platforms) seek to be subsumed under the umbrella "sharing economy" for marketing purposes. For Frenken and Schor (2017) the sharing economy consists of "consumers granting each other temporary access to under-utilized physical assets ("idle capacity"), possibly for money" (Frenken and Schor, 2017). The phenomenon is particularly strong in sectors with a lot of underutilized "sharable goods" (Benkler, 2004). For instance, homes and cars often have large underutilized potential in the form of spare space and seats.

But the sharing economy according to *Frenken et al.* needs to be distinguished from the on-demand economy, the second-hand economy and the product-service economy. When a person does not usually inhabit a home that he or she rents out on *Airbnb* or a driver embarks on a journey that he would usually not have undertaken, this is part of the On-Demand economy. Platforms that facilitate the resell or donate second hand products grant new ownership and therefore are part of the second-hand economy rather than the sharing economy. Platforms that allow businesses to rent goods are part of the product-service economy.

4 Role of State and Non-State Actors in the field of Digitalization and Consumption

This chapter identifies state and non-state actors that shape, drive, hinder or facilitate the digital transformation of consumption[2].

4.1 The Key Role of the State: Between Public Procurement and Regulation

The German government and EU-Commission increasingly intend to shape the digital transformation as well as continue to facilitate digital innovation / the growth of the digital economy.

Since 2018, digitalization has been a formalized task of the Federal Chancellery. Led by the *State Minister for Digital Affairs*, the *Digitalkabinett*, *IT-Planungsrat*, *Datenethikkommission* and *IT-Rat* and *Digitalrat* are responsible for steering digital transformation processes and advising the government on digitalization. Also, **several programmes and strategies** have been adopted, such as the *Artificial Intelligence Strategy* and the *Digitalization Implementation Strategy*. In the implementation strategy, the German government outlines different action fields, namely digital competence, infrastructure, innovation, society and the state. By doing so, it aims at "increasing the quality of life for all inhabitants, revealing economic and ecologic potentials and ensuring social cohesion". Also, political actors responsible for (sustainable) consumption are increasingly aware of the digital transformation, acknowledging its relevance and beginning to shape its course. One example is the *Federal Ministry of Justice and Consumer Protection* which has initiated a platform on Corporate Digital Responsibility.

The EU has also adopted several strategies. The *European Commission Digital Strategy* from 2018 aims at the internal digital transformation of the European Commission in order to increase the efficiency of its work as well as its effectiveness, transparency and security and to deliver digital public services. Essential elements for a successful implementation of the strategy are governance, e.g. monitoring of implementation of the digital strategy, resources, e.g. funding as well as digital and data skills of among others staff members. The *Digital Agenda for Europe* forms part of the overarching *Europe 2020* strategy and was published in 2010. In order to support innovation, economic growth and improvements of quality of life, this programme mainly focuses on the economic potentials of ICT. One part of this agenda is the *Digital Single Market Strategy for Europe* which aims at creating a "better access for consumers and businesses to digital goods and services across Europe", "creating the right conditions and a level playing field for digital networks and innovative services to flourish" and "maximising the growth potential of the digital economy".

[2] As this report pays attention to the systemic as well as the individual side of consumption, actors are included when they are an integral part of or influence collective decision making with regards to digitalization of consumption and/or influence individual consumption choices. Indicators for selecting actors are formalized authority / functions (for the state), market share and advertisement revenue (for companies) as well as membership numbers and budget (for civil society organizations).

Public procurement in Germany amounts to at least 300 billion € each year (Bundesministerium für Wirtschaft und Energie, 2017). By purchasing "state-of-the-art products and new technical solutions, government institutions can offer modern services and save money" (Bundesministerium für Umwelt, Naturschutz und nukleare Sicherkeit, 2017b). The public sector can serve as an important role model regarding sustainable consumption (Bundesministerium für Umwelt, Naturschutz und nukleare Sicherkeit, 2017b). With an average procurement volume of up to € 640 per inhabitant (2013), municipalities are the main actors in the field of public procurement (Becher, 2017). Next to contributing to sustainable development, reasons for sustainable public procurement can be setting an example for ethical business practices as well as creating incentives for companies to develop sustainable and innovative solutions (Becher, 2017). Legal and political success factors for sustainable public procurement are regulations on sustainability aspects in German public procurement law, a strong political will, and guidelines and sustainability strategies (Becher, 2017).

The 2018 update of the *German Sustainable Development Strategy* addresses sustainable public procurement. It integrates indicator 12.3 a "Paper with Blue Angel certification as a proportion of the direct federal administration's total paper use" and sets as target 95 % by 2020. A second indicator (12.3 b) is "CO_2 emissions of commercially available vehicles in the public sector" with the target to significantly reduce these emissions. The indicators are meant to be exemplary for the general goal to strengthen sustainable procurement.

4.2 Overview: Core Actors in the Field of Digitalization and Consumption

Primary drivers as well as facilitators for the digitalization of consumption are **companies**. They thus influence all three key trends. Historically, enterprises have been at the forefront of the digital revolution, developing both the digital infrastructure (e. g. hardware and software) as well as digital solutions and use cases which transformed entire business segments (e. g. the tourism sector), and together form the digital economy.

Multinational enterprises (MNEs) have the highest relevance with regards to the digitalization of consumption as they drive the digital transformation in Germany, the EU and internationally, and they influence collective decision making and consumption choices alike. In 2015, the total sales of the top 100 digital and ICT multinational enterprises amounted to 3 656 billion $ signifying their enormous economic weight and relevance for the consumer sector (UNCTAD, 2017). This is also visible in comparison to other multinational enterprises: Six of the world's top ten companies with regards to their market value are part of the digital economy (*Apple*, *Alphabet* (*Google*), *Microsoft*, *Amazon*, *Facebook*, *Tencent*) (Statista, 2019d). Their impact on consumers is observable in the digital advertisement revenue; e. g. Amazon spent 1.65 billion $ on advertisements in 2017 in the US alone (Statista, 2019a).

MNEs in the digital economy can be generally divided into ICT and Digital MNEs (UNCTAD, 2017). ICT MNEs comprise those companies which manufacture ICT hardware, develop software and provide the telecommunication infrastructure (UNCTAD, 2017) which renders them important facilitators of the digital transformation of consumption. Digital MNEs provide goods and services for consumption. For example, internet platforms host search engines, digital solutions companies offer electronic and digital payment services, e-commerce companies supply online stores and digital content enterprises provide digital media and info and data services (UNCTAD, 2017). The following (Table 1) summarizes these actors:

Table 1:Digital MNEs & ICT MNEs

Category		Subcategory	Description
Digital MNEs	Internet platforms	• Search engines • Social networks • Other platforms	• Companies providing digital services through internet and cloud-based platforms, engines and social networks. • Includes sharing economy platforms (e.g. transaction platforms and open-source platforms).
	Digital solutions	• Electronic payments • Other digital solutions	• Includes a variety of players with core activities based on or strictly linked to internet technologies. • Providers of electronic and digital payments, cloud hosting and computing, web hosting and e-mail services, digital solutions for business management and for financial applications (fintech).
	E-commerce	• Internet retailers • Other e-commerce	• Specialized and non-specialized online stores and online travel and booking agencies. • Includes agencies specialized in online marketing and advertising.
	Digital content	• Digital media • Games • Info and data	• Producers and providers of digital content – media and gaming. • Production relying on digital formats or files; delivery through both traditional channels and online channels • Database-related products and services: big data providers, marketing and customer intelligence, and providers of economic, business and credit information.
ICT MNEs	IT	• Devices and components • Software and services	• Manufacturers of ICT hardware (computer brands) but also components. • Developers of software; providers of assistance and IT consultancy. Major software houses, turning from a physical delivery model (with physically installed applications) to remote service applications delivered on demand. Category bordering “Digital solutions”.
	Telecom		• Owners of the telecommunication infrastructure on which internet data is carried. Increasingly active also as providers of internet services and OTT contents.

Source: table taken from UNCTAD, 2017

The *German Sustainable Development Strategy* addresses companies. In its sustainability management system it mentions the private sector which is „called upon to do their part to support sustainable development” (The Federal Government, 2018, p. 49). Companies are “responsible for their production processes as well as their products and services … [including] informing consumers about the health- and environment-related properties of the products” (The Federal Government, 2018, p. 49). In its sustainability management concept the strategy also includes the objective to “strengthen sustainable economic activity”, by “structural transformation” as well as “absolute decoupling” (The Federal Government, 2018, p. 50). It also includes an indicator for sustainable production – „EMAS eco-management

5000" with the target to have 5000 organisation locations by 2030 (The Federal Government, 2018, p. 55).

Closely connected to the digital economy are start-ups and labs/hubs. Start-ups are considered to be important drivers of digital innovation (BMWi, 2019a); they have the potential to disrupt current consumption patterns, but they also often aim at being bought by large corporations (Lange and Santarius, 2018). Labs and hubs are "physical spaces or programmes where different actors such as SMEs, start-ups, scientists and entrepreneurs work together to test and develop new innovative technologies, products and business models" (BMWi, 2019b). Labs and Hubs are sometimes supported by the state; one example is de:hub which includes 12 different hubs for digital innovations and was launched by the *Federal Ministry of Economics and Technology*. The *German Sustainable Development Strategy* mentions start-ups in the section "Ministries' priorities for the implementation of the German Sustainable Development Strategy". The *Federal Ministry for Economic Affairs and Energy* (*BMWi*) highlights that it "will support start-ups with the Digital Hub Initiative, for example, expand the Mittelstand-Digital competence centres, launch a "digitisation of the Mittelstand" investment programme, strengthen Industry 4.0 activities and continue to develop its technology programmes for application-oriented research to promote advanced digital technologies" (The Federal Government, 2018, p. 28).

Some internet platforms contribute to shape the digital transformation more sustainably. Online plattforms like *eBay*, *reBuy* or *Kleiderkreisel* enable and simplify the private commerce of second-hand products. In the first quarter of 2019 *eBay* reached 180 million active users (Statista, 2019c) and in 2018 the German platform *reBuy* could achieve a turnover of about 140 million € (Statista, 2019e). Furthermore, some internet platforms are important drivers for key trend 2 – increased access to information: There already exists a wide range of apps, initiatives and applications for consumer information (Kahlenborn *et al.*, 2019). Apps like *Codecheck* and *Get neutral* offer real time indicators on the environmental impacts of different products (e. g. ecological footprint and GHG emissions) (Lange and Santarius, 2018). These internet platforms are not yet addressed in the *German Sustainable Development Strategy*.

