



Sector Analysis: Communication

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Executive Summary

This study explores the main environmental and social issues related to companies in the Communication Sector as well as the relevant fields of action with regards to a sustainable development. Furthermore, material sustainability themes such as data usage, energy consumption as well as anti-competitive behaviour are discussed in terms of environmental, social and governance (ESG) risks and opportunities.

Communication is a human need, which is fulfilled by a variety of complementary products and services provided by the Communication Sector. Communication technologies have seen a rapid growth in the last decade and we have entered an age in which data is considered “the new oil”. The transition to the information age has been characterized by digitalization efforts and disruptive technologies that fundamentally changed the way people communicate and access information. Facilitated through innovative solutions and the expansion of the network infrastructure, new business models have emerged. The Communication Sector exerts a high degree of influence on society, which presents both challenges (e.g. data privacy, information quality and energy consumption) and opportunities (e.g. social inclusion, decarbonization).

Numerous companies potentially produce a positive net sustainability impact by offering products and services that substitute traditional activities (e.g. facilitation of geographically independent communication instead of long-distance travelling). However, as opposed to face-to-face communication, digital communication, requiring data flows over a certain distance through a transmission medium, certainly produces negative externalities: extensive energy usage through digitalization, social exclusion due to a lack of internet access or privacy infringements caused by the exploitation of data.

The sector, as defined by Inrate, ranges from telecommunications operators to advertising and printing companies and therefore entails a wide array of companies with diverging products and services with differing impacts on society, the environment and the economy. Further, the Communication Sector is driven by constant technological innovation and disruption, which not only transforms business models within the industry itself but also changes the business conduct across all other industries. Inrate’s ESG Impact Analysis takes all these factors into consideration in order to help responsible investors in identifying companies that contribute to sustainable development.

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1. Relevance for Responsible Investors

Whenever new business models emerge, investors face new risks and opportunities in their decision-making process. These dynamics are probably most prevalent in the Communication Sector where constant technological innovation and disruption not only transform business models within the industry itself but also drives growth across all other industries.

The Inrate Service Sector Communication represents 9.1% of the MSCI All Country World Index (MSCI ACWI; capital weighted). Along with other Inrate sectors such as Financial Services (18.2%), Health (10.8%) and Energy (9.6%), Communication is among the major sectors in the Inrate research universe comprising 241 out of the total of over 3'500 titles. These numbers not only reflect the significance of communication as a societal need, but also the potentially prominent role of certain communication companies.

Why impact assessments matter

Corresponding to their financial relevance, communication companies can have significant positive and/or negative impacts on environment and society, which potentially translates into financial and reputational investment risks and opportunities. With its **ESG Impact Rating**, Inrate assesses the sustainability impact of companies. This assessment is a crucial prerequisite for investors to reallocate capital towards or engage for a more sustainable economy and to manage impact-related investment opportunities and risks.

The sustainability impacts of companies are defined as those impacts that are not internalized into market prices due to market failures such as external effects. The assessment takes into consideration the impacts along the entire value chains, i.e. a company's supply chain and during product usage and disposal. It focuses on the absolute impact on the environment and society as well as the relative impact due to substitutional effects, such as communication technologies as a substitution for long-distance journeys. As shown in the below figure, the assessment translates into a sustainability rating on a scale from A+ to D-, reflecting a company's contribution to sustainable development.

Figure 1: ESG Impact Rating Scale

A	A+ A A- Sustainable or supports the transition towards sustainability	Through its practices, products or services, the company already contributes to the reduction of the social or environmental imbalances of the economy and supports the global transition towards a long-term sustainable economy.
B	B+ B B- On the path to sustainability	The activity of the company is compatible with a long-term sustainable economy, but its products, services or practices, do not meet all sustainability requirements yet . The company demonstrates the willingness and ability to improve its sustainability performance.
C	C+ C C- Not sustainable, but with less negative impact	The activity of the company is currently not sustainable . Its products, services or practices exert a heavy social or environmental burden, but the company demonstrates the willingness and some ability to modify its products or practice in order to reduce the negative impact.
D	D+ D D- Not sustainable	The activity of the company is not sustainable . Its products, services or practices contribute to a rapid deterioration of environmental and/or social conditions. The company has no possibility or demonstrates no willingness to reduce this impact .

Source: Inrate 2020.

Inrate's **Best-in-Service** approach groups companies according to the services provided to society, such as communication, transportation, nutrition, energy, etc. and allows a comparison between companies serving similar societal needs. This provides an indication on potential **investment risks and opportunities**: Sooner or later, negative impacts are taken up by stakeholders: Governments tighten laws, consumers increasingly demand sustainable products, non-governmental organizations (NGOs) and the media exert pressure, etc. This promotes structural change and leads to an impact that has implications on companies: Negative impacts become transition risks, while positive impacts become transition opportunities. Accordingly, an impact measurement is future-oriented: Companies that offer innovative, sustainable solutions are assessed positively, whereas companies that are not sustainable are assessed negatively.

The ESG case for the Communication Sector

The Communication Sector is characterized by market concentration, particularly within its subsectors **Internet** (3.7%), **Telecommunications** (3.1%) and **Media Provider** (1.2%) where few companies exert a high degree of **market power**. Alongside this market power, **data privacy** has become a considerable ESG risk with the rise of internet companies whose business model is built around gathering and selling data. Facebook for example has increasingly lost its reputation as the company came under pressure due to its controversial behaviour with regards to the handling of user data. (Bloomberg 2018a). Since its Initial Public Offering (IPO) in 2012, Facebook has regularly appeared in Inrate's Controversy Impact Assessment. Both the largely unclear use of customer data and the company's lack of transparency towards investors and stakeholders represents a substantial reputation risk.¹ Consequently, Inrate has recommended Facebook to be excluded by responsible investors since 2016.² The latest data breach controversy involving consulting firm Cambridge Analytica had significant implications for Facebook on the stock market as the stock price fell drastically. This example highlights the importance for companies to have a strict policy and a strong data management system in place. Risks related to data breaches such as increasing costs of rehabilitation, loss of customers and eventually reputational loss can thus be avoided (Rahm 2014). Inrate considers a sound handling of data a high priority and established a separate controversy indicator over content and privacy of customer data.

