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Information Technology and Sustainability in the Information Society

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The sustainability concept has developed in a policy context. Its main relevance has been in policy forums such as the United Nations Conference on Environment and Development and the United Nations Conference on Sustainable Development. In the realm of information and communication technologies (ICTs), sustainability has played a policy role in the context of the World Summit on the Information Society. This article asks: How can we think of sustainability and ICTs in the context of a critical theory of society? How is the sustainability of ICTs related to capitalism and class? It provides a critique of the dominant reductionist and dualistic understandings of information technology sustainability in an information society context. The question that arises in this context is whether, from a critical theory perspective, the sustainability concept should be discarded. The view advanced in this article is that a critical social theory should provide an ideology critique of information technology sustainability; at the same time, it should not discard, but transform, the sustainability concept into a critical notion of un/sustainable information technology sustainability in the context of the information society.

Keywords: sustainability, information and communication technology, ICT, ICTs, information, critical social theory, critical theory, information society

Sustainability has to do with the question of how present and future generations can lead a good life in society (for a review of its genesis, see Fuchs, 2017). It is a concept that has been developed in forums such as the United Nations Conference on Environment and Development and the United Nations Conference on Sustainable Development. In the realm of information and communication technologies (ICTs), the sustainability concept has played a role in the context of the World Summit on the Information Society (WSIS). Sustainable ICTs involve the question of whether and how ICTs contribute to and/or harm the development of society in ways that allow present and future generations to lead a good life.

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This article asks: How can we think of sustainability and ICTs in the context of a critical theory of society? How is the sustainability of ICTs related to capitalism and class? The approach taken stands in the tradition of critical sociology, which "seeks to make problematic existing social relations in order to uncover the underlying structural explanations for those relations" (Fasenfest, 2007, p. 17). Critical sociology is opposed to functionalism, is antipositivist, uses the tradition of critical political economy, asks questions of power at large, and deconstructs ideologies (Fasenfest, 2007). Critical sociology is "a critique of the social order in the exploration of extant power relationships existing within a society organized under the principles of capitalist social relations" (Fasenfest, 2007, p. 22). Its knowledge addresses "how to influence change toward a more progressive and positive vision for the future" (Fasenfest, 2007, p. 20). Given such a focus, it is evident that critical sociology is an approach suited for the study of un/sustainable development.

This article discusses the relationship of technology and capitalism, identifies four ways to think about sustainability in the context of the information society, and criticizes reductionist understandings of information technology sustainability. It provides a critique of dualistic understandings of information technology sustainability. Dualism and reductionism are the predominant mainstream concepts of sustainability in an ICT context. This article suggests an alternative framework that uses critical theory as the foundation for a critical theory of sustainability in the information society.

Technology and Capitalism

The term *technology* has its roots in the Greek term *techné* [τἐχνη] (Feenberg, 2006; Reydon, 2012; Williams, 1983), which means the knowledge, art, and craft of making something. Technology as *techné* was considered in subjective terms oriented to humans' skills, capacities, and knowledge to create something in a purposeful manner and thereby change the world. With the rise of modern large-scale industry and machinery, the dominant meaning of the category of technology shifted toward a more objective understanding. Technology has come to be understood as things, systems, machines, tools, artifacts, and hardware that apply the results of science for controlling humans and nature (see Dusek, 2006, Chapter 2; Li-Hua, 2009; Williams, 1983).

Georg Lukács (1971) argues that, with the rise of capitalism, "human relations (viewed as the objects of social activity) assume increasingly the objective forms of the abstract elements of the conceptual systems of natural science and of the abstract substrata of the laws of nature" (p. 131). The economy thereby became "transformed into an abstract and mathematically orientated system of formal 'laws'" (p. 105) that is governed by "the abstract, quantitative mode of calculability" (p. 93). Technology in such a system is a machine that is used for controlling and instrumentalizing nature and human activities for partial interests such as corporations' monetary profits and commodity production, bureaucratic power, possessive individualism, and consumerism.