Consumer review websites such as *Yelp*, *trip advisor* or *trust pilot* play an important role in the digitalization of consumption (and for key trend 2 – access to information) as they have the potential to influence consumption decisions by facilitating electronic "word of mouth". Electronic word of mouth is "any positive or negative statement made by … customers about a product or company, which is made available to a multitude of people and institutions via the Internet" (Hennig-Thurau *et al.*, 2004). Advice by others through word of mouth is an important factor, as positive evaluations may increase trust in the good or service and may induce a higher willingness to pay while negative evaluations decrease trust and customers are less likely to purchase (Sparks and Browning, 2011). Consumer review websites may also lead to greater transparency e. g. by informing potential buyers on the lifespan of goods and thus shape the sustainability of consumption. Due to the importance of consumer reviews however, they are also bound to be manipulated; a study in the tourism sector for example finds that hotel managers use different strategies to influence reviews (both ethical and unethical), e. g. writing fake negative evaluations on competing businesses (Gössling *et al.*, 2018). Consumer review websites are currently not addressed in the *German Sustainable Development Strategy*.

Interest organizations differ with regards to their role in the digitalization of consumption. Generally, interest organizations target political decision-making processes, potentially influencing all three key trends. Some organizations function as drivers of the transformation namely associations representing the interests of the digital economy. Examples are *bitkom*

which represents about 2600 companies and eco- the association of the internet economy which represents ca. 1100 enterprises. *Bitkom*'s stated goal is, for example, "the digitisation of the economy, our society and public administration", it "push[es] for the faster rollout of gigabit networks and digital infrastructure for energy and mobility, for trade and for smart homes, for cities and regions" and "advocate[s] for ideal political and legal framework conditions in the digital economy to carve the way for digital innovation" (bitkom, 2019). Consumer organizations on the other hand intend to shape the digital transformation so as to protect consumer's interests. A key actor in this field is *VZBV* (*Verbraucherzentrale Bundesverband*) which represents 42 consumer associations in Germany. One of the topics it addresses is the "digital world"; the *VZBV* strives to, among others, protect privacy in the internet as well as "net-neutrality" (vzbv, 2019). Other important actors of relevance are the *Chaos Computer Club*, Europe's largest association of hackers, *Open Knowledge Foundation*, an organisation committed to the use of technology in the interests of the civil society and *Initiative D21*, Germany's largest network for the digital society consisting of business, politics, science and civil society actors. Interest organizations are addressed in the *German Sustainable Development Strategy*. In its sustainability management system the strategy posits that "stakeholders from civil society are required for the realisation of sustainability in many different ways and are involved on a constant basis" (The Federal Government, 2018, p. 49).

Political foundations are active "shapers" in the field of digital policy, but are less prominently working on the intersection between digitalization and consumption. For example, the *Friedrich-Ebert-Stiftung* (*FES*) is, among others, concerned with digitalization with regards to social progress and the job market, and the *Konrad-Adenauer-Stiftung* (*KAS*) is mainly dealing with issues of artificial intelligence, robotic and Open Data. Foundations are not explicitly mentioned in the *German Sustainable Development Strategy*.

Important facilitating and shaping actors for the digitalization of consumption are **research organizations** like *Fraunhofer society*, *Helmholtz*, *Leibniz society* and *Max-Plank-society*. Their research activities contribute to developing the digital infrastructure and also rendering it more sustainable. Examples are the *Helmholtz programme on supercomputing and Big Data* which aims at the development of instruments and infrastructures for supercomputing, as well as the administration and analysis of large databases and the programme *Future Information Technology* which "explores the fundamentals of solid-state based new technologies and strategies for a future green ICT" (Helmholtz, 2019). Further research institutions, like the *Einstein Center Digital Future* (*ECDF*), *Weizenbaum Institute* and *Alexander von Humboldt Institute for Internet and Society* (*HIIG*) focus not only on digital infrastructures but also on overarching issues, such as "digital health, digital society, digital industry and services" (*ECDF*), "work and cooperation in the sharing economy (Weizenbaum Institute) or "knowledge and society" (*HIIG*). In the *German Sustainable Development Strategy*, the sixth sustainable development principle calls for "us[ing] education, science and research, and innovation as drivers of sustainable development" (The Federal Government, 2018, p. 45). It also argues that "sustainability aspects must be included in innovation processes in a consistent manner from the start, especially in the context of digitisation, so that opportunities for sustainable development can be seized and risks for people and the environment can be avoided" (The Federal Government, 2018, p. 51).

Added value of the German Sustainable Development Strategy for addressing the key actors

This chapter highlights that the *German Sustainable Development Strategy* already addresses some of the key actors involved in digitalization. However, differences are

discernible; indicators and associated goals have already been formulated for some actors, e.g. for companies. Other actors are only named in individual subsections, e.g. labs and hubs. Others are not addressed. From the point of view of a digital-sensitive update of the *German Sustainable Development Strategy*, it seems important to address those actors who shape, enable or advance the digital transformation of sustainable consumption even more comprehensively. This should build on the existing state of the strategy and expand it. For example, the sustainable procurement indicator should be extended to other products and should cover the entire procurement process if possible.

The *German Sustainable Development Strategy* offers added value with regard to addressing the aforementioned actors. Through the strategy, the importance of the digital transformation for sustainable consumption could be emphasized; central topics of concern (see Chapter 5) could be placed on the agenda and important goals communicated. Also, the fact that primary responsibility for the sustainable development strategy lies with the Chancellery underlines – for example vis-à-vis multinational companies – the political importance attached to sustainable consumption and digitalization. Clear added value could thus be created by raising the level of ambition of the indicators and goals, addressing the most important risks and opportunities of the digital transformation of sustainable consumption and addressing the most important actors more comprehensively.

5 Risks and Opportunities of Digitalization for Sustainable Consumption: Need for Political Action

This chapter outlines risks and opportunities of the digital transformation for sustainable consumption. The chapter builds on the identified three key trends and discusses the respective impact each has on sustainability, and the possibilities for political action to boost the opportunities and minimize the risks. For each trend, the risks and opportunities are presented in the text; they are also summarized in a table at the end of this chapter. In addition, the infrastructure and material base of digitalization are analysed in the first section.

Often, the key trend may have both positive and negative effects. Appropriate political action can help maximize positive effects, while simultaneously reducing the negative ones. Recommendations for political action are presented in bullet points along with short notes on needed involvement from stakeholder groups and required data input (see annex for a long list of policy recommendations).

5.1 The socio-economic and ecological impact of the digital infrastructure and material base of digitalization

In order to fully understand the impact of the digital transformation on consumption, one needs to consider the risks and opportunities posed by digital infrastructures and the material basis of digital devices. This is particularly important because many goods are only consumed in a digital form (see chapter 3.3.).

5.1.1 Risks for sustainable consumption

Increasing energy demand through digitalization

Digitalization has substantially enhanced the per capita energy demand. Altogether ICT consumes around 10 percent of the total global energy demand, a number which could rise up to 30 to 50 percent until 2030 due to the production of digital devices, the energy consumption of data centers, the consumption of different forms of network access and the energy consumption of the end-user devices (Lange and Santarius, 2018). Energy use for ICT devices mainly emanates from the production phase (Williams, 2011). For example, DRAM chips lifetime energy use stems to over 70 percent from production (Williams, 2011). Currently, the largest share of energy used for operating electronic devices stems from coal; in 2010, the total CO_2-Footprint of the internet was at around 300 Million tons. Considering that in 2020, there will be about 4.1 billion people accessing the Internet worldwide, this number will likely rise (Sühlmann-Faul and Rammler, 2018).

One reason is the energy required for the digital infrastructure. Data centres worldwide require approximately 300 TWh per year, which equals half of Germany's total energy consumption of 2016 (594 TWh) (Kahlenborn *et al.*, 2019).

Further, the smartphone has a large environmental impact: Between 2007 and 2017 around seven billion smartphones have been produced globally, and the production alone consumed

around 250 terawatt hours – equaling the annual electricity demand of countries like Sweden or Poland (Lange and Santarius, 2018). The CO_2-Footprint of an *iPhone 7 (32 GB)* amounts already to 56 kg CO_2-eq., 78 percent of which stems from the production phase, 18 % from the use phase, three percent from transport and one percent from its disposal (Lange and Santarius, 2018). Modern smartphones have become increasingly more energy efficient. However, this tendency is being contradicted by improved processing power, memory capacity, larger displays and more frequent usage, which offsets energy efficiency gains (Lange and Santarius, 2018). Another important factor is that mobile data consumes more energy than wireless connection (Lange and Santarius, 2018; see also Ercan *et al.*, 2016; Fehske *et al.*, 2011).

Smart Home applications such as live video surveillance are another group of end-user devices that has increased in popularity (see Chapter 3); they have a considerable energy demand and often need to process large amounts of data (Kahlenborn *et al.*, 2019).

The increasingly popular streaming services (see Chapter 3.3) are particularly energy intensive as they require large amounts of data transmission. A study by technology provider *Cisco* showed that already in 2015, 55 percent of the internet traffic stemmed from video streaming (Sühlmann-Faul and Rammler, 2018).

Increasing resource demand and demand in raw materials

Digital devices require large amounts of raw and rare metals. In particular for electrical appliances, critical materials are cadmium, cobalt, copper, gallium, indium, lithium and silver (Zepf and Simmons, 2014, p. 15). Twenty-five percent of the globally mined silver is being used in electronic devices (Lange and Santarius, 2018). Marscheider-Weidemann *et al.* (2016) find that for 42 core technologies including RFID, super alloys, displays, 16 materials were of high importance, with expected future demand to more than double by 2035 in comparison to 2013 for lithium, dysprosium/terbium and rhenium (Zepf and Simmons, 2014, p. 18).

In Germany, every year, 27 million smartphones are sold, which contain a total of 0.8 tons of gold, 8 tons of silver and 0.3 tons of palladium (Kahlenborn *et al.*, 2019). Bookhagen *et al.* (2018) outline the resource demand of smartphones; according to their analysis a smartphone contains on average of 6.6 g copper, 0.01 g silver, 0.02 g gold and 0.002 g palladium; given the price of these metals in 2017 and multiplying it with the number of smartphones globally shows that their value amounts to roughly a billion Euro (Bookhagen *et al.*, 2018, p. 523). There is thus a large potential for recycling of metals: As Schiller *et al.* (2015) show, in Germany, there is a large “reservoir of secondary raw materials” e. g. from ICT infrastructure and durable consumer goods. At the same time, the recycling rates of metals are currently low (Graedel *et al.*, 2011).