While vast amounts of data pose certain ESG risks, they also present important opportunities. The availability of extensive amounts of data in shorter time allows companies to analyse sustainability issues at stake, to address them more efficiently and to report more accurately and thus increase transparency. This in turn helps investors to better assess the industry- and company-specific sustainability impact and incorporate it into their decision-making process (GRI 2016).

Supply chain due diligence as well as responsible management systems are ESG topics receiving much attention. The sourcing of conflict minerals in particular represents a sensitive topic for telecommunications companies. These companies not only operate networks, but also retail mobile phones and electronic devices containing minerals that are highly controversial with regards to human rights. Furthermore, a number of devices are assembled by contract manufacturers known for their poor working conditions. Typically, ESG risks arise upstream in supply chains mainly beyond first-tier suppliers. Demonstrating commitment to local legislation, such as the Dodd-Frank Act and the UK Modern Slavery Act, as well as participating in sector-specific initiatives such as the Global e-Sustainability Initiative (GeSI) increase responsible investors' trust. Offering alternative devices with socially compatible services and components can lead to a competitive advantage.

Although the Communication Sector predominantly affects society, **environmental risks and opportunities** deserve equal attention. The comprehensive assessment of a company's impact on the environment requires an analysis of the entire product life cycle, including supply chains, product usage

¹ Inrate 2018: Facebook exclusion confirmed.

² For more information see: <https://www.inrate.com/en/facebook-exclusion-confirmed.htm>.

and disposal. A major environmental issue is electricity usage (GRI 2013a) given that data centres require around 1.4% of the global electricity consumption. This figure is projected to grow even further alongside rising volumes of data (Castellazzi et al. 2017). Electricity use of network infrastructure and the prevention of hazardous materials and electronic waste generation of consumer goods are further issues that need to be tackled. Examples of risks related to ineffective environmental measures are non-compliance with national pollution laws and high costs driven by excessive energy consumption (CDC Group plc 2018). Inrate identifies these risks by covering sector-specific environmental issues in the assessment of communication companies.

Despite these challenges, communication products and services can have a **substitution effect** on certain traditional activities, such as the replacement of physical media or the reduction of travels. This eventually leads to a reduction of CO₂ emissions, resource usage and pollution. Moreover, companies hold the potential to improve energy efficiency by improving the power usage effectiveness in data centers and use renewable energy sources by expanding photovoltaic systems (CDC Group plc 2018). Fostering a responsible business conduct drives innovation, reduces operational costs and avoids risks to be non-compliant with pollution laws.

Governance issues arise within the sector for various reasons depending on the service a communication company provides. The sector comprises among the most innovative companies, and the majority of them operate in a highly competitive and global environment. This presents a challenge for regulators, the businesses as well as a risk for responsible investors. Telecommunication companies are prone to corruption due to large scale projects and difficulties in entering new markets (CDC Group plc 2018). Tangible integrity policies and effective compliance programs raise confidence of investors in the long run as a culture of integrity reflects a responsible and sustainable business conduct.

The relevance of certain ESG issues varies between the subsectors as the Communication Sector entails a variety of different businesses. Investors rely on a **transparent reporting** of companies related to, but not limited to, material ESG information. Opportunities arising from tackling ESG issues are valuable information for investors. Even more so, as technological innovations from the Communication Sector potentially enable sustainable development.

2. The Communication Sector

Communication is “*the imparting or exchanging of information by speaking, writing or using some other medium*” (Oxford Dictionaries 2018). The simplest form – orally and face-to-face – requires no further tools. However, for temporal or financial reasons, this form of communication is often not possible. In order to communicate over distances or time, a medium is needed through which our information is transported or stored. The service of communication provided by companies consists in the transmission and storage of information. It can be provided in different ways.

Since Inrate focuses on the evaluation of companies, the scope of this study is limited to those communication services that are provided with the help of goods and services. Therefore, in the following, we define communication as the transmission or storage of information over spatial or timely distance using a physical and/or technical medium.

The Communication Sector includes all companies along the value chain that make a significant contribution to the production and information transmission. Furthermore, the sector comprises companies that provide storage services. The value chain consists of various partial services (Vettori et al. 2006):

- **Manufacture of equipment and components for the transmission of information:** e.g. network equipment such as routers, switches, terminal devices such as telephones or components such as copper or fiber optic cables.
- **Development and distribution of services** such as telephony, internet access as well as the operation of network infrastructures (the core of information transmission), with the transmission of information either electronically (via cable, antenna or satellite) or by means of vehicles (post).
- **Production and distribution of applications and content as well as data storage,** e.g. software for Voice over Internet Protocol (VoIP) or communication applications such as Facebook.
- **Construction and maintenance** of network infrastructures.

The above listed activities can be substitutes for technologies, product and services, which would have a greater negative sustainability impact. Substitution is possible for the transmission medium: Information can be transmitted via copper cable, optical fibre or radio. However, the various partial services cannot be substituted with each other. For example, a telephone set is not a substitute for a radio network.

Inrate considers companies that offer the following services as relevant (not a conclusive list):

- Two-way communication such as telephony and mail via landline, radio or satellite.
- One-way communication such as radio, television and internet applications via cable, fixed network, satellite.

The last several years have seen an evolution in the way people communicate or access information. Social media, for example, has opened new communications channels beyond traditional voice service. In case someone is not reachable by phone, there are opportunities to leave a voice mail, send a text, a Facebook message, tweet or touch base in other ways. The variety of communication means has grown as a result of the integration between telecommunications, media and internet companies. This convergence may make some services obsolete, such as cable television and radio, but opens up many opportunities for existing service providers. Companies have moved further in this direction by consolidating through mergers and acquisitions. Many companies now offer bundled services such as cable, internet services and telephone services. Moreover, the media and broadcasting industries have gone through a transformation due to emerging digital technologies and new business models. Thus, a growing convergence of broadcasting and telecommunications operators can be observed which, in turn, led to new ways of distributing informational content.

In response to these changes, the S&P Dow Jones Indices and MSCI announced revisions to the Global Industry Classification Standard (GICS) structure in November 2017. The Telecommunication Services Sector was broadened and renamed as Communication Services to include companies that facilitate communication and offer related content and information through various media (MSCI 2018). In recent years, telecom carriers and media content providers have found synergies between creation of content and its delivery.

The Inrate Service Sector Communication reflects this evolution. Companies that primarily provide information and communication services are considered to be within the same sector (see fig.2 in chapter 4). The sector contains companies associated to telecommunication services as well as companies in the field of internet & media services.