Alfred Sohn-Rethel (1978) argues that this instrumental understanding of knowledge and technology goes back to the division of labor between manual and mental labor in class societies. The "logic of the market and of mechanistic thinking is a logic of intellectual labour divided from manual labour" (Sohn-Rethel, 1978, p. 73). For Sohn-Rethel, the logic of mechanistic, quantifying, mathematical reasoning is not something that emerged with the existence of capitalism, but rather is much older. He argues that it goes

as far back as ancient Greek slavery, which instituted a division between manual labor performed by slaves and the mental labor of philosophers, politicians, and scientists: "It is Greek philosophy which constitutes the first historical manifestations of the separation of head and hand in this particular mode" (Sohn-Rethel, 1978, p. 66). This division of labor has, for Sohn-Rethel, to do with the rise of the mathematical logic of measurement and quantification. Class society's division of labor would in the realm of thinking and logic be accompanied by quantifying reason and in the realm of the economy by exchange value.

In a general understanding, technology is neither knowledge nor a thing, but a process in which humans make use of their skills, knowledge, and capacities and of objects to change the world in an intentional and purposeful manner. In modern class society, technology is no longer a human-controlled means for human-defined ends. Means and ends are reversed: Humanity is not an end in itself, but humans have become means and instruments for dominant classes' partial interests (Fuchs, 2016, Chapter 15). Technology is in this context an instrument for domination. Capital, including technology as its means of production, is a subject that dominates labor. Technology is in such a system not a means to humane ends, but rather serves a specific instrumental aim—namely, capital accumulation—and as part of this end, it turns humans into objects.

The instrumental character of technology is not inherent in technology as such or in society in general, but rather has to do with how partial interests shape technology and society. Technology is not neutral and value-free, but embedded into power structures, contradictions, and struggles that shape its invention, design, application, and use. This also means that technologies can be redesigned, reinvented, changed, repurposed, abolished, and so on. Putting technologies to humane and democratic use requires shaping society, invention, design, application, and use by humane and democratic values. It requires a political struggle for alternative technological and alternative frameworks that benefit all humans.

ICTs are means that humans use for creating, disseminating, and consuming information about the world. The computer and networked computer systems are particular technologies that, unlike traditional media (radio, television, newspapers, etc.), allow not just the consumption of information but its production, coproduction, and dissemination.

The networked computer allows the convergence of the production, dissemination, and consumption of information in one tool. Given that technology is not independent from society, we cannot speak of the sustainability of technology only in technological terms; rather, we need to connect this topic to society. A computer-controlled atom bomb is a particular political technology used for threatening actual or potential enemies. Its existence has to do with political power relations in the world. Defining technological sustainability immanently would mean that the atom bomb would be sustainable if it works error-free; has comprehensive usability; and can be controlled with the help of a user-friendly, secure, and stable computer interface. The problem of such an understanding is, however, that the computer-controlled atom bomb is inherently political and conflicts with the goal of a peaceful global society. It is politically unsustainable.

Such immanent definitions of technological sustainability that stay in the realm of technology without considering society often take on ideological forms. Mulder, Ferrer, and van Lente (2011) argue that

technological sustainability is not an end in itself: "Rather, sustainability of a technology can only be determined through a socio-political process" (p. 242).

Computer technology cannot simply be made sustainable by changing chips, cables, variables, codes, or algorithms. Sustainable computing is not a technological matter because computing is embedded into environmental, economic, political, and cultural contexts of design, production, and use. It is therefore necessary to discuss the topic of computing and sustainability in the context of the information society. Making computing sustainable requires shaping technology and society in an integrated manner (cf. Bijker, Hughes, & Pinch, 1987; MacKenzie & Wajcman, 1999).

Such an understanding of technology underlies the philosopher Ivan Illich's (1973) book *Tools for Conviviality*. He argues that it is dangerous to base society on what is technologically possible and not on what is politically and ethically feasible. Illich argues that both society and technology need to be redesigned in an integrated manner, and he writes of convivial tools in a convivial society: "Such a society, in which modern technologies serve politically interrelated individuals rather than managers, I will call 'convivial'. . . . I have chosen 'convivial' as a technical term to designate a modern society of responsibly limited tools" (p. 12). We cannot assume that technological developments are automatically societally responsible. Sustainability and technology development should be seen as two interlinked social and political tasks. One can certainly see the critique of unsustainable developments and technologies as a political task. At the same time, reflecting on the implications of critical technology assessment for society and the construction of technology is an important political task. Schot and Rip (1996) argue in this context that constructive technology assessment and sociotechnical criticism are inherently connected.