Environmental risks associated with metals relate to mining / extraction (water quality, waste, energy consumption, health related impacts), use phase (energy consumption) and end of life (waste treatment) according to UNEP’s *International Resource Panel* (van der Voet, 2013). The majority of cobalt, tantalum and platinum stems from developing and economically emerging countries. In these countries, workers are often exposed to dangerous and inhumane working conditions and receive very low wages (Lange and Santarius, 2018). Most of the rare materials can only be gained by washing them out of rocks with acid. As those minerals are sparsely distributed, tons of rocks have to be washed in order to extract a few grams. This process produces toxic runoff and chemical residues, which contaminate both soil and air (Sühlmann-Faul and Rammler, 2018).

The Democratic Republic of Congo is globally the largest exporter of cobalt. For a single smartphone, around 5 grams of cobalt are needed. With seven billion smartphones produced

between 2007 and 2017, this amounts to about 38.000 tons of cobalt. In the Democratic Republic of Congo, rebel groups often finance their activities through the mining of cobalt. This is not only problematic from a socio-political viewpoint, but also from an environmental standpoint: The rebel groups tend to mismanage natural resources through unsustainable mining practices. These practices not only deplete the soils of other minerals, they also contribute to mass deforestation, which has caused erosion and thus, the destruction of animal and human habitats (Sühlmann-Faul and Rammler, 2018). Furthermore, the majority of electronic devices are produced in Southeast Asia, which is an area that predominately uses fossil fuels. In fact, the share of renewables in energy production is still under 10% in most of these countries. Factoring in the low share of renewables, the carbon footprint of mineral extraction is further increased. Moreover, long and complicated supply chains in the industry avoid social and ecological standards and cause more transport emissions (Sühlmann-Faul and Rammler, 2018).

Increase in e-waste

Worldwide, the level of e-waste is growing according to the *Global E-Waste Monitor* (Baldé *et al.*, 2017). Annually, 44.7 million metric tonnes are produced (Baldé *et al.*, 2017, p. 4). This is directly related to the digital transformation and increasing demand in ICT-devices. At the same time, the known recycling rate of e-waste amounts only to ca. 20 percent (official statistics are frequently missing).

Digital devices often have a very short life span. A smartphone, for instance, is used on average for only 2.5 years, which includes a potential resale period (Kahlenborn *et al.*, 2019). This tendency has been intensified by changing designs that make it difficult, if not impossible, to replace key components. Contracts that tempt consumers to continuously buy new models, and in some cases even using planned obsolescence, to further fuel sales are contributing to the problem (Sühlmann-Faul and Rammler, 2018). The “prevalent throw-away mentality with regard to digital electronics” (Hilty and Bieser, 2017) will translate into an increasing footprint of the ICT sector, even with a well-established recycling system in place. The growing demand for devices means that the dissipation of many scarce metals will increase as well (Hilty and Bieser, 2017).

To date, there is no material loop that ensures the optimal recycling of all materials used in electronic devices (as *van Schalkwyk et al.* highlight there are significant challenges for digitalizing the circular economy due to losses to nature (van Schalkwyk *et al.*, 2018)).So called “e-waste” emits toxic substances that contaminate the air and soil in and around landfills, which can harm workers during improper disposal. *Greenpeace* estimates that between 50-80% of all devices are exported to the Far East and are disassembled by workers without protective gear or appropriate tools (Greenpeace, 2018). Much of the E-Waste and its toxic components end up in the landfills of developing countries. According to the *Magazine Scientific America*, Agbogbloshie, in Ghana, is the most toxic place in the world. A staggering 215.000 tons of E waste are delivered to this town on a daily basis (Sühlmann-Faul and Rammler, 2018).

5.1.2 Opportunities for sustainable consumption

ICT-based solutions also have the potential to increase energy efficiency in many sectors, and thus, contribute significantly to the abatement of greenhouse gas emissions. Hilty and Bieser (2017) identify the transportation, building and energy sectors as having the highest potential for ICT-enabled (“smart”) solutions to reduce greenhouse gas emissions (GHG). As demonstrated above, there is a risk that the carbon footprint of the ICT sector itself would

overcome the energy efficiency gains. The latter can be avoided by reducing the carbon footprint of the ICT sector by 17%, which is technologically and economically feasible (Hilty and Bieser, 2017).

They demonstrate the potential for abatement in 2025 of GHG emissions in three scenarios, the pessimistic, the expected and the optimistic one. Smart logistics alone could, in an optimistic scenario, result in approx. 2,25 Mt CO2 avoided each year. Strikingly, in the pessimistic scenario, e-commerce could actually further increase CO_2 emissions instead of decreasing them.

5.1.3 Digital infrastructure and material base of digitalization: options for political action

There are several options for political action which address the identified risk and opportunities.

Stakeholders that could be involved for implementing these options include the *Bundesnetzagentur*, *BMWi/BMZ*, consumer protection /legal entities, sustainable cloud computing and green software experts, open source developer and contributor, producers/supply chain partners, scientists in the field of raw materials and tax experts (data tax).

Supportive data for the implementation the political options relate to supply chains, material loss in production and end of product life as well as energy efficiency of provided telecommunication infrastructure.

Potential fields of action are:

Boosting data and energy efficiency

- "Digital-ecological tax reform", taxing resources and energy used as well as gains generated through digitized automatization (Lange and Santarius, 2018)
- Tax on collected data
- Cooperation with network operators to push penetration of fast and efficient internet connection in Germany, help dissemination of free WLAN hotspots (e.g. in underground railway tunnels) to reduce energy consumption (since using mobile data is more energy intensive than using a hotspot) (Sühlmann-Faul and Rammler, 2018)
- Boost sustainable cloud computing and green software (Sühlmann-Faul and Rammler, 2018)

Improving/creating applicable socio-ecological standards

- Certification of ICT devices that are "sustainable" (socially and environmentally) and do not constitute health hazards (Sühlmann-Faul and Rammler, 2018) e.g. *fairphone*
- Regulate the use of raw materials, especially those that are extracted in conflict zones (Sühlmann-Faul and Rammler, 2018)
- Oblige companies that use raw materials extracted in other countries with poor social equality and access to education to contribute a part of their revenue to the educative system and other social institutions of the respective country (Sühlmann-Faul and Rammler, 2018)
- Finance research to find alternative non-toxic materials and materials that emanate from areas outside of conflict zones (Sühlmann-Faul and Rammler, 2018)

- "Smart phone Bill of Rights" (*Elisabeth Woyke*) which ensures that customers have access to information about price policy, wage policy of workers along the supply chain and how data is protected (Sühlmann-Faul and Rammler, 2018)

Tackling e-waste

- Regulate product life/repairability and reuse of materials in order to boost circular economy and reduce waste (WBGU, 2019; Sühlmann-Faul and Rammler, 2018)
- Enlarge the take-back obligation and create legal framework for a (semi) automated waste disposal system (Kahlenborn *et al.*, 2019)
- Round table / research on (semi) automated waste disposal systems to identify the products for which such a solution would be most useful (Kahlenborn *et al.*, 2019)
- Finance pilot studies/projects that focus on blockchain technology for greater transparency in supply chains, and thereby, avoid loss of materials (Sühlmann-Faul and Rammler, 2018)
- Open-source operating systems for laptops, computers and smartphones to keep devices up-to-date and render the purchase of new devices unnecessary (Sühlmann-Faul and Rammler, 2018) (see also Chapter 5.4.2)
- Reward companies that combine delivery of goods and take-back of old electronic devices
- Set high fines for companies which do not ensure repairability by design and do not grant free/low cost repairs of their products (Sühlmann-Faul and Rammler, 2018)
- Roundtable with e-commerce stakeholders in order to identify challenges with regards to waste reduction (WBGU, 2019)
- Initiate public discussion/raise awareness for repairability, provide guidelines, help navigate and find platforms with online tutorials for repairing, upcycling and reusing
- Tax items with shorter life cycle and low repairability (WBGU, 2019) or grant tax breaks on repairs; ***Best practice:*** Sweden 2016 tax breaks for repairs (Frenken, 2017)

5.2 The impact of increased and simplified access to products on sustainable consumption

This chapter discusses impacts of the first key trend "increased and simplified access to products" on sustainable consumption and identifies stakeholders and fields of action.

5.2.1 Risks for sustainable consumption

Increased consumption rate

E-commerce poses a critical challenge for sustainability as it might lead to a higher consumption rate. The EHI Retail Institute (2019) argues that instant shopping – a sub-phenomenon of e-commerce – will increase consumption via automated and simplified ordering through virtual assistants, digitized one click payment and 24 hour availability (Lange and Santarius, 2018). There is also less awareness for the amount of money spent (Deutschland Verbindungsstelle e-Commerce, 2018). Some authors suggest that the gained time from more efficient shopping is used for even more shopping. This "time rebound effect" may also take a toll on the social sustainability, rendering life more stressful. Pahlevan Sharif and Yeoh (2018) highlight the problem of compulsive online shopping. Majamaa *et al.* (2019) observe an increase in financial hardship and debt among consumers. Online purchases do

not require face-to-face human interaction, thus creating psychological distance which makes it less likely that people are aware of the socio-ecological impact of their shopping behaviour. Therefore, sustainability is likely not a deciding factor in their purchasing decisions (Lange and Santarius, 2018).

Increased transport based emissions

As e-commerce and trends such as same-day and instant delivery become more widespread the risk for increased transport based emissions such as airborne pollutants increases (Lange and Santarius, 2018; see also Rotem-Mindali and Weltevreden, 2013). ICT-technologies made logistics and fleet management more efficient; however, the gains in efficiency did not translate in reduced traffic. The concept of just-in-time logistics shifted stockpiling of products from storage halls to driving trucks. This resulted in, on the one hand higher efficiency regarding cost and time, but on the other side in increased traffic and energy consumption (Lange and Santarius, 2018). Also the risk of rebound effects is relatively high in the transportation sector – reducing time for and costs of transportation increases the demand for logistic services Hilty (2017). For example, as the fuel intensity of European road freight logistics decreased from 1992 until 2012 by roughly 20%, the demand for road freight transport increased by over 15% (Llorca and Jamasb, 2017).

In particular, high return rates of online shopping may lead to an increase in airborne emissions. Generally, offline shopping results in lower return rates than online shopping. One reason is that it is inconvenient to return products to the store; additionally, the products' quality is usually assessed by consumers in the store during shopping. In contrast, the return rate in the clothing sector in e-commerce amounts to 40 percent (Greenpeace, 2018). Online stores often advertise a free return policy to encourage people to buy a variety of sizes and styles. Customers often order the same product in different sizes and colours and choose the product that fits best.