Telecommunication services include companies that provide telecommunication, internet and wireless services. Companies engaged in content and information creation or distribution through proprietary platforms, where revenues are derived mainly through pay-per click advertisements, are classified within the internet & media services. This includes social media and networking platforms, search engines, mobile or print media services, email cloud services but also online entertainment streaming companies.

3. Main Developments and Current Trends

Communication is associated with inventions such as the telephone, radio and emails - essentially, the ways in which we communicate daily. Technological progress has played a crucial role in social and economic development and each innovation often extends the capabilities for innovation development.

Most recently, the Communication Sector has faced a wave of change from new digital devices and more robust models for delivering information (McKinsey 2016). As companies rely more on cloud-based applications, comprehensive technology architecture is becoming an essential need. Technological progress will continue the transformation and enabling effect of the Communication Sector. Some of these changes have already been realized or are underway, others will have shorter timelines and more incremental effects while others will occur over a longer time horizon. Ongoing developments in information processing and transmission continue to reshape how information is delivered. This in turn drives new business models and blurs the boundaries between media content and communications technology (Australian Government 2016).

New points of interaction between businesses, products and customers based on Internet of Things (IoT) technologies represent disruptive innovations. The current IoT revolution, also known as the fourth industrial revolution, is about to change the communication services landscape. IoT connects people, processes, data and things. Devices based on IoT technologies are fortified with communication capabilities and create new forms of engagement with users: A comprehensive system of devices embedded in everyday objects enables users to control, transmit and share data over the internet (Australian Government 2016). In this manner, IoT leads the way to a high-tech machine-to-machine (M2M) interaction. The IoT 2018 Report, published by BI Intelligence based on its second annual Global IoT Executive Survey, projects that there would be more than 55 billion IoT devices (devices connected to the internet) by 2025, up from about 8 billion in 2019 (Business Insider 2020). From wearable devices, connected cars to smart home technologies and smart cities, IoT is transforming the world and paving its way to becoming the internet of everything. A widening scope of M2M is seen in sectors like healthcare, agriculture, education etc. (Gulati 2016).

The IoT comes with the idea that everything is electronically integrated and interconnected. To this end enormous amount of data is gathered and shared. Thus, production and consumption of data has seen a radical increase. Hence, adopting a robust cloud infrastructure to storage and/or share data is critical for network operators. Also, communication service providers may adopt a more data-centric approach that enables smart devices to stay connected with the internet. Furthermore, IoT drives partnerships between companies within the Communication Sector, such as telecommunication providers partnering with platform providers to get tailored platforms for their needs (Gupta 2017).

There are several future technological developments that are likely to have a significant impact on the Communication Sector in the near future such as the following:³

- **Blockchain:** Blockchain technology allows individuals to share information and coordinate activities, without relying on a central authority or trusted third party (Australian Government 2016). Blockchain is expected to go mainstream and get a major share of IT budgets of companies working in a vast range of fields ranging from finance to healthcare (Euler Hermes Economic Research 2018).
- **Artificial Intelligence (AI):** AI is expected to shift communication technologies and drive new business models (Euler Hermes Economic Research 2018). Companies can use data-backed insights to better serve their customers e.g. through personalized communications and marketing promotions. Virtually all technology companies are currently working to use AI – particularly machine learning and analytics – as part of their solutions (Bird & Bird 2017).
- **Augmented Reality (AR) & Virtual Reality (VR):** AR and VR will be a source of innovation in how we interface with technology in both consumer and business contexts. AR integrates or overlays digital information with the user's environment in real time to enhance perception of

³ The mentioned developments will not be elaborated explicitly since they are either developed predominantly by companies that belong to other sector or present a prerequisite for the usage of certain technologies

reality. VR uses computer technology to create a simulated environment that is affected by the user (Australian Government 2016).

- **5G:** 5G (the fifth generation of mobile technology) networks offering faster data transfer and more reliable connections on smartphones and other communicating devices. All major telecommunication companies worldwide have set goals for the 5G network deployment in 2019. 5G makes wireless networks a real substitute for fiber cables and will be the critical link that blends nascent uses of mobile technology, such as the IoT (Euler Hermes Economic Research 2018).

Delivering content to any device, will be the most important factor in the telecommunication development. Developments such as connected cars, smart homes, smart grids or smart cities are reliant on an uninterrupted and ubiquitous network, internet and calling facilities (iam wire 2017). Telecommunication companies need to deliver essential infrastructure, applications and productivity improvements in many areas to allow the digital revolution to take place (Accenture 2017).

Digitalization transforms business

The emergence of the new digital technologies stated above and new business models such as over-the-top (OTT) operators which utilize them, has transformed the telecommunication and media industries. OTT is a new way of providing communications services or delivering content over which traditional services such as network operators or internet service providers do not have a direct influence or control (Australian Government 2016). As advanced technologies and business models are adopted, convergence between telecommunications and internet & media sectors has become a common business practice. As a result, the transformation has changed the structure of the industries and strategies of corporates within the Communication Sector. The thinning line between internet & media and telecom services has enabled the convergence of both operators and has led to the integrated distribution of various forms of information content such as texts, images, and videos within the networks (Hwanho 2017).

As a result, media companies are in a constant mode of business expansion and exploring new opportunities through mergers, acquisitions, and business alliances. By acquiring or merging companies with digital capabilities, traditional players also continue to move into new digital territories, which allows the firms to enhance their scope by expanding their distribution channels and thereby achieve economies of scale (Hwanho 2017).