For Illich, the problem is that technological innovations have the danger to blind people to potential negative consequences. Their all-too-optimistic adoption can backfire and result in unforeseen consequences. In an argument comparable to Illich's, Horkheimer and Adorno (2002) argue that enlightenment reason can turn negatively against itself and have dangerous consequences. They call this the dialectic of the enlightenment. The implication of the problems that technologies can entail is to take an approach that tries to actively limit negative consequences by designing society and technology in human-centered ways. Such designs do not think primarily about what is "good for institutions" (Illich, 1973, p. 25), but about what is good for all humans.

Four Approaches to Understanding Sustainability in the Information Society

Discussions about the un/sustainability of information technology's role in society have especially emerged since the First World Summit on the Information Society that was held in two phases in 2003 and 2005.

Table 1. Approaches to Sustainability and Information Society Policies (Based on Fuchs, 2010).

Type of approach	Description
Reductionism	Ecology, economy, or technology are considered the driving forces of a sustainable information society.
Projectivism	Politics and/or culture are seen as the determinant forces of a sustainable information society.
Dualism	Multiple dimensions and goals of a sustainable information society are identified, but are not causally related to one another.
Dialectic	Multiple dialectically interrelated dimensions and goals of a sustainable information society are identified, existing contradictions of these dimensions are analyzed, and changes are seen as integral, interdependent, and systemic.

We can classify information society policy discourses according to how they relate the domains of ecology and the economy to the realms of politics and culture. According to the information philosopher Wolfgang Hofkirchner (2013), there are four ways to explain the relationship of two categories, C1 and C2 (see Table 1): *reductionism*, *projectivism*, *disjunctivism/dualism*, and *dialectical integrativism*. Reductionism causally reduces the relation C1–C2 to C1. Projectivism projects causality into C2. Dualistic thought argues that C1 and C2 have independent causalities. A dialectical approach sees C1 and C2 as relatively autonomous and mutually constituting each other. In a dialectic, C1 and C2 are identical and nonidentical at the same time. I have in other publications elaborated on and applied, based on Hofkirchner's typology, a distinction of four information society policy discourses (Fuchs, 2010; Verdegem & Fuchs, 2013).

Reductionist approaches see ecological or technological or economic developments (e.g., GDP investment in information technology and the information economy) as the sole driving forces of the un/sustainable information society. Projectivist approaches see the political and/or cultural system as the determining forces of un/sustainability in the information age. Reductionism sees the physical aspects of society as determining, whereas projectivism assumes that the realms of human ideas and politics are determine society's development. Dualistic approaches define multiple goals and dimensions of a(n) un/sustainable information society, but they do not consider whether these goals are compatible and whether and how they are causally linked. Dialectical approaches see the various dimensions and goals of un/sustainability in the information society as interdependent, mutually causally linked, and only relatively autonomous.

Projectivism is an approach that is rarely found in ICT policy discourses on sustainability, because the notion of sustainability originates in the environmental realm and this kind of discourse tends to be associated with industry interests. Therefore, either the ecological dimension or the economic dimension or both normally tend to play a role. Theoretically, ICT sustainability could, of course, be conceived in purely political or cultural terms with a focus on either digital democracy or fostering online understanding. Reductionist understandings are much more common than projectionist ones.

Reductionist Understandings of Sustainability in the Information Society

Hilty and Ruddy (2010) reject multidimensional definitions of sustainability in general and in the ICT context in particular, because they argue that nature is the most fundamental dimension of human survival. They write that "multidimensionality mitigates the radical nature of SD" (p. 11). They define the central concern of sustainable development as the "sustainability dilemma"—that is, "the physical impossibility of extending the present consumption patterns of the industrialized countries to all parts of the world without putting a great burden on future generations" (p. 10)—and reduce the sustainability of information technology to the ecological dimension.

The emergence of ICTs and the Internet has not dematerialized the economy. The depletion of nonrenewable natural resources and the massive emission of carbon dioxide continue. Ecological catastrophe is certainly an important challenge in the information society. But assuming that we had solved this problem, other ways of destroying humanity could nonetheless persist, especially politically and ideologically motivated wars and spirals of violence that, in escalation, could result in the large-scale use of nuclear, chemical, and biological weapons that could wipe out humanity. Economic crises also have the potential to render the lives of many people precarious and can lead to political crises—and, in the last instance, also to wars. The example of dematerialization's promises shows that, in a society, where groups compete for resources (including capital, influence, attention, and support), technological determinism is used as a means in the struggle for mobilizing resources for political interests.