This process of flexible shipping and easy returns has led to higher transport related greenhouse gas emissions. Economists of the University of Bamberg reported that in 2018, 280 million packages, which included 487 million products, were returned. This resulted in 238.000 tons of CO2 emissions, which equals 2200 daily car rides from Hamburg to Moscow (Tagesschau.de, 2019). According to investigations by the *ZDF* and the *Wirtschaftswoche Amazon* discharges around 30% of returned products, because repackaging would be too work intensive, and thus, too costly (Greenpeace, 2018).

Monopolization

E-commerce is prone to monopolization which leads to several risks . A first risk is that small and medium sized enterprises and local commerce are disadvantaged (Lange and Santarius, 2018). A second risk is that ICT and digital MNEs use public infrastructures without proper contribution to state funds (Lange and Santarius, 2018). *Google*, for instance, generated 22.6 billion Euros in Europe, the Middle East and Africa but paid only 47.8 million Euros in taxes in 2016 (The Guardian, 2016). A third risk relates to inequality. Digitalization may further enlarge inequality by a shift of wage income to capital income. In the digital age, it may become more profitable to own software, programs and robots than to offer jobs on the market (Lange and Santarius, 2018).

5.2.2 Opportunities for sustainable consumption

Collaborative logistics

Digitalization could enable emission reduction. Transport logistics can make use of customer demand data to improve efficiency (PWC, 2017). Moreover, sharing logistical assets among companies in road freight transport can increase asset utilization, and thus reduce emissions (Hilty and Bieser, 2017). Collaborative logistics can occur vertically (i.e. among customers and service providers) or horizontally (i.e. among different companies) (Barratt, 2004). Collaborative logistics can also have positive economic effects and therefore be attractive for companies, as they can reduce their cost for logistics while enhancing customer satisfaction through increased order fill rates and order accuracy (Langley, 2015).

A large share of transport emissions is generated in the last mile of delivery. E-commerce has the potential to facilitate sustainable solutions for the last mile for example by intelligent bundling of deliveries combined with efficient and low emission vehicles such as the *StreetScooter* in Germany (Arnold *et al.*, 2008). Covering the last mile with a delivery system also allows people with reduced mobility to shop independently (KENYON *et al.*, 2003).

Increased accessibility of sustainable products and reduction of waste

While many sustainable products such as organic food used to be available only in specific stores, they are now available online from anywhere. The same holds true for sustainable clothing, which can still only rarely be found in stationary commerce. Alternative online marketplaces, such as *Avocadostore*, *Fairmondo* and *Glore*, specialize in offering sustainable products (Lange and Santarius, 2018).

Mass customization allows for products that cater more towards individual needs. This may reduce waste (Boër *et al.*, 2018). Also point repairability of products may be enhanced through 3D printing technology, which is able to re-produce replacement parts that are no longer available.

E-commerce as a booster for the local economy

E-commerce, mass customization, personalization of products and prosumption are also opportunities for capitalization by local businesses and can boost local economy for three main reasons.

First, the improvements in the logistics of deliveries can make local production more efficiently accessible (bevh, 2018; Lange and Santarius, 2018). Second, digitalization can increase efficiency in the production and allocation of goods. Small-batch production offers an opportunity to SMEs and a renaissance to previously more economically successful sectors (e.g. the textile sector) (bevh, 2018). Efficiency gains through precision framing could also play out in urban and regional food production. Moreover, digital platforms may help in organizing farm sales more efficiently. Farms can post online which products they have to offer, and interested consumers can reserve them ahead of time. The farmers can then deliver the product to an agreed point of sale where the consumers pick up their purchase. Similarly, subscription models to *Community Supported Agriculture* (*CSA*) can be boosted through digitalization, which may help reach a larger number of potential customers. Third, blockchain technology supports direct trade for example by creating a decentralized booking system.

E-procurement as a driver for sustainable consumption

In Germany, 900 contracting authorities on the federal, state and communal level conduct e-procurement. The market size equals around 1 billion EUR with 60,000 suppliers registered

at www.evergabe-online.de (BeschA, 2019). The German federal department store (*Kaufhaus des Bundes* (*KdB*)) is the central tool for e-procurement. Sustainable e-procurement is likely to have a large impact given the purchasing power of public institutions of approx. 350bn EUR[3], i.e. 13% of GNP. Public institutions make up a fifth of the German ICT market; there is thus a large leverage potential when public institutions adhere to high standards for data protection and ecological design with little energy consumption (Green IT). The centralized procurement of product portfolios does not only allow for cost savings through bulk discounts, but also potentially helps customers to make more sustainable purchasing decisions. The sustainability compass[4] offers information on sustainable e-procurement, keeping authorities and interested organizations updated on recently released product groups, sustainability labels, best practices and potential suppliers for certified products.

There are also attractive procurement opportunities for civil society organizations. Intermediary online platforms such as www.innatura.org and www.inkinddirect.org distribute new products that are not suitable for direct retail (e.g. returned products or promotional products). This helps to reduce waste and increase the purchasing power of civil society organizations, thus, empowering them to further help people in need.

5.2.3 Increased and simplified access to products: options for political action

There are several options for political action which address the identified risk and opportunities.

Stakeholders that could be involved for implementing these options include e-commerce platforms/associations, logistic firms, tax experts (e.g. waste taxation), circular economy experts (with knowledge on return shipments) as well as the *BeschA*, *KNB* and *GIZ*.

Supportive data for the implementation of the political options relate to evaluation of logistics data, relation between accessibility and consumption behaviour, understanding the consumer expectations from personalized/customized products and purchasing data.

Options for political action are:

Tackling transport emissions:

- Policies to mitigate the increase in transportation emissions taking into account the decreasing cost of transportation (e.g. higher fuel prices) (Hilty and Bieser, 2017)
- Encourage and facilitate collaborative logistics (e.g. roundtable with e-commerce firms to achieve cooperation in delivery and return shipping)
- Toll roads in cities for delivery trucks as an economic incentive to increase bundling and collaborate with other companies
- Reward innovative ideas in ecofriendly/ green logistics (e.g. slow/patient delivery option with better carbon footprint, delivery by city scooters)

Regaining taxable assets and thereby improve wealth distribution

[3] Covering: textiles, ICT, food, infrastructure, etc.

[4] GIZ and Engagement Global : https://www.kompass-nachhaltigkeit.de/en/

- Seek international cooperation and develop innovative tax plans to ensure that ICT and digital MNEs contribute to common good (Lange and Santarius, 2018)
- Tax on e-commerce (Lange and Santarius, 2018)
- Tax on “IT giants” (Lange and Santarius, 2018)

Boost green economy

- Financial aid for green digital start-ups, platforms and companies that use alternative forms of production and contribute to sustainability (WBGU, 2019)
- Create awards for innovative and sustainable examples in e-commerce
- Boost sustainable e-procurement, focus on ict-appliances with ecological design and high energy-efficiency, insist on enhanced data protection and practice digital sufficiency (Lange and Santarius, 2018)

Reform antitrust and monopoly law

- Regulate platform size (e.g. when platforms exceed a certain threshold they are declared as public institutions) (Lange and Santarius, 2018)
- Data and knowledge should systematically become the basis for considerations of antitrust law (Lange and Santarius, 2018)

5.3 The impact of increased access to information

This chapter outlines risks and opportunities arising from the second key trend “increased access to information”.

5.3.1 Risks for sustainable consumption

Expansion of tourism and air travel

Digitalization may expand the tourism market (Bieger and Beritelli, 2018; Datta *et al.*, 2018). Consumers prefer to book trips online because of the extensive range of choices, the convenience, time and price saving (Escobar-Rodríguez and Carvajal-Trujillo, 2014). Low-cost airlines offer their flights cheaper online as there is no surcharge for a travelling agency (Escobar-Rodríguez and Carvajal-Trujillo, 2014) and there are low transaction costs (Bieger and Beritelli, 2018). Platforms like *Kayak* and *Skyscanner* compare prices of different airlines and help find the cheapest fares, rendering air travel more accessible and affordable (Mauelshagen, 2016). Platforms offer individually customized travel searches, e.g. bundle packages that combine air travel, hotel and car rental for a reduced rate.

Personalized pricing and just in time push messages

An effective way to manipulate a consumer’s decision is to apply personalized pricing. Data collected on consumers is evaluated and algorithms determine how much a consumer is likely willing to pay on a product, travel or event. This means that some customers will be paying higher prices due to their expected higher willingness to pay and others lower prices for the same good or service. In Germany, personalized pricing is yet rarely applied as companies are worried about losing consumers who think that such pricing is unfair (Schleusener and Hosell, 2016).

Personalized push messages are another way to make use of collected consumer data (Lange and Santarius, 2018). Just in time push messages encourage consumption when

surfing online. Weather conditions, traffic and other external factors are evaluated and used to frame these messages, thereby inducing consumption and creating additional desires (BVDW and MMA Germany, 2019).

Asymmetry of information and subsequent power-shifts

The asymmetry of utilization of big data collection, storage, and analysis may result in a power-shift from traditional businesses and governments to data-driven businesses. Data-driven businesses also widen the gap between developing and developed countries with regard to access to information (Linkov/Trump 2018). Consequently, technology developers preferentially target the market of developed countries, rather than developing countries (Linkov *et al.*, 2018).

Big Data and social media as a sales accelerator

Social media pushes consumption by connecting it to specific lifestyles and images, which enhance the psychological/emotional value of products (Wallaschkowski and Niehuis, 2017).

For example via pinterest, consumers can upload a picture of a product, and immediately receive information on where it can be purchased (Lange and Santarius, 2018). Online shops are active in social media and place targeted advertisements, promotions and gift certificates in user feeds. Fashion blogs may speed up consumption and lead to fast fashion i.e. short fashion cycles and shorter product life span for textiles. van Dam and van Reijmersdal (2019) find in their study that adolescents are particularly vulnerable to influencer marketing. Adolescents follow social media stars for instance on *YouTube*, while being unaware of the strategic placement of products. Berryman and Kavka (2017) underscore the importance of virtual intimacy that beauty vloggers convey by framing themselves as the “big sister” or “best friend”.

Increased vulnerability

The increasing digital interconnectedness and storage of sensitive data online and in clouds poses the risk of increasing vulnerability to cyber-attacks. For instance, digital attackers may infiltrate hospitals, food supply and traffic systems (Lange and Santarius, 2018).