4. Sector Delimitation

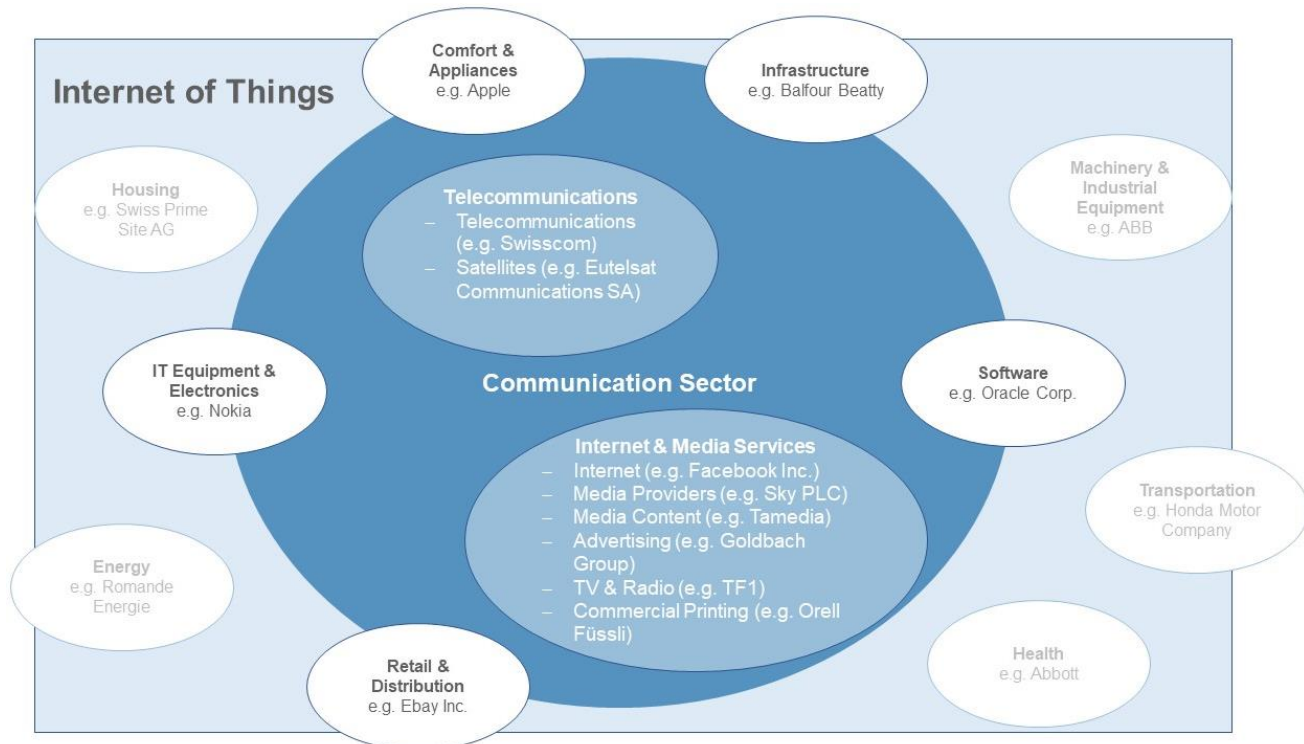
The intertwining nature of communication services makes the distinction to other sectors rather challenging. The sector allocation in the study at hand is thus subject to the rule that a company is assigned to the sector wherein it generates most of its revenue. Overlapping sectors encompass companies that either render goods or services along the value chain or rely on the availability of communication infrastructure and services or vice versa (see fig. 2). In sum, they are generally not considered as part of the sector but are significantly impacted by changes within the sector:

- Software is a technological driver for the Communication Sector and plays a significant role in facilitating the delivery of services that used to be delivered via hardware. Frequently, software is a means of automating work processes (Reutimann et al. 2008). However, the technology offered from a software company does not solely serve the Communication Sector. Consequently, a software company is to be assigned to the **Software** Sector. On the other hand, a company that publishes a software that serves the transmission of communication is to be allocated to the Communication Sector (e.g. Google's parent company, Alphabet Inc.).
- Civil engineering company offering cabling and communication transmission usually conduct other engineering projects. Consequently, a civil engineering company is to be assigned to the **Infrastructure** Sector.
- Companies in the sectors **IT Equipment & Electronics** and **Comfort & Appliances** such as Nokia or Apple derive most of their revenue from manufacturing and retail of communication and media devices. Whereas companies in the Communication Sector, being largely service providers, operate mobile networks and convert the inputs of mobile phones into voice and data connectivity (GSMA 2016).
- E-commerce companies and online marketplaces (e.g. Ebay Inc. or TripAdvisor) pertain to the **Retail & Distribution** Sector. Although such companies offer web portals, they act as intermediaries between buyers and sellers and derive their revenue mainly from advertisement and the provision of sold goods or services on their respective platform. Such platforms are significantly impacted by changes and innovation within the Communication Sector.

Other sectors rely less on the Communication Sector but they may have an online presence or conduct transactions over the internet. IoT enables to build a network of objects, devices and people via the internet, which are increasingly used by the industry. Furthermore, the private sector makes use of big data for marketing and management purposes by improving consumer profiles and personalized services (United Nations 2018). Examples include remote monitoring and health tracking applications in the **Health** Sector as well as smart grid technologies applied in the **Energy-** and **Housing** Sector.

The following graph (non-exhaustive presentation) shows the delimitation and overlapping of the Communication Sector. All subsectors within the blue circle are part of the Communication Sector. The circles at the border are sectors with strong intertwining with the Communication Sector. The faded circles surrounding are sectors that are affected by technological innovations developed in the Communication Sector. They serve as examples since the sector exerts influence across all industries.

Figure 2: Delimitation of the Communication Sector



Source: Inrate 2018.

5. Impact on the Environment

Opportunities

The Communication Sector plays a key role in reducing CO₂ emissions and enables sustainable growth: According to GeSI, the ICT⁴ sector has the potential to reduce up to 20% of annual CO₂ emissions worldwide by 2030 through supporting companies and consumers to more intelligently use and save energy (GeSI 2015). Technology-enabled solutions such as smart metering, control systems and the IoT will provide users, whether commercial or household, with greater energy consumption control and an enhanced living experience whilst saving energy and resources. Data collected via smart meters allows users to monitor their energy use, remotely control building functions such as heating, cooling or lighting. In the business environment ICT solutions have already started to revolutionize the way people work and do business: Organizations apply electronic working (e-work) by using cloud platforms or smart communication devices to facilitate daily office work.

Within the energy sector, technology-enabled solutions such as M2M learnings, advanced data analytics and distribution management systems have the potential to significantly improve efficiency of existing grids. ICT is a key driver behind the development of smart grids and, hence, in accelerating the decarbonization of the energy sector (GeSI 2019).

Challenges

In order for people or companies to communicate, various goods and services are necessary. Inrate's Impact Assessment covers the entire value chain as well as the entire product life cycle. The life cycle can be divided into the following four different stages:

- Extraction of raw materials
- Development, production and distribution
- Usage
- Disposal

Different levels of the environmental impact occur in each stage of the value chain. Certain partial services, however, do not cover all stages: The value chain of content providers for instance only includes development, production and usage (e.g. user agreements etc.).