Hilty and Ruddy (2010) create the impression that the environmental crisis is the only problem that needs to be solved in the information age. Their approach is a form of *environmental reductionism*. We also cannot exclude the possibility that it may indeed be possible to universalize today's per capita quantity of physical consumption to all humans if it is at the same time possible to make a large-scale qualitative shift to green energy and renewable resource use. Given that there is more than one dimension that threatens the existence of humanity and the attainability of a good society, a one-dimensional use of the category of the sustainable information society is not feasible.

The European Union in 2010 introduced its new information society policy called *A Digital Agenda for Europe*, in which it formulates a policy strategy and goals it wants to reach until 2020: "The overall aim of the Digital Agenda is to deliver sustainable economic and social benefits from a digital single market based on fast and ultra fast internet and interoperable applications" (European Commission, 2010, p. 3). The notion of sustainability is here used as meaning both (a) the continuous growth of profits and the GDP as well as (b) the continuous guarantee of social cohesion. There is no consideration that there may be an antagonism between, on the one side, the focus on companies' profits, which in past decades has in most parts of the world meant a neoliberal policy agenda, and, on the other side, the increasing social inequalities that have come along with neoliberalism. The overall aim formulated in the Digital Agenda is both *economically reductionist* and *technologically deterministic*: The EU assumes that the combination of the Internet and neoliberalism automatically brings about economic and social sustainability.

The EU expresses its view that the Internet in Europe is not developed enough, is not fast enough, and that the uptake is not wide enough:

> More needs to be done to ensure the roll-out and take-up of broadband for all, at increasing speeds, through both fixed and wireless technologies, and to facilitate investment in the new very fast open and competitive internet networks that will be the arteries of a future economy. Our action needs to be focused on providing the right incentives to stimulate private investment, complemented by carefully targeted public investments, without re-monopolising our networks, as well as improving spectrum allocation. (European Commission, 2010, p. 6)

One of the EU's keywords for creating sustainability is the focus on a "vibrant digital single market" for Internet services, digital content, and "telecom services" (European Commission, 2010, p. 7), which includes Internet access and infrastructure:

> *We need very fast Internet for the economy to grow strongly and to create jobs and prosperity, and to ensure citizens can access the content and services they want*. The future economy will be a network-based knowledge economy with the internet at its centre. Europe needs widely available and competitively-priced fast and ultra fast internet access. The Europe 2020 Strategy has underlined the importance of broadband deployment to promote social inclusion and competitiveness in the EU. (pp. 18–19, emphasis in original)

The EU has the objective to achieve "broadband for all" (European Commission, 2010, p. 26) and wants to specifically foster the deployment of next-generation access networks (p. 20), which are Internet networks that have a download speed of more than 24 megabits per second. The EU strategy in this respect is to "encourage market investment in open and competitive networks" (p. 20).

The EU overall fosters a neoliberal approach to digital society's sustainability. There are, of course, exceptions, such as the EU research project netCommons (http://www.netcommons.eu), which stresses the need for alternative technological, legal, political, social, ethical, and economic frameworks for advancing the sustainability of the information society. The EU sees capitalist businesses as the key to providing Internet access and services and sees Internet capitalism as the source of the growth of economic profitability and the creation of wealth and social inclusion. In the quotes above, social goals are reduced to an economic dimension: the advancement of digital capitalism. The Digital Agenda overlooks that capitalist investments in Internet access and services do not guarantee social cohesion. Capital has the inherent drive to increase itself and, as one of its means for accumulation, tends to aim at reducing wage costs. Precarious and unpaid digital labor—that is, labor that produces digital media technologies and services—has been one of the effects of the capitalist Internet economy (Fuchs, 2014b).

Regional development is an aspect of sustainable development. If certain regions are significantly worse off than others, then regional inequality constitutes a form of unsustainability. The EU considers regions that have a per capita GDP lower than 75% of the EU average less developed. In 2014–20, this includes all of Bulgaria, Estonia, Latvia, Lithuania, Romania, Slovakia, and Slovenia as well as parts of Croatia, the Czech Republic, Greece, Hungary, Poland, Portugal, southern Italy, Spain, and the United

Kingdom (Cornwall, west Wales). Figure 1 illustrates these regions and shows that they are especially located in Europe's south and east, which is an indication of uneven development in Europe. As shown in Table 2, less developed regions, sparsely populated areas, poor households, and individuals with low education have significantly lower use of the Internet and computers than the average EU citizen.