5.3.2 Opportunities for sustainable consumption

Apps to boost green consumption and reduce waste

Digitalization has the potential to democratize access to information. There are now manifold ways to gain information on goods and services and consumers can also now navigate information more easily. For instance, Lange and Santarius (2018) point out that with “Green Apps” like *Codecheck* or *Get Natural*, consumers can simply scan a product’s barcode to receive additional information on the carbon footprint, health effects and toxicity of products.

The apps *Food Loop* and *Too Good to Go* support local businesses and decrease food waste. A product’s price automatically decreases when it is close to reaching its expiration date (Kahlenborn et al. 2018).

Product identification and labels

Digitalization offers opportunities for product information and labelling which could support the circular economy. van Schaik and Reuter (2016) for example develop a recycling index in analogy to energy labels which could be used for communicating recyclability. Such an index would be in particular useful if it is accompanied with a public institution tasked with collecting and monitoring mandatory information from producers (Ressourcenkommission

am Umweltbundesamt, 2017). Digital solutions could also help explain EU's energy label[5] (e.g. through QR codes / touch screens).

Development of a social and ecological sustainable view of consumption

Gazzola *et al.* (2017) found that, when purchasing products, millennials demand transparency and corporate responsibility from companies. This raises the hope for the further growth of a social and ecological view on consumption, in case such views become more widespread and transfer into behavioural change. Millenials spend extensive time online and on social media, promoting their life styles (Gazzola *et al.*, 2017), which could lead to increased awareness among other consumers.

Increased market potential for sustainable and tailored products

There is an increased market potential for niche products as producers can reach potential customers globally now. More sustainable products may become globally available (Lange and Santarius, 2018) as well as products that are tailored to different needs of minority groups that are not otherwise available in traditional commerce (Euromonitor International, 2017; see also Savrul *et al.*, 2014).

5.3.3 Increased access to information: options for political action

There are several options for political action which address the identified risk and opportunities.

Stakeholders that could be involved for implementing these options include consumer protection /legal entities, nudging/behavioural economics experts, e-commerce platforms, producers/supply chain partners, conveyors of supply chain information/data (e.g. *GS1*), tax experts (data tax).

Supportive data for the implementation of the political options relate to dynamic prizing (what is the "willingness to pay" for sustainable products), user patterns from smart home data (for dynamic energy management) and purchasing data in general to understand consumer's interests.

Options for political action are:

Regulation on algorithms and targeted online advertisement

- Regulate the use of algorithms (commercial use, sponsored content) (Sühlmann-Faul and Rammler, 2018)
- Selective advertising ban, limitation of personalized online advertisement, complete transparency (reveal bots, reveal source of information, clear divide between information services and advertisement) (Lange and Santarius, 2018)
- Use algorithms to nudge people towards sustainable consumption (Sühlmann-Faul and Rammler, 2018)
- Legal framework to boost anonymous browsing by default to avoid data collection and targeted advertisement
- Privacy by design (Lange and Santarius, 2018)
- Push companies to use collected customer data to inform about environmental aspects through tailored messages (Kahlenborn *et al.*, 2019)

[5] See EU Horizon 2020 project Pocket Watt (https://pocketwatt.eu/About.aspx).

Boost green digital offers (apps, platforms etc.)

- Workshop with green app developers and investors in order to devise "green all inclusive" apps and a roadmap for dissemination of environmentally sustainable information (Kahlenborn *et al.*, 2019; Sühlmann-Faul and Rammler, 2018)
- Financial aid for green digital start-ups, platforms and firms that use alternative forms of production and contribute to sustainability (WBGU, 2019)
- Financially reward companies that have green apps as a default setting on their smartphones

Raise awareness and increase online advertisement literacy

- Initiate public discussion/raise awareness of asymmetric information (Kahlenborn *et al.*, 2019)
- Finance research on the effectiveness of virtual realities for awareness raising in the environmental sector/ identify ways to fight delegitimization of environmental politics through virtual/mixed realities / research technical and resulting social trends of virtual/mixed/augmented realities and their ecological impact (Kahlenborn *et al.*, 2019)
- Use virtual realities to inform about environmental problems/disasters and raise empathy to help legitimize environmental policies (Kahlenborn *et al.*, 2019)
- Help foster digital literacy in communities
- Involve citizens through citizens science projects (WBGU, 2019)

5.4 The impact of sharing and collaborative consumption

This chapter outlines risks and opportunities arising from the third key trend "sharing and collaborative consumption".

5.4.1 Risks for sustainable consumption

Unfair practices undermining regulations and customer and worker protection

Some authors have pointed out unfair practices of large platforms. These comprise of potential undermining of regulations and consumer protection laws (Demary, 2015) as pseudo-independent workers such as *Uber* drivers have no right to paid vacation, parental leave or any social benefits, nor can they unionize. They serve as de facto cheap employees.

These platforms may also lead to inequality within the bottom 80% of the income distribution as people with high education levels capture market opportunities that used to be captured by lower educated workers (such as driving and cleaning) (Schor, 2016).

Traditional businesses are challenged

The sharing economy challenges traditional businesses such as the taxi and hotel industry. The home sharing platform *Airbnb* has over four million listings of homes around the world and was valued at $31 billion US-Dollar by the end of 2017. This is striking since it exceeds the value of big international hotel chains, such as *Hilton* and *Marriot* (Wachsmuth and Weisler, 2018). Established hotels are challenged by home sharing, especially lower-end hotels and hotels that are not catering to businesses. This is likely to result in a decline of legacy business and may ultimately result in unemployment for hotel workers (Frenken and

Schor, 2017). Byers *et al.* (2013) found that hotel earnings significantly declined parallel to the growth of *Airbnb* in the state of Texas.

Low clean energy index and increasing sales of new products

Germany's most popular second-hand platform covers it's energy demand with 50% of natural gas, its clean energy index is low with 10% clean energy (Sühlmann-Faul and Rammler, 2018). Moreover, users looking for used goods on the platform are increasingly targeted with online advertisement for new products. In 2008, more than half of all products sold on *eBay* were second hand, eight years later in 2016 second-hand sales only constituted 20% of total sales (Lange and Santarius, 2018).

Unaffordable Housing

Wachsmuth and Weisler (2018) list researchers, community groups and housing advocates that are concerned with the impact that home sharing, as through *Airbnb*, has on affordable housing. According to the *Los Angeles Alliance for a New Economy* (*LAANE*), home sharing platforms undermined efforts to increase housing stock. They stated that in popular neighborhoods, the number of full-time, short-term rental units was four times higher than the number of newly built homes. Entire neighborhoods can turn into "de facto hotel districts" (Cócola Gant 2016). This is consequently transforming neighbourhoods and social cohesion in neighborhoods.

Monopolization and increasing power of platforms

Platforms have a tendency to scale up and monopolize. Due to the lock-in mechanisms described by Krisch and Plank (2018) in the sharing economy a network effect may occur in which the value of a platform grows with the number of users. Thus, it becomes increasingly difficult for users to shift to another less popular platform. Once firmly part of a platform, it can change the terms and conditions to be less favorable for users. For example, if a host has a disagreement with *Airbnb*, they risk being banned from the website. In the same vein, when *Facebook* bans users, the banned user loses the ability to reach a similarly large group of people (Lange and Santarius, 2018).

Rebound effects

Sharing economy solutions may generate significant rebound effects as they render access to goods and services less costly and thus might incentivize additional consumption (Acquier *et al.*, 2017). For example, consumers may buy "unnecessary items" or may "purchase other things with the savings from second-hand buying" (Parguel *et al.*, 2017).

5.4.2 Opportunities for sustainable consumption

Use idle goods

More than a quarter of total CO_2 emissions of private consumption stems from individual mobility (BMU, 2018). Applying the criteria of idle capacity (Frenken and Schor, 2017) to the existing mobility sharing offers, it becomes clear that ride sharing platforms such as *BlaBlaCar* or carpooling sites may have a largely positive impact on emissions because they allow people to make use of underutilized seats[6]. Furthermore, mobility apps that allow interconnected mobility smart solutions can enhance the use of public transport in

[6] However, Coulombel et al. find that rebound effects may arise, induced among others by shifting from public transport to cars and "travelling longer distances" Coulombel *et al.* (2019, p. 110).

combination with bike sharing, e-scooters and e-cars. This may reduce transport related greenhouse gas emissions significantly (The Federal Government, 2016).

Home sharing may fall into the category of underutilized goods, when apartment rooms are shared that are not used. Home sharing exists in various forms and ranges from free accommodation offers such as couchsurfing (Decrop *et al.*, 2018) swapping homes such as *Haustauschferien.de*, to accommodation offers in exchange for taking over tasks (e. g. babysitting) facilitated by platforms such as *GigRove* and finally in exchange for money, facilitated by platforms such as *Airbnb* (e.g. (Wachsmuth and Weisler, 2018).

Avoiding waste

Food consumption is responsible for 20-30% of environmental burdens of total consumption (Papargyropoulou *et al.*, 2014). Tackling food waste through a better management of food surpluses has great potential to reduce the carbon footprint of the food industry. This may be done by raising awareness of the consumers for sustainability issues regarding food. berr (Berti and Mulligan, 2015) optimistically stated that "*digital technologies may hold the key to the successful coordination of a more sustainable food system*". Food banks allow food allocation to low income and homeless populations (El Bilali and Allahyari, 2018). In Germany and Austria *foodsharing.de* is a platform that saves food that is overproduced and/or bought. The platform also promotes sustainable consumption.

Instead of producing and selling new goods, there is a growing market for the resale or donation of old goods. Platforms help consumers connect. Thanks to low transaction costs, this can also occur over greater distance. In Germany, platforms such as *ebay* and *ebaykleinanzeigen* are well established. The market for apparel, books and toys exchanged online is especially large (Schor, 2016). In Germany, the foundation *Anstiftung & Ertomis* facilitates a network of repair initiatives, mapping repair cafés as well as organizing meetings of community members (Kannengießer, 2018).

Enhanced social and cultural experiences

Digitalization enables people to unfold their talents and offer their services and products online without costly advertisement (Lange and Santarius, 2018). Many customers of home sharing platforms have a social motivation and interest in new social relations. Platforms might increase understanding among different groups of people and enhance cultural experience when travelling abroad.

Schor (2016) found that food sharing was more common in communities and neighborhoods since goods were mostly picked up in the same area to avoid longer travel. Revitalizing social neighborhoods is also the mission of the German platform *nebenan.de*: Neighbors can exchange, lend and borrow products, help out, offer their skills or simply meet and spend time with each other.