Electricity consumption and carbon footprint

Target 7.3 of the 2030 Sustainable Development Goals (SDGs) is determined to “double the global rate of improvement in energy efficiency” (United Nations 2019). Digital transformation has the potential to be more efficient i.e. “smarter” about using energy, which in turn will enable users to better measure and manage energy consumption. The increase in information helps to adjust usage patterns and enables users to reduce their energy use and save energy costs. In the long run, lower energy consumption will allow for an increased reliance on renewable energy sources. However, it is important to note that the digital transformation requires an enormous amount of energy (Greenpeace 2017).

According to a study published in October 2017, the communication industry could use 20% of all the world's electricity by 2025, as demand by server farms storing digital data from billions of smartphones, tablets and internet-connected devices grows exponentially. Furthermore, Andrae (2017) expects

⁴ As outlined in the sector delimitation (chapter 3) the Communication Sector is not completely congruent to the so called “ICT sector”. However, according to a study of Gupta (2018) in the Journal of Telecommunications System & Management “Telecommunications and Data centres are the main sources of whole energy consumption of Information and Communication Technology (ICT).”

information and communication technology to create up to 3.5% of global carbon emissions by 2020 and up to 14% by 2040, around the same proportion as the US emits today.

Global computing electricity demand from internet-connected devices, high resolution video streaming, emails, surveillance cameras and a new generation of smart TVs is growing by 20% per year, according to Andrae's (2017) study. This equals roughly 3-5% of the world's electricity consumption in 2015 (Climate Home News 2017). Andrae (2017) assumes that everything which can be will be digitalized. The expected increase in electricity demand results from:

- 5G, which is widely predicted to mark a step change in digital communication;
- IP (internet protocol) traffic, which is much higher than estimated;
- all cars, machines and robots being increasingly digitalized.

These developments will inevitably result in a growth in internet traffic and in the production of huge amounts of data which has to be stored in data centers (Climate Home News 2017). The energy and carbon footprint of the internet as well as its supporting systems is estimated to exceed the footprint produced by the airline industry in the near future (BBC 2020).

Resource consumption

Innovative technologies of information and communication devices, such as smartphones and laptops, require supply chains and manufacturing processes that rely on exhaustive energy sources, mining of finite resources, hazardous chemicals and non-durable products that drive consumption of the earth's resources (Greenpeace 2017).

A smartphone, for instance, is generally comprised of approximately 40% metals and 40% plastics by weight, with the remainder made up of glass and/or ceramic and other miscellaneous materials (UL 2014). Some metals, like iron and aluminum are available in large quantities while for others, such as copper, availability is critical in the long term. Copper is among the three most used metals in the world and the most used element in telecommunication systems (European Copper Institute 2018). Although they only represent a small amount of the device's total mass, precious metals such as gold, silver and platinum are significant by virtue of their limited availability, energy footprint and recovery value (UL 2014). Conflict minerals such as tantalum and tungsten and alloys containing these metals are used in many devices.

The majority of the 17 existing rare earth metals are included in smartphones. Moreover, rare earth metals are used for rechargeable batteries which can be found in consumer electronics. Finding rare metals is difficult and their extract in concentrations high enough for economic value poses an additional challenge (Phys.org 2016).

Hazardous materials management

From smartphones to computers or televisions, electronics are manufactured with a long list of substances that are known to be toxic, including metals such as lead and hexavalent chromium, and other contaminants such as phthalates and brominated flame retardants. Growing awareness of these issues has led to an increasing public pressure on companies to change. Additionally, emerging regulations around hazardous chemicals, such as the Restriction of Hazardous Substances in Electrical and Electronic Equipment (RoHS 2) and the Registration, Evaluation, Authorization and Restriction of Chemicals (REACH) in Europe, the industry has found incentives to change how to operate. As a result, a growing number of companies as well as non-profit organizations and industry associations such as the International Electronics Manufacturing Initiative have been working together to reduce or eliminate the use of toxic chemicals in electronic products and substitute them with alternatives (Greenbiz 2016).

Problem of quantity

Rapid technological progress has led to shorter innovation cycles, and thus, shorter product usage cycles. Electronic devices, especially mobile phones and computers are at times outdated after only a

few years. As a result of this development, communication devices are being renewed at ever shorter intervals, although their technical life expectancy is far from expired. Additionally, faced with market saturation for their devices, companies across the sector have increasingly changed the design of their products in a way that accelerates the replacement cycle by making them difficult to repair or upgrade. The short lifespans exacerbate the toll these devices take on the planet's finite resources and contribution to GHG emissions (Greenpeace 2017).

Product end-of-life management

With the increasing usage of information and communication technology (ICT) equipment, the waste of electrical and electronic equipment (WEEE) produced each day grows enormously around the globe. A reason for this is that ICT equipment is characterized by high demand and life spans that are becoming shorter. WEEE is a complex mixture of various materials and components that, due to their hazardous content, can cause major environmental and health problems when managed incorrectly (European Commission 2020). Additionally, this leads to the systematic depletion of the resource base of secondary equipment (ITU 2012). To contribute to a circular economy and to enhance resource efficiency, it is essential to improve the collection, treatment and recycling of electronics at the end of their life (European Commission 2020).

According to Greenpeace's Guide to Greener Electronics, recyclability refers to both incorporating more recycled materials in place of virgin materials and designing products to be more easily recycled at their end of life (Greenpeace 2017). Repair, reuse and recycling are already being implemented today by many manufacturers as an extension of value creation against the backdrop of the high proportion of recyclable materials and functional components. Telecommunication companies work in partnership with phone manufacturers to bundle services and mobile devices, and this way, admit a shared responsibility for the end-of-life management of such devices (SASB 2014).

To improve the environmental management of WEEE at European level, the EU Directives on waste electrical and electronic equipment (WEEE Directives) have been put in place. The first WEEE Directive entered into force in 2003 and provided for the creation of collection schemes where consumers return their WEEE free of charge. The revised Directive that entered into force in 2012 aims to tackle the rapidly increasing waste stream and to improve the environmental performance of all involved in the life cycle of electrical and electronic products (European Commission 2020).