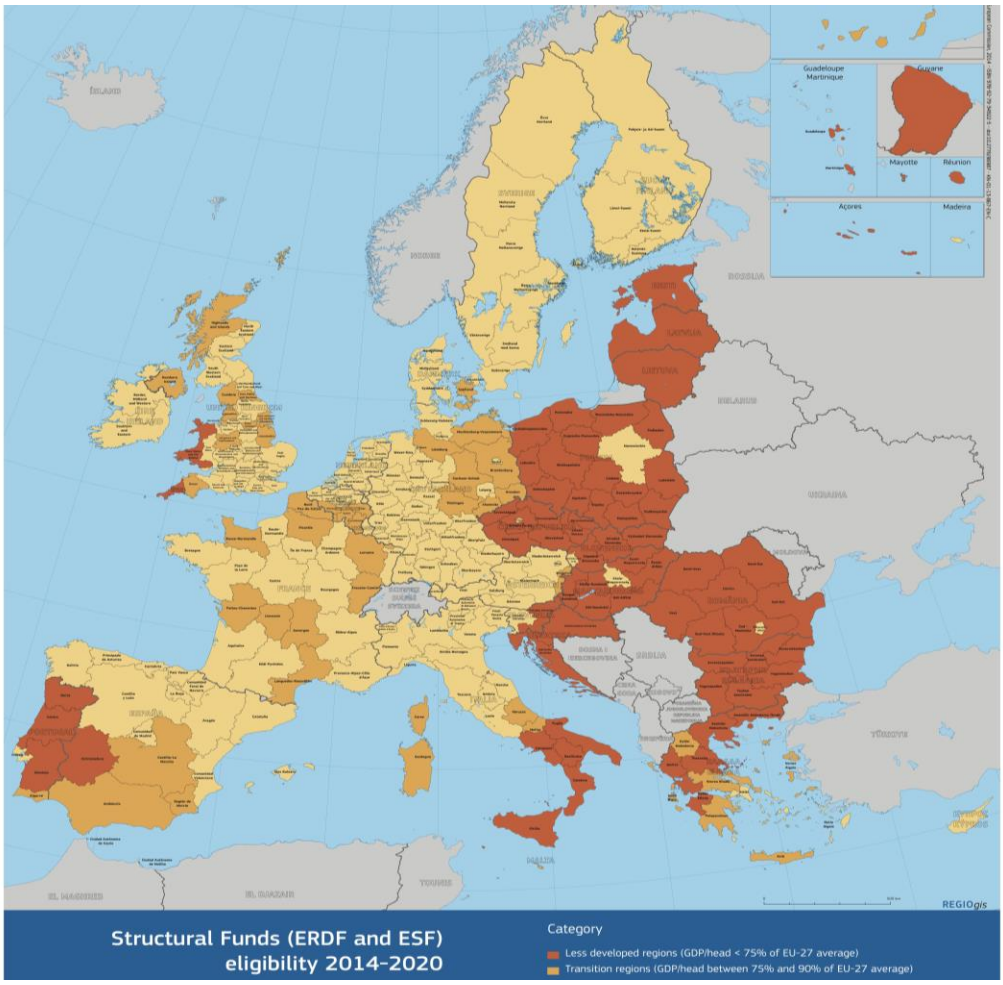

Figure 1. Less developed regions in Europe shown in orange, 2014–2020. From European Commission (*http://ec.europa.eu/regional_policy*).

Table 2. Internet and Computer Use Statistics for the European Union, 2015.

	Individuals who regularly (at least once a week) use the Internet, %	Households with Internet access, %	Households with broadband access, %	Households owning a computer, %	Individuals who have never used the Internet, %
EU-28	76 (2010 65%)	83	80	82	16
Less developed regions[a]	59 (EU-28 72%)	68 (EU-28 79%)	66 (EU-28 76%)	70 (EU-28 80%)	31 (EU-28 20%)
ICT professionals	92	–	–	–	3
Manual workers	72	–	–	–	17
Low education	55	–	–	–	36
Individuals in poorest households (lowest quartile)	48	62	59	62	31
Individuals in richest households (upper quartile)	81	97	95	97	5
Households in sparsely populated areas (< 100 inhabitants/km^2)	–	–	73	77	23

Note. All data are from Eurostat (2016a). EU-28 refers to all 28 countries in the European Union.
[a] Data for this category are for 2013.