Increased accessibility of goods for people across different income levels

Shared and collaborative consumption has the potential to democratize access to goods, tools and know-how, which can benefit low-income households (Schor, 2016). Shared mobility and shared housing makes traveling more accessible for low income households. Kahlenborn *et al.* (2019) and Gazzola *et al.* (2017) raise the hope that the educational aspect of product sharing and repairing will contribute to a socially responsible view on consumption.

Democratization and decentralization of the economy and social-ecological benefit

Platforms help connect small-scale farmers to exchange ideas, information and resources, may empower rural communities (El Bilali and Allahyari, 2018). Urban gardening as an

alternative food production grew substantially through the use of digital platforms by connecting land owners willing to share land with urban gardeners (El Bilali and Allahyari, 2018).

Fairmondo aims to be the socio-ecological alternative to *Amazon* focusing on ecological, fair trade and used products. *FairBnB* is launching "a vacation rental platform which gives back 50% of its revenues to support local community projects of your choice such as social housing for residents, community gardens and more" (Fairbnb, 2019). *Loconomics* is an alternative to *Taskrabbit* or *Myhammer*; freelancers have a shared interest in the platform, receive dividends whenever profit is made and are involved in decision-making (Lange and Santarius, 2018).

Open-source platforms provide free hardware, software and data and thus boost the rise of cooperative citizen-led platforms. For example, the availability of apps for farmers has allowed users to select seed species that would be optimized for their specific biome. Apps may also assist by providing information on harvesting. Open-Source operating systems for laptops, computers and smartphones can help keep devices up-to-date and render the purchase of new devices unnecessary (Sühlmann-Faul and Rammler, 2018).

LivingLabs for developing digital and sustainable communities

Living labs could be used for developing digital and sustainable communities, neighbourhoods, cities and villages (Wuppertal Institut für Klima, Umwelt, Energie and Fraunhofer-Institut für System- und Innovationsforschung ISI, 2018; Liedtke *et al.*, 2015; Burbridge *et al.*, 2017; Keyson *et al.*, 2017). Making use of the potential of living labs would require to build up the necessary innovation infrastructure (e.g. through research funding and establishing standards for living labs).

5.4.3 Sharing and collaborative consumption: options for political action

There are several options for political action which address the identified risk and opportunities.

Stakeholders that could be involved for implementing these options include worker protection /legal entities, civil society organizations, (green) IT specialists and open-source activists.

Supportive data for the implementation of the political options relate to e. g. "work force" in the sharing economy and number of *AirBnB* hosts and listings.

Boost sustainable sharing economy

- Set incentives for open-source hardware and software as well as open-data
- Raise awareness for alternative platforms (e.g. *Fairmondo* and *FairBnB*)
- Strategy paper on how to boost the sharing economy (Kahlenborn *et al.*, 2019)
- Establish an award for sustainable sharing economy platforms (e.g. annual award)
- Boost the "good" sharing economy (peer-to peer, democratically organized) through financial aid for platforms (Kahlenborn *et al.*, 2019; Lange and Santarius, 2018) e.g. in the form of incubator programs or accelerator camps to help startups in the difficult, first phase (Lange and Santarius, 2018).
- Workshop with experts of digitalization (from science and politics) and stakeholders of the sharing economy to identify potentials for environmental politics to reduce obstacles and thereby develop sharing economy further (Kahlenborn *et al.*, 2019)
- Create a framework for the exchange of best practices.

- Cooperation with online platforms (*Google-Facebook*) to encourage second-hand peer-to-peer merchandise
- Create a national office of social innovation and civic participation (***Best Practice*:** The US has such an office to boost social innovation and socio-ecological sharing platforms and forms of prosuming) (Lange and Santarius, 2018)
- Supporting sharing practices, involving and educating the public
  Best Practice: Project "Buen Conocer" of the Ecuadorian state that aims to radically reimagine the nation according to principles of sharing—open networks, open production, and an economy of the commons

Regulate on-demand economy

- Create a legal framework that applies to on-demand economy workers (*Uber*, *Lyft*, *Deliveroo*, *foodora* etc. drivers) regarding unemployment insurance, overtime, night- and weekend shifts, parental leave, minimum wage and the right to unionize
- Regulate that only inhabited apartments can be rented via *AirBnB* and similar platforms
- Regulate short-term rentals and limit housing rental prices
- Provide housing vouchers for local residents financed through occupancy taxes (short-term rental)
- Apply cap logic to limit the number of nights in which a house/apartment can be rented out.
  Best Practice: For instance, in London regulation allows to rent apartments for 90 nights (Wachsmuth and Weisler, 2018).

5.5 Overview: risks and opportunities

This table summarizes the identified risks and opportunities.

Digital infrastructure and the material base	
Risks	**Opportunities**
Increasing energy demand through digitalization Increasing resource demand and demand in raw materials Increase in e-waste and low recycling rates Low wages and dangerous working conditions Mining activities monopolized by rebel groups Destruction of human habitats and increase health hazards Increased vulnerability to cyber attacks	Potential to increase energy efficiency in many sectors, including transportation, building and energy sectors
Increased and simplified access to products	
Risks	**Opportunities**
Increased consumption due to instant shopping and convenience Increased transport based emissions due to delivery / return shipments Monopolization Decline of stationary commerce and local infrastructures	Positive impact of collaborative logistics: reduced cost More opportunities for regional economy Boost for sustainable production due to sustainable e-procurement Preservation an creation of jobs in the local economy

Rebound effects in the transportation sector Psychological distance Power of IT Giants in influencing politics IT Giants as freeloaders Increasing social divide Increasing financial hardship among consumers/ excessive debt Time-rebound effect	E-procurement for civil society organizations Transport emissions can be reduced through bundling of delivery Enhanced efficiency of logistics through anticipated customer demand Collaborative logistics can increase utilization of assets E-commerce as driver for transport solution for the last mile Mass customization: potential waste reduction high adaptation potential to new regulations
Increased access to information	
Risks	**Opportunities**
Expansion of tourism/ Increased (air) travel Increased energy demand Personal pricing Increased consumption, shorter product cycles (Big Data -> Big needs) Increased vulnerability to cyber attacks Asymmetry of information Insinuation of social pressure within online consumption communities Personalized and just in time push messages Vulnerability to video influencer marketing Virtual intimacy of beauty vloggers “big sister/best friend”	Algorithms can boost sustainable decision making Reduction of food waste due to better allocation Market potential for green Apps Possibility to find customer base for niche products Increased market potential for social entrepreneurship Increased market potential for sustainable products Possibility to organize efficient farm sales, increase CSA Increased food sovereignty of local communities Potential for democratization of access to information More specific equipment for different needs of minority groups available Empowerment of consumers vote with their wallets

	Development of a socially responsible view on consumption Social benefits due to social entrepreneurship
Impact of sharing	
Risks	**Opportunities**
Increased accessibility of cars might result in more extensive car usage Increased carbon footprint due to the demand for additional facilities Additional income that households earn used for purchasing more goods Increased emissions through food deliveries and packaging Reusage of inefficient products and therefore increased emissions Rebound effect Low clean energy index of sharing and second hand platforms Unfair competition; Potential loss of legacy businesses (restaurants) Monopolization and increasing power of platforms Undermining of worker and customer protection laws Exclusion of people with disabilities Gentrification of neighborhoods Loss of vivid and interactive neighborhoods (loss of sense of community) Superficial short-term relations Third parties suffer from externalities Exclusion of people who used to trade offline Undemocratic organization of sharing platforms	Car sharing (ride sharing) leads to substantial reduction in CO2 Emissions Interconnected smart mobility solutions enhancing use of transportation Less demand for privately owned cars Reduce of food waste and thereby significant reduction in emissions Boost sustainable agriculture Democratization and decentralization of the economy Creation of new markets that expand the volume of commerce New opportunities for sustainable agriculture Creation of new social ties Help social mobility through increased social capital Make travelling more accessible for people with lower income Enhanced cultural experience when travelling abroad Help social mobility through additional income that can be dedicated Strengthen community feeling in neighborhoods, enhance trust Strengthen collaborative food production as in urban gardening Food banks allow allocation of food to low income / homeless population LivingLabs for developing digital and sustainable communities

6 Strengthening the German Sustainable Development Strategy and the National Programme on Sustainable Consumption: Recommendations for a Digitally-Sensitive Update

Building on chapter five and the identification of positive and negative impacts that digitalization might have on sustainable consumption this chapter outlines policy recommendations for a digitally-sensitive update to the *German Sustainable Development Strategy*; it also includes recommendations that should be taken into account for the *National Programme on Sustainable Consumption*.

This chapter includes recommendations that are more closely linked to the current sustainable development strategy as well as recommendations that are less connected and more ambitious, focusing on the legal framework underpinning the digital transformation of consumption. The recommendations address both political actors in general (6.1 policy recommendations) as well as science policy (6.2 research recommendations).

Core criterion for selection is that the proposed changes impact sustainable consumption, as assessed in Chapter 5.

6.1 Policy recommendations

1) Support the "good" sharing economy and set more ambitious goals for sustainable consumption

As outlined in chapter 5, not all platforms that are set under the umbrella of the sharing economy can be considered a driver for sustainable consumption. Forms of the sharing economy that make use of idle vehicles, homes, soft- and hardware, other physical products and knowledge have the potential to contribute to sustainability. Peer-to-peer sharing platforms that are organized democratically may decentralize, democratize the economy, strengthen social cohesion in neighborhoods, boost local economies and reduce transport-based emissions.

Such forms of sharing should be supported politically (Kahlenborn et al. 2019). An example is the initiative "Buen Conocer" of the Ecuadorian state that aims to radically reimagine the nation according to principles of sharing — open networks, open production, and an economy of the commons. However there is a risk that sharing results in additive consumption and financial rebound effects: not-spend money may simply be used for other consumption fields (Ludman 2018). Consequently, legislation should accompany these measures and tackle other drivers of increased consumption, such as personalized online advertisement. Also, it is critical to continue to monitor and evaluate the existing sharing economy regarding rebound effects. This should build on research results e.g. from *BMBF*-funded projects *i-share* and *peer sharing*. When developing social innovation, monitoring and evaluation should pay particular attention to the material base of innovations in order to

minimize risks for rebounds and associated environmental and socio-economic effects (digital divide).