6. Impact on Society

Opportunities

Communication is a human need and, therefore, companies within the Communication Sector potentially have a positive net sustainability impact on society. Communication technologies connect people and allow for social interaction at low costs. By replacing the need to travel, it saves time, costs and reduces CO₂ emissions. This is substantially fostered by the increased interconnection between devices and the resulting ubiquity of available information (Customerthink 2018).

Reliable and readily available information is indispensable to democracies. The media has always taken up the role as a platform for the provision of information and public debate and for promoting active citizenship (UNESCO 2017). It allows for informed political decisions and acts as a watchdog. Therefore, media is often referred to as the “fourth estate” – alongside legislature, judiciary and the executive (Medium 2017a). Nowadays, there is a large number of media channels at no to low cost that people can choose from in order to receive and disseminate information. The convergence of traditional and digital media is even taking it to a new level, as news, facts and opinions circulate in a faster pace. While this development at times stirs confusion or irritations, the occurrence of social media platforms enables people to maintain connected and to overcome social, economic and cultural boundaries. This makes digital media a powerful tool for social inclusion, given that companies and policy makers implement effective measures for advancing digital literacy (UNESCO 2011).

Communication technology is also essential for an efficient economy. An improved and secure exchange of data allows the ecosystem of devices, i.e. physical objects and systems, which share information and functionality to be better monitored (Customerthink 2018). The management of connected devices will be even further simplified with the roll out of the 5G network enabling faster data transmission. Individuals and businesses in the digitalized world benefit from digital solutions mainly in terms of efficiency gains, cost savings and convenience.

All in all, communication services have played and most likely will play a major role for society as well as the economy. Innovative technologies developed in the Communication Sector exert a substantial social impact and ultimately help shape societal development.

Challenges

Numerous technical innovations, the growing access to information and its underlying infrastructure unlock potential. At the same time, the rapidly changing environment creates challenges, which are associated with a set of ESG risks.

Data privacy

According to a report from IBM, 90% of data available in 2013 was created within two years (IBM 2013). The total amount of data is projected to increase by 40% per year. The UN states that most data collected is “data exhaust”, which refers to data deriving as a by-product from everyday interactions during digital and online activities (United Nations 2018).

A growing number of communication companies rely on customer information, which poses risks related to privacy rights and increases the significance of privacy as a universal human right (GRI 2013). Although the notion of data protection originates from the rights of privacy and preserves fundamental rights (e.g. freedom of speech or the right to assembly), it is not yet incorporated in the Universal Declaration of Human Rights (European Data Protection Supervisor 2018). Companies hold enormous amounts of data and personal information (e.g. call records, payment details, demographic data), which makes such entities stewards of the data provided. Additionally, flows of data can have a material impact on personal security, especially in those cases where companies host government data (GRI 2013b).

Increasingly, companies use the growing volumes of data not only to improve their service, but also to generate revenue by selling data to third parties and to gain a competitive advantage through a better understanding of consumer needs. The service of internet firms such as Facebook and Alphabet Inc. is commonly perceived as free of charge. However, when signing up for platforms or using search engines, users hand over the control over their personal data and lose their role as a gatekeeper. Due to the fact that consumer data generates revenue and makes products and services profitable, there is a great risk that consumer data is used to exploit consumers in favour of business and profitability rather than to improve welfare and benefits of society (Hwanho 2017). Furthermore, the exchange of data between authorities across borders in crime matters has risen. This in turn challenges the balance between privacy and security as commercial data is increasingly used for law enforcement purposes (GRI 2013a). There are legitimate concerns on the data handling- and processing of private and public entities, particularly in the absence of a common set of principles with regards to data protection and privacy (United Nations 2017).

Digital divide

According to a report of the International Telecommunication Union (ITU) (2019), around half of the world's population does not have access to the internet, while it is estimated that half of all households still do not possess a computer. Technological innovations potentially foster societal and/or economic participation of communities in rural areas or marginalized groups. Economic development is the preliminary stage for sustainable social development. A reliable network infrastructure lays the foundation for society to benefit from technological innovations, provided that governments incentivize investments in infrastructure. Therefore, network access can be considered a prerequisite for the process of digital inclusion (Benton Institute 2016).

Target 9C of the SDGs emphasizes the need to "significantly increase access to information and communications technology and strive to provide universal and affordable access to the internet in least developed countries by 2020." (United Nations 2019). Even though a clear goal has been set, the world is far away from a universal adoption of digital technologies. Such technologies spread in a very fast pace but still only a rather small part of the population benefits from these innovations (TUAC 2017).

The term digital divide stems from the knowledge gap hypothesis which was set up in 1970 by Tichenor, Donohue, and Olien at the University of Minnesota projecting that "as the infusion of mass media information into a social system increases, segments of the population with higher socioeconomic status tend to acquire this information at a faster rate than the lower status segments, so that the gap in knowledge between these segments tends to increase rather than decrease" (Tichenor et al. 1970). In other words, communities that are socioeconomically advantaged absorb the growing flow of information quicker than those parts of the population that are socioeconomically disadvantaged and/or have a lower or no educational qualification. Consequently, the gap in knowledge between the groups tends to become larger over time. The digital divide reveals a social weak point of the Communication Sector, in which the technological progress is complicit. This phenomenon can be increasingly observed due to the dissemination of information via the internet.

For years, the international debate over the digital divide was limited to the implications of accessibility of hardware. Meanwhile, more emphasis is put on the ability to use media since the sheer availability of hardware and information does not give any evidence on the competent use of information (Vettori et al. 2006). Although the rise of social media channels has given numerous people worldwide the opportunity to express themselves, new digital divides emerge as the interconnected world presumes digital media literacy, critical thinking and communication skills (Scientific American 2011). Studies show that further criteria such as educational attainment, the educational level of the family of origin, gender, age as well as regional aspects can have significant effects on the media competence (Vettori et al. 2006).

Market concentration

In recent years, the value of communication networks has risen and will continue to rise as more people and appliances are connected to it and the more data is transmitted. This fast development is spurring technological progress, and the competitive conditions within the market have substantial effects on societal development by influencing prices, quality and innovation of services and products (Monti 2003). On the side of network providers, infrastructure projects, including wireless and fixed-line connections, are large scale by nature, which in turn creates barriers for market entry and contributes to market domination. Limiting competition affects customers' choice, pricing and network neutrality (SASB 2014). Transparency International notes that the subsector Telecommunications is particularly prone to corruption due to the highly regulated and complex environment as well as large scale operations, especially, but not solely, in countries with weak governance structures (Transparency International 2015). Thus, competitive behaviour presents a governance issue for the sector (SASB 2014).