Figures 2, 3, and 4 illustrate the geographical access to the Internet in Europe. The figures indicate that there is less Internet use in less developed regions. Tables 3 and 4 show the regions in Europe that in 2015 had the largest percentage of citizens who had never used a computer and the lowest use of broadband Internet. The tables again indicate that it is the southern and eastern regions of Europe that have the lowest computer and Internet use.

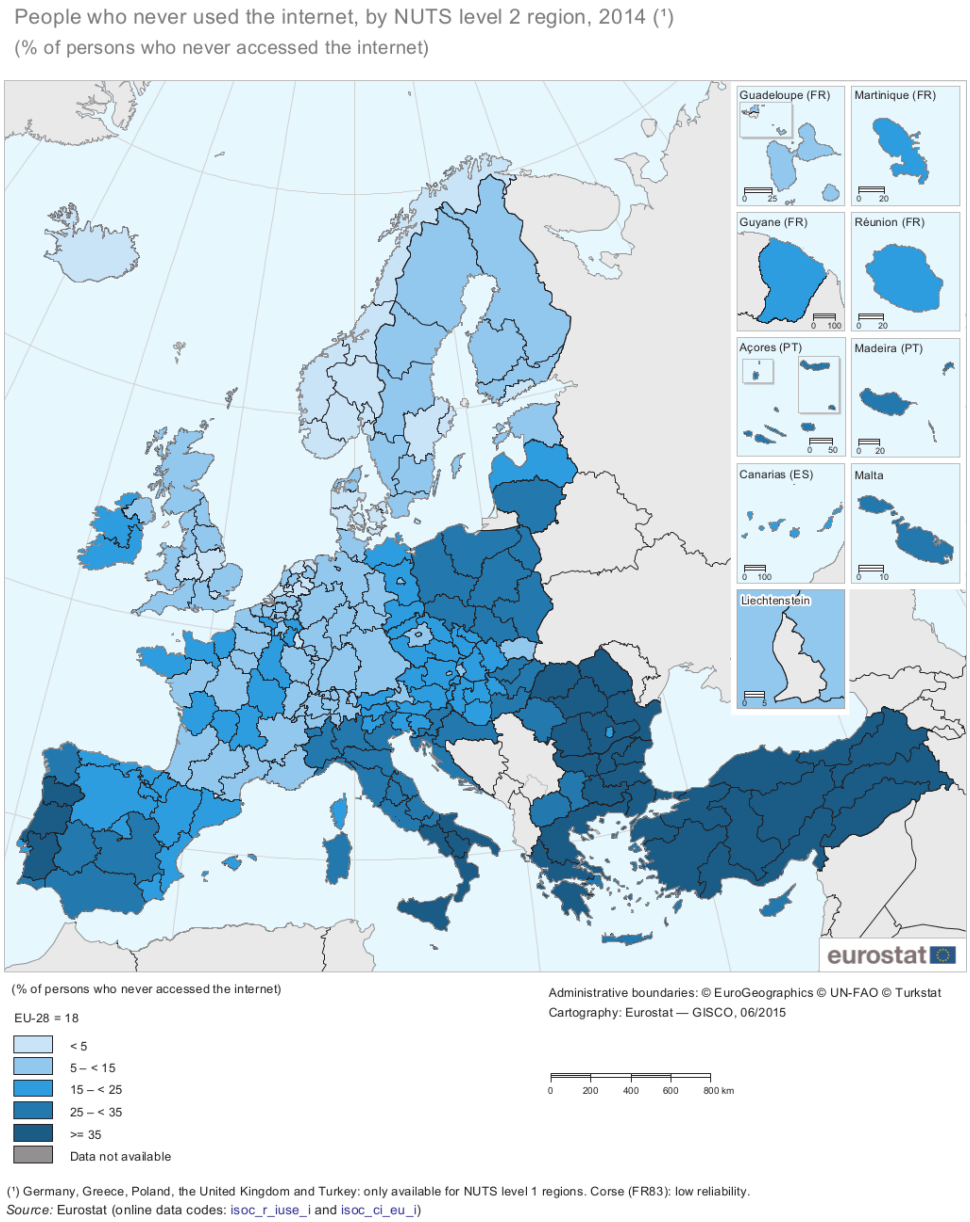

Figure 2. Percentage of Europeans who have never used the Internet, 2014 (source: Eurostat, 2016b).