In the *National Programme on Sustainable Consumption*, the sharing economy is mentioned in the background section on "new consumption patterns and different business models" (The Federal Government, 2016, p. 17). The chapter on social innovations mentions car-sharing as „ having the "potential to impact positively on sustainability outside conventional market structures (The Federal Government, 2016, p. 36). In the *German Sustainable Development Strategy*, a main entry point is *SDG 12* implementation; the existing indicators on sustainable consumption do not yet focus on collaborative consumption; the topic is also not yet explicitly addressed. Including the topic in the strategy could help setting it higher on the political agenda as well as raising awareness of some non-beneficial aspects of the platform economy.

One political instrument would be to establish an **Office of Social Innovation and Civic Participation** which aims at supporting social innovation and socio-ecological sharing platforms and forms of prosuming (Lange and Santarius, 2018). The office would be in charge of helping the "good" sharing economy through economic measures such as financial aid (Kahlenborn et al. 2019; Lange/Santarius 2018) or in the form of incubator programs or accelerator camps to help startups in the difficult first phase. The creation of an independent office would be a strong signal to the German public and other governments. Alternatively, existing institutions (such as the competence center for sustainable consumption which supports the implementation of the National Programme for Sustainable Consumption) can take up the recommended tasks.

Another political instrument would be to **establish living labs to test and further expand best practices** of the sharing and circular economy on a regional level. The *German Sustainable Development Strategy* already mentions living labs in its chapter on Ministries' priorities for theimplementation of thestrategy (*BMBF*) (The Federal Government, 2018, p. 35). Establishing living labs should build on existing research and practice of living labs (Burbridge *et al.*, 2017; Liedtke *et al.*, 2015; Keyson *et al.*, 2017; Wuppertal Institut für Klima, Umwelt, Energie and Fraunhofer-Institut für System- und Innovationsforschung ISI, 2018). Canada and the Netherlands are using the living lab format to support the circular economy[7]. In August 2017, Sweden launched a national program called *Sharing Cities*[8]. The country aims at developing "world-leading test-beds for the sharing economy in Stockholm, Gothenburg, Malmö and Umeå". A stronger reference to living labs in the *German Sustainable Development Strategy* would highlight its importance.

Best practices to design living labs are available, for instance through the *European Network of Living Labs* (*ENoLL*). New living labs can also profit from synergies with similar labs and financing channels enlisted on the ENoLL website[9]. ENoLL also offers digital and face-to-face coaching and workshops to help design living labs.

What is required is establishing the necessary innovation infrastructure for living labs so they are able to develop products and services for the sharing and circular economy (Geibler and Erdmann, 2017). This involves shoring up research funding, connecting different labs and stakeholders, standardizing use of methods as well as integrating *SDG*s in funding priorities. Furthermore, visibility of living labs should be improved, stakeholder sensitized for their new

[7] https://www.circulareconomycanada.net

[8] https://www.sharingcities.se/

[9] https://enoll.org/.

role in the innovation system and sustainability be established as core criterion for living labs (Wuppertal Institut für Klima, Umwelt, Energie and Fraunhofer-Institut für System- und Innovationsforschung ISI, 2018).

2) Shed light on the blind spot of sustainable e-procurement

Currently, the consumption related indicators in the *German Sustainable Development Strategy* focus on paper and vehicles procured by public authorities; sustainable e-procurement is not mentioned. For the update of the strategy, a sustainable e-procurement indicator should be included, specifically focusing on the sustainable e-procurement of ICT appliances with ecological design and high energy efficiency rates, insisting on enhanced data protection (Lange and Santarius, 2018). There should be a goal set for the percentage of sustainable ICT appliances purchased by public authorities in the years to come (e.g. 50 %). In order to set and implement such a goal it would be helpful to have data on the current ICT equipment of the different political levels and an estimate of upcoming purchases.

Greener administrations enable green growth, encourage ICT-related green jobs and are a signal to other governments and the public, helping the needed diffusion and application of Green ICT (OECD 2018). The strong purchasing power of public authorities can also influence ICT companies.

It is feasible to increase the share of sustainable ICT appliances, thanks to the available guidelines and tools. The *Federal Ministry for the Environment, Nature Conservation and Nuclear Safety* (*BMU*) supports the establishment of manuals and guidelines for procurement of sustainable ICT appliances and recommends the usage of the independent platform ***https://www.itk-beschaffung.de/***. Guidelines for product neutral public tender are available for notebooks, personal computers, thin clients, monitors, printers and servers, with more guidelines will follow (Bundesministerium für Umwelt, Naturschutz und nukleare Sicherkeit, 2017a). Moreover the sustainability compass provides a helpful tool for sustainable e-procurement.

3) Address consumers, enhance competences and establish Green standards for internet use

SDG 12.7 stipulates to promote a universal understanding of sustainable lifestyles and to ensure that people everywhere have the relevant information and awareness for sustainable development and lifestyles. The *German National Programm on Sustainable Consumption* addresses this issue and calls for “raising consumer awareness of sustainable ICT and expanding the range of sustainable ICT products” (The Federal Government, 2018, p. 55). The *German Sustainable Development Strategy* could also take up the topic in the background chapter, which would highlight the increased digital transformation of sustainable consumption.

Awareness of the possible impacts of digital consumption (especially with regard to e-commerce) on the environment should be raised by educational programmes and communication measures (e.g. an information campaign). To bridge the gap between knowledge and action insights from behavioural economics and social psychology (“nudging” for instance) should be taken into account (Thorun *et al.*, 2016). Furthermore, Green standards for internet use should be established to reduce the risk for rebound effects, following the principle of “as much as necessary and as little as possible”.

4) Strengthen product labelling and Green standards for ICT-products

Product labelling as well as Green standards for ICT-products should be strengthened e. g. by establishing a public institution that oversees obligatory product labelling (Ressourcenkommission am Umweltbundesamt, 2017). Such an institution would collect

information from companies on products, evaluate whether submitted information fits the requirements as well as monitor implementation. Companies should be required to submit data on life span of products, resource inputs in the whole life cycle, resource consumption in real use situations as well as the product's ability for reuse and recycling. The data collected could e. g. be used to rank products on an recycling index for consumer information (van Schaik and Reuter, 2016). This institution would support the circular economy with regards to ICT and beyond. The *German Sustainable Development Strategy* already includes an indicator on labelling – "market share of goods certified by independently verified sustainability labelling schemes". Also the *National Programme on Sustainable Consumption* underlines that "to enable consumers to make informed decisions and create incentives for manufacturers to develop sustainable products and services, environmental and social labelling schemes will be further strengthened" (The Federal Government, 2016, p. 29).

Raising the bar – an outlook on ambitious changes in a digitally sensitive update of the current regulations and laws

In this outlook, three more ambitious changes in legislation that do not directly connect to the current sustainable development strategy are presented. These changes are expected to have a great impact on sustainable consumption.

- *Reform antitrust and monopoly law:* platforms should be limited in size (Lange and Santarius, 2018). Such legislation would enable peer-to-peer, non-profit and democratically organized platforms that are more desirable from a social and ecological point of view to expand.
- *Reform tax law to create a digitally sensitive tax in accordance with the proposal of the European Commission:* This reform would entail taxing resources and energy used as well as gains generated through digitized automatization (Lange and Santarius, 2018).The gained resources can be dedicated towards regional subsidies, for example ensuring basic supply in local commerce in smaller towns (grocery stores, pharmacies etc.) (Kahlenborn *et al.,* 2019). For this measure to be effective, it is crucial to seek international cooperation (Lange and Santarius, 2018). To avoid further fragmentation of the European single market, the tax reform should be a result of an European agreement. The economic gains would be significant given the sales of ICT and Digital MNEs like *Amazon*. The *European Commission* suggests that online businesses should pay taxes in the countries where they have significant digital presence, defined as gains from sales and services amounting to more than 7 Million EUR, more than 100 000 users and more than 3000 online business contracts. The gains stemming from collected user data (e.g. to place advertisements), services that connect users to each other (e.g. online market places, services of the sharing economy) and other digital services (e.g. streaming abonnements) would be taken into consideration (Europäische Kommission, 2018).
- *Regulate use of algorithms (commercial use, sponsored content)* (Sühlmann-Faul and Rammler, 2018): The commercial use of algorithms to cater sponsored content to potential consumers should be limited. A selective advertising ban could limit personalized online and instore advertisement to instances with complete transparency (reveal bots, reveal source of information, clear divide between information services and advertisement) (Lange and Santarius, 2018). Another option is to legally force companies to use collected customer data to inform about environmental aspects through tailored messages (Kahlenborn *et al.,* 2019). Oversight should in general be improved (SVRV, 2018).

6.2 Research recommendations

5) Finance research in the field of digitalization and sustainable consumption

According to the updated version of the *German Sustainable Development Strategy* of November 2018, "private and public expenses for research and development shall be increased to a minimum of 3.5 % of GDP by 2025" (The Federal Government, 2018).

Financing ***research that explores alternative less-toxic materials as well as materials that are not imported from conflict zones*** (Sühlmann-Faul and Rammler, 2018) should be on the top of the agenda. This would alleviate harmful environmental and social effects. It would also result in synergies with other indicators of the *Sustainable development strategy* such as "7a conservation of resources" or "8.6. global supply chains". It could serve as an economic opportunity, contributing to securing Germany as a business location and profiting from developed patent rights in the field of digital appliances.

Similarly, research funding should also be allocated to e-waste prevention. As previously outlined, internet-of-things applications are increasingly used and so is the number of connected devices that will eventually be discarded. Consequently, the problems related to the mining of needed rare materials and improper disposal of devices (see Chapter 5) will be accentuated (OECD, 2018). One solution would be to establish ***a (semi) automated waste disposal system***. But in order to launch such a system research first needs to ***identify the products for which the system would prove to be the most useful*** (Kahlenborn *et al.,* 2019). Another solution would be to capitalize on ***blockchain technology*** which may increase transparency in supply chains.

The gained insights on material flows can be used for a better management of materials and thus ***avoid the loss of materials*** (Sühlmann-Faul and Rammler, 2018). As UNEP's *International Resource Panel* highlights recycling rates of metals are currently very low, due to among others in-efficiencies in accruing and handling metals as well as high availability of primary materials (van der Voet, 2013; Graedel *et al.*, 2011). At the same time metals impact health and environment; environmental impacts arise e.g. from mining and refining (van der Voet, 2013). As Reuter *et al.* (2018) show in a case study on *fairphone 2* recycling, dismantling of the product is the best pathway regarding environmental footprint and material recovery, in comparison to smelting and shredding and sorting. The study highlights the need to design products for recycling.