According to Bloomberg, Google (a subsidiary of Alphabet Inc.) and Facebook together dominate the mobile ad market in the US with a market share of 56%. Google alone receives about 78% of advertisement spending in the US market. This rise of global technology firms poses a serious challenge for regulatory bodies. In contrast to the EU, US market regulators have been quite passive in terms of anti-trust enforcement since Google's product is, according to US regulators, ostensibly free of charge for users and, thus, pricing is supposedly irrelevant and does not directly harm consumers. A further premise of US regulators is that if technology firms merge, they typically buy smaller competitors or other companies in order to enter new markets (Bloomberg 2017). The EU on the other hand is stricter when it comes to anti-competitive behaviour. In 2017, the European Commission (EC) imposed a fine of EUR 2.42 billion on Alphabet Inc. for favouring its own shopping service via its search engine by adjusting the criteria in the algorithms (European Commission 2017). This case is a good example of revealing the link between the value of data and anti-competitive practices that eventually hamper consumer choice (Politico 2017). More recently, the European Commission imposed an even higher fine of EUR 4.34 billion on Alphabet Inc. for illegally requiring device manufacturers to pre-install Google apps as a condition for licensing the company's own app store or making payments to manufacturers and network operators for exclusively pre-installing certain apps (European Commission 2018).

Working conditions

The market liberalization of the Telecommunications subsector led to a number of new providers that entered the market. This caused a rapid increase in competition among service providers, which changed working environments considerably. Since 2003, the sector has been marked by restructuring measures and downsizing with regards to staff (Vettori et al. 2006). Furthermore, the economic crisis of 2007-2008 had a considerable impact on employment by subsectors such as the telecommunication, commercial printing and media companies (European Foundation for the Improvement of Living and Working Conditions 2014). Drastic staff reductions have led to a growing unease among employees. Furthermore, the competitive intensity is causing steady pressure on labour productivity. This results in a rise in stress symptoms and burnout cases (Vettori et al. 2006). Between 2008 and 2010, France Telecom (now Orange SA) was hit by a wave of employee suicides, which was said to coincide with the restructuring of the company to become more competitive. More than 30 employees committed suicide within two years. The former chief executive officer is now facing charges over moral harassment (Bloomberg 2018b). Media companies have been frequently scrutinized regarding working conditions. In light of the subsector's role of reflecting society's values, diversity is a particular issue as women, ethnic minorities and people with disabilities remain underrepresented (Ofcom 2017). The communications regulator Ofcom states that while some of the largest companies seem to be committed to improve diversity, the barriers for minorities remain worrying, as it creates a cultural disconnect between media providers and their recipients (Ofcom 2017).

Supply chain traceability

A large proportion of the social footprint of business activities occur upstream in the supply chain. Thus, internal labour conditions alone do not give a comprehensive indication on the social responsibility of a company and its impact on society. While the adherence to labour standards can be expected in countries with a strong rule of law, this does not apply to production sites in jurisdictions with weaker regulations. This particularly pertains to telecommunications firms due to the reliance on electronic equipment, which is frequently sourced from emerging countries. Although most telecommunications providers do not buy conflict minerals as a raw material, numerous products purchased from original equipment manufacturers (OEM), such as smartphones and network equipment, contain tantalum (Usanov et al. 2013). The extraction occurs in small-scale mines in the Democratic Republic of Congo (DRC) and other conflict zones under the presence of armed groups. The extraction of minerals has repeatedly been linked to human rights abuses due to the widespread use of child labour and the rigorous exploitation and killing of local communities (Business & Human Rights Resource Centre 2018). Furthermore, a number of companies in the Inrate sectors IT Equipment & Electronics and Comfort & Appliances, which are part of the supply chain of numerous companies pertaining to the Communication Sector, work in collaboration with electronic supplier Foxconn. Pricing pressures of buyers such as Apple and Dell lead to inhumane working conditions at the factories where workers are faced with systemic harassment and unpaid work (humanrights.ch 2016). In 2010, after a wave of suicides of Foxconn employees, investigations were launched and there was widespread media scrutiny over poor working conditions in its factories (Financial Times 2010).

Disinformation via social media

A survey conducted in 2017 revealed that 67% of adults in the US retrieve at least a fraction of news from social media platforms. This number reflects the growing investments made by such platforms to improve their news usability (Pew Research Center 2017). Traditional media such as newspapers followed the trend and frequently use such platforms as part of their digitalization efforts.

Today, a large fraction of articles on social media stems from non-reliable sources that target specific audiences and try to generate clicks on their pages (Medium 2017b). Furthermore, depending on users' behaviour, algorithms can limit the range of content and even determine the content itself that a specific user sees. Eventually, this can change or at least shape the perception of the user, influence voting and consumption behaviour. Although the way algorithms work differs among various platforms, internet companies increasingly take over the role as gatekeepers of information, which used to be limited to journalists of traditional media (Bozdog 2013). In recent cases, involving Facebook and consulting firm Cambridge Analytica, data was gathered to advertize and specifically persuade users for certain political campaigns (CNBC 2018). In order for the public to be able to form an opinion it needs credibility of information. This is not given with intermediaries such as Facebook or Google since channels have been created where everyone can create journalistic content without upholding certain ethical standards for news construction (Medium 2017b). A report from the Ethical Journalism Network states that the communication revolution is a growing concern as social media increasingly compete with traditional media companies without having the required sense of regard for the public impact of journalism (White 2017). Yet, it is in the media's responsibility to advance the democratization of society by upholding the principles such as truth, fairness, respect, privacy and human dignity (Schweizer Presserat 2018).

Related to this, an international discussion emerged recently over content filtering of social media channels. Subject to discussion are the moral responsibilities of internet platforms and what counts as "hate speech" or "fake news" (Forbes 2018). Such channels are often used to intentionally spread information to harm a certain person or a social group, referred to as disinformation (UNESCO 2018). While some call for more rigorous filtering others perceive the deletion of inappropriate content as censorship that ultimately undermines freedom of speech (Bloomberg 2018c). Although most social media platforms have meanwhile established content-moderation teams and run fact-checking units, they are still reluctant to remove hate speech or other fraudulent content in a proactive manner

(University of Pennsylvania 2018, Reuters 2020). Hence, Germany adopted a law in 2017 (Network Enforcement - NetzDG) for regulating content on social networks with more than 2 million or more registered users. It aims to oppose hate speech or fake news by improving the enforcement mechanisms (Böttcher 2018). Meanwhile, in order to diminish the dissemination of terrorist content online, the European Commission issued a proposal for legislation (European Commission 2018).

Radiation

Mobile phones produce electromagnetic fields during the back-and-forth transmission of radio waves within a network of antennas (WHO 2014). The effects of radiation on health have been subject of controversial discussions and opinions are still divided. A report from the World Health Organization (WHO) stated in 2014 "To date, no adverse health effects have been established as being caused by mobile phone use." Nevertheless, the topic receives strong public attention, even more so as the usage of mobile devices has drastically increased with more than half of the population having a mobile phone subscription (ITU 2018). The discussion on the effects of exposure to non-ionizing radio frequency remains without consensus as particularly the industry denies adverse health effects of radiation levels within legal limits due to inconsistent research results to date (Scientific American 2018). The 5G network expansion, which enables faster wireless transmission and data transfer and, therefore, requires more antennas, sparked the discussion about the radiation exposure as the consequences are considered unforeseeable (Beobachter 2018).

7. Inrate's Vision of a Sustainable Communication Sector

The Communication Sector inherently bears a considerable responsibility towards society as it provides a human need. To meet the needs of present and future generations, communication technologies should ideally be available, affordable and reliable for everyone, and the negative impact should be mitigated as much as possible. Solutions that mitigate the negative impact and potentially bring about positive change are to be found along its entire value chain. Even though, generally speaking, most communication products and services have a neutral to positive net impact on the environment and society, there is much room for improvement.

Energy saving

The power consumption used for information processing, transmission, and reception and the bandwidth usage are the prime factors influencing carbon emissions in the Communications Sector. The more digitalization proceeds, the more data is required. In order to meet the need of saving data an extensive number of data centers have been built. The storage of data consumes a massive amount of energy and the energy efficiency of such centers has been questioned.

Therefore, there is a need to move towards energy efficient technologies and alternative sources of energy. A strategic and responsible energy management holds vast potential in terms of mitigating wasted energy, driving effective air-cooling systems and allowing renewable energy usage.

Provision of sustainable products

Telecommunication companies are among the main retailers for communication tools and are therefore at the end of an extensive supply chain. Especially in the area of mobile communication, telecommunication companies procure and sell devices that contain raw materials sourced from sensitive countries.

Therefore, the aim is to build and promote sustainable products with environmentally- and socially conscious design principles covering the entire lifecycle of a product, ranging from the extraction of raw materials to the usage and recycling or re-usage of the end-product. Product design needs to be improved in the following areas in order to improve the impact along the entire product chain: Energy consumption, origin of materials, packaging, durability, hazardous substances and recyclability or re-usage. Moreover, consumer awareness is a critical building block. This can be fostered by improved product transparency concerning standards being applied and implemented programs.

Data protection

Data flows across borders while the respective legal frameworks are found at the national level. According to the United Nations Conference on Trade and Development (UNCTAD 2018), only 51% of all countries worldwide have legislation on data protection and privacy in place (UNCTAD 2018). On the one hand, this favours the private sectors as it not only gives companies the possibility to collect personal data but also increases the flexibility concerning the location in which the data can be stored (Consumers International 2018). On the other hand, this makes it difficult for companies to assess the legality of their business practices and for states to ensure these. The gaps between business practices and data protection laws could pose reputational and legal risks for companies that lack appropriate mechanisms (GRI 2013).

In order to tackle the issue of data control by their citizens as well to overhaul the legal discrepancy between EU states, a directive has been passed by the European Parliament. The General Data Protection Regulation (GDPR) is a binding regulation addressing the cross-border flow of data. It requires from all entities offering goods and services to individuals in the EU to adhere to the privacy principles set out in the GDPR (European Data Protection Supervisor 2018). The directive is mainly in

favour of consumers, but it holds benefits for companies as well. Once the capacity has been built, better legal and policy compliance leads to public confidence and caters for a level playing field for all market players (Computerweekly 2017).

A large number of companies in the Communication Sector accrue personal data while providing a service. Apart from the regulatory viewpoint of data protection, it is in the interest of every entity processing data to be seen as reliable in order to prevent loss of customer trust. Thus, proactive and transparent dealing with customer data is inevitable. It is vital that data protection and cybersecurity measures are included into strategic decisions. Methods and procedures need to be developed that ensure a systematic inclusion of data protection issues earlier in the planning phase of projects or services. Furthermore, products and services require constant review processes. Transparency is another corner stone when it comes to using customer data, not only in terms of what information is being used but also for what purpose. This includes explaining the benefits for the companies as well as for customers, and, in this way, helps customers to decide whether to consent to privacy policies or not.

Infrastructure

There are two dimensions when it comes to providing sustainable telecommunication infrastructure: On one hand, the infrastructure has to be provided with the least negative social and environmental impact possible. Base stations for example, being essential for the usage of telecommunication and broadcasting services, may have an adverse impact on the environment and the surrounding communities. Parameters need to be taken into account such as a reasonable integration into the landscape during the installation process as well as energy consumption during usage. More importantly, potential health risks caused by the exposure to emissions like electromagnetic fields need to be identified and regarded for.

On the other hand, the availability of network infrastructure in rural and remote areas needs to be ensured. Moreover, its necessary devices and services have to be affordable in all regions across the world in order to bridge the emerging digital divide. The roll out of country-wide networks is among the main responsibilities of the local regulator and the respective telecommunication companies in order to allow social and economic participation.

Digital literacy

Providing access to essential and affordable infrastructure is not the only significant aspect in furthering social inclusion. With growing internet access, participation increasingly requires training to provide people with the skills necessary to effectively make use of the potentials of digital technologies. A concerted effort by policymakers, the education system, non-governmental organizations and the private sector is required to assure that consumers not only learn the technical skills but also how to engage on the internet and to critically use and process information. Target groups of such initiatives are mainly, but not only, children, people from disadvantaged communities and senior citizens.

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