Conducting the aforementioned research paves the way for setting regulations on product life/ repairability and reuse of materials (wpn2030, 2019). This is also highlighted by the *National Programme on Sustainable Consumption*'s section on workplace and office which higlights the need to "work towards extending the life span of ICT products", focusing on education, communication and awareness for consumers (The Federal Government, 2016, p. 56). In addition regulation would boost the circular economy, reduce waste (WBGU, 2019; Sühlmann-Faul and Rammler, 2018), enlarge take-back obligation and create a legal framework for a (semi) automated waste disposal (Kahlenborn *et al.*, 2019). Tax breaks on repairs, could further enhance the life cycle length of products. For instance, in Sweden, the government decreased the VAT rate on repairs from 25% to 12% to encourage Swedes to engage in repairs instead of purchasing new goods (Egerton-Read 2016; theguardian.com 2016).

As outlined in Chapter 3, some trends have not been researched thoroughly with regards to their impact on sustainability. Creating an empirical basis would help assess whether further

legislative changes are necessary. Such research could, for example, focus on digital payments regarding the risk of resulting environmental complications and the opportunity to boost the circular economy (Kahlenborn *et. al.,* 2019).

Also research should look more closely at digital equity. This would mean to take socio-economic differences into account, analysing who has access to, uses, profits from digital solutions and why – for example by looking at the costs and access to car sharing and e-scooter and related equity implications. It should be assessed how such monitoring / evaluation can be connected to *SDG 12* indicators and monitoring.

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8 Annex

The following table groups political options into four categories of political instruments: legal, economic, communicative and cooperative. Note that this table is more exhaustive than the bullet points in chapter 5 (the table represents a long list).

Table 1: Legal, economic, communicative and cooperative political instruments

	Legal political instruments	Economic political instruments	Communicative political instruments	Cooperative political instruments
Impact of digitalization infrastructure and the material base *(Chapter 5.1.)*	Regulate the usage of raw materials especially the ones that are extracted in conflict zones "Smart phone Bill of Rights" (Elisabeth Woyke) to ensure that customers can find about price policy, wage policy of workers along the supply chain and the handling of data protection Set regulations on product life/ repairability and reuse of materials in order to boost circular economy and to reduce waste Enlarge take-back obligation	Boost sustainable cloud computing and green software "Digital-ecological Tax reform" taxing resources and energy used as well as gains generated through digitized automatization Obligate companies that use raw materials extracted in other countries with poor social equality and access to education to contribute a part of their revenue to the educative system and other social institutions of the respective country Open-Source operating	Certification of ICT devices that are "sustainable" (socially and environmentally) and do not constitute health hazards Initiate public discussion/rise awareness for the topic or repairability, provide guidelines, help navigate and find platforms with online tutorials for repairing, upcycling and reusing	Cooperation with network operators to push penetration of fast and efficient internet connection in Germany, help dissemination of free WLAN hotspots (e.g. in underground railway tunnels) to reduce energy consumption (since using mobile data is more energyintensive than using a hotspot) Cooperation with Scientists to find alternative materials to the toxic ones and the ones that can only be found in conflict zones Round Table/ Research on (semi) automated waste disposal to identify the products for which this

	and create legal framework for a (semi) automated waste disposal	systems for laptops, computers and smartphones to keep devices up-to-date and to render the purchase of new devices unnecessary Reward companies that combine delivery of goods and take-back of old electronic devices Establish high fines for companies who do not ensure repairability through their design and who do not grant free/low cost repairs of their products Tax items with shorter life cycle and low repairability or grant tax breaks on repairs ***Best practice:*** Sweden 2016 Tax breaks for repairs		would be the most useful Research to identify potentials for recycling and reusing of electronic devices Projects that focus on Blockchain Technology for more transparency in supply chains, and thereby, avoid the loss of materials Roundtable with e-commerce stakeholders in order to scope for challenges/ideas as to reduce waste
Increased and simplified access to products *(Chapter 5.2)*	Elaborate new ecological standards that apply to e-commerce Legislation on imperative exposure of the carbon footprint of products which are sold online Reform so that platforms are	Tax on e-commerce, use gained resources for regional subventions e.g. to ensure basic supply through stationary commerce in towns (Grocery stores, pharmacies etc.) “Digital-ecological Taxreform” taxing resources and energy	Strategy Paper on how to react to loss of stationary commerce Create awards for innovative and sustainable examples in e-commerce	Seek international cooperation and develop innovative tax plans to ensure that IT Giants contribute to common good instead of freeloading Encourage and facilitate collaborative logistics (e.g. Roundtable with e-commerce firms

	limited in size (e.g. when they exceed a certain threshold are declared as public institutions) Data and knowledge should systematically become the basis for considerations of antitrust law Facilitate legal framework for Green Logistics (bundling) And impose recyclable Packaging Forbid the use of dash buttons (already implemented)	used as well as gains generated through digitized automatization Tax on digital giants and use gained resources to finance sustainable projects and redistribute wealth to avoid widening of the social gap *https://ec.europa.eu/taxation_customs/sites/taxation/files/factsheet_digital_taxation_21032018_de.pdf* Policies to mitigate increase of transportation as a reaction to decreasing cost of transportation (e.g. higher fuel prices) Toll roads in the cities for delivery trucks as an economic incentive to increase bundling and collaborate with other companies Financial aid for green digital start-ups, platforms, firms that use alternative forms of production and contribute to sustainability Reward innovative ideas in	Boost sustainable e-procurement, focus on ICT appliances with ecological design and high energy efficiency rates, insist on enhanced data protection and practice digital sufficiency	to achieve cooperation in delivery and return shipping) Roundtable/pilot project: Market place for eco- products Research on digital payments and resulting environmental complications

		ecofriendly/ Green Logistics (e.g. slow/patient delivery option with better carbon footprint, delivery by city scooters)		
Increased access to information *(Chapter 5.3)*	Regulate Use of Algorithms (commercial use, sponsored content) “Algorithm law” Push companies to use the collected customer data to inform about environmental aspects through tailored messages Legal framework to boost anonymous browsing in the web (default setting) to avoid data collection and targeted advertisement Legislation to ensure privacy by design Establish statutory disclosure duty with specific requirements of the presentation of information (accessibility and intelligibleness)	Financially reward companies that have Green Apps as a default setting on their smart phones Financial aid for green digital start-ups, platforms, firms that use alternative forms of production and contribute to sustainability	Initiate public discussion/raise awareness of asymmetric information ´→ issue enters important sociopolitical digitalization conferences such as re:publica Use algorithms to nudge people towards sustainable consumption Use virtual realities to inform about environmental problems/disasters and raise empathy to help legitimize environmental policies Establish educative programs to enhance media literacy and support existing media literacy programs (e.g. programs in schools to	Workshop with Green App Developers and Investors in order to come up with “Green all inclusive” apps and a roadmap for dissemination Research on the effectiveness of virtual realities for awareness raising in the environmental sector/ identify ways to fight delegitimization of environmental politics through virtual/mixed realities / research technical and resulting social trends of virtual/mixed/augmented realities and their ecological impact Involve citizens through citizens science projects Workshop regarding acceptance with potential green influencers and other experts

			inform children and adolescents about targeted online advertisement) Strategy paper on what a digital consumer has to know and how to achieve the education of digital consumers including a sensibilization for online scams (such as fake e-stores)	
Shared and collaborative consumption *(Chapter 5.4)*	Facilitate a legal framework that enables (green digital start-ups, cooperative platforms and alternative production forms such as commons-based peer production, prosumers) Legal framework to boost digital common goods such as trustworthy databasis, open data and open source (especially in the agricultural sector to help reduce environmental damage through pesticides and fertilizers and enable	Boost good sharing economy (mainly peer-to peer that is organized democratically) through financial aid for platforms which could be in the form of incubator programs or accelerator camps to help startups in the difficult first phase Create incentives for Open-Source Hard-, Software and data Reward the sharing and maintenance of common digital goods	Strategy paper on how to boost sharing economy Establish an Award for sustainable sharing economy platforms (e.g. annual award) Raise awareness for socio-ecological alternatives to big platforms (e.g. Fairmondo and FairBnB) Create an award for significant contribution to common digital goods Create a national Office of Social Innovation and	Workshop with experts of digitalization (from science and politics), stakeholders of sharing economy to identify potentials of environmental politics to reduce obstacles and thereby enable sharing economy further →Create a framework for the exchange of best practices. Cooperation with Online-Platforms (Google-Facebook) to encourage more environmental commercial posts or Second-Hand peer-to-peer merchandise e.g. Facebook Marketplace

	independence of small scale farms Create a legal framework that applies to On-demand economy workers (Uber, Lyft, Deliveroo, foodora etc. drivers) regarding unemployment insurance, overtime, night- and weekend shifts, parental leave, minimum wage and the right to unionize (***Best Practice*** **:** California Supreme Court imposed the ABC test to determine whether an independent contractor should actually be an employee/ France is currently working on a similar legislation) Legislation that only inhabited places (actual residence of the host) can be rented out on AirBnB and similar platforms, that way making sure that people do not Airbnb out entire apartments, contributing to gentrification and quickly rising rents. Regulations on short-term rentals and having housing rental price limits, which would impact short-term rentals like		Civic Participation (***Best Practice*****:** USA has such an office to boost social innovation and socio-ecological sharing platforms and forms of prosuming) Support sharing practices, involving and educating the public (***Best Practice:*** Project “Buen Conocer” of the Ecuadorian state, that aims to radically reimagine the nation according to principles of sharing—open networks, open production, and an economy of the commons)	

	Airbnb and hotels Provide more housing vouchers for local residents financed through occupancy taxes (short-term rental) Apply Cap Logic for: limiting the number of nights in which a house/apartment can be rented out. Similar attempts could be to cap the on-demand driving services. (***Best Practice:*** For instance, in London the regulation allows to rent out 90 nights and in Amsterdam 60 nights			

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Über die wpn2030

Die Plattform

Die Wissenschaftsplattform Nachhaltigkeit 2030 ist ein zentraler Ort der Wissenschaft, an dem sie drängende Fragen der Nachhaltigkeitspolitik reflektiert und diskutiert – im Austausch mit Politik, Wirtschaft und Gesellschaft. Wissen für Nachhaltigkeit wird dort zusammengetragen und weitergetragen, insbesondere im Hinblick auf die Umsetzung der Deutschen Nachhaltigkeitsstrategie. Die Plattform arbeitet unabhängig und ist systematisch eingebunden in den offiziellen politischen Steuerungs-, Dialog- und Umsetzungsprozess der Agenda 2030. Träger der Plattform sind SDSN Germany, DKN Future Earth und das IASS Potsdam

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