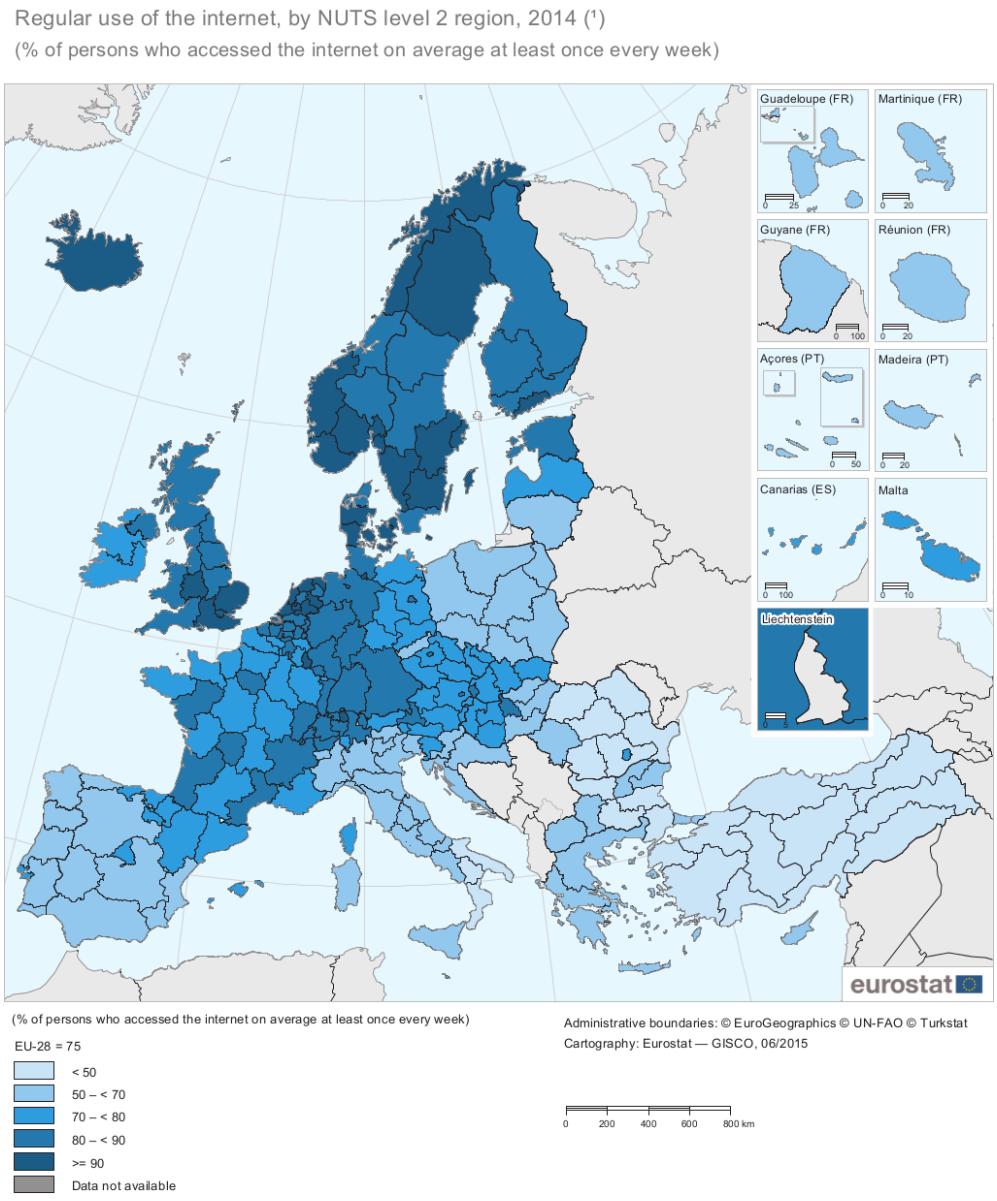

Figure 3. Percentage of Europeans who regularly used the Internet in 2014 (source: Eurostat, 2016b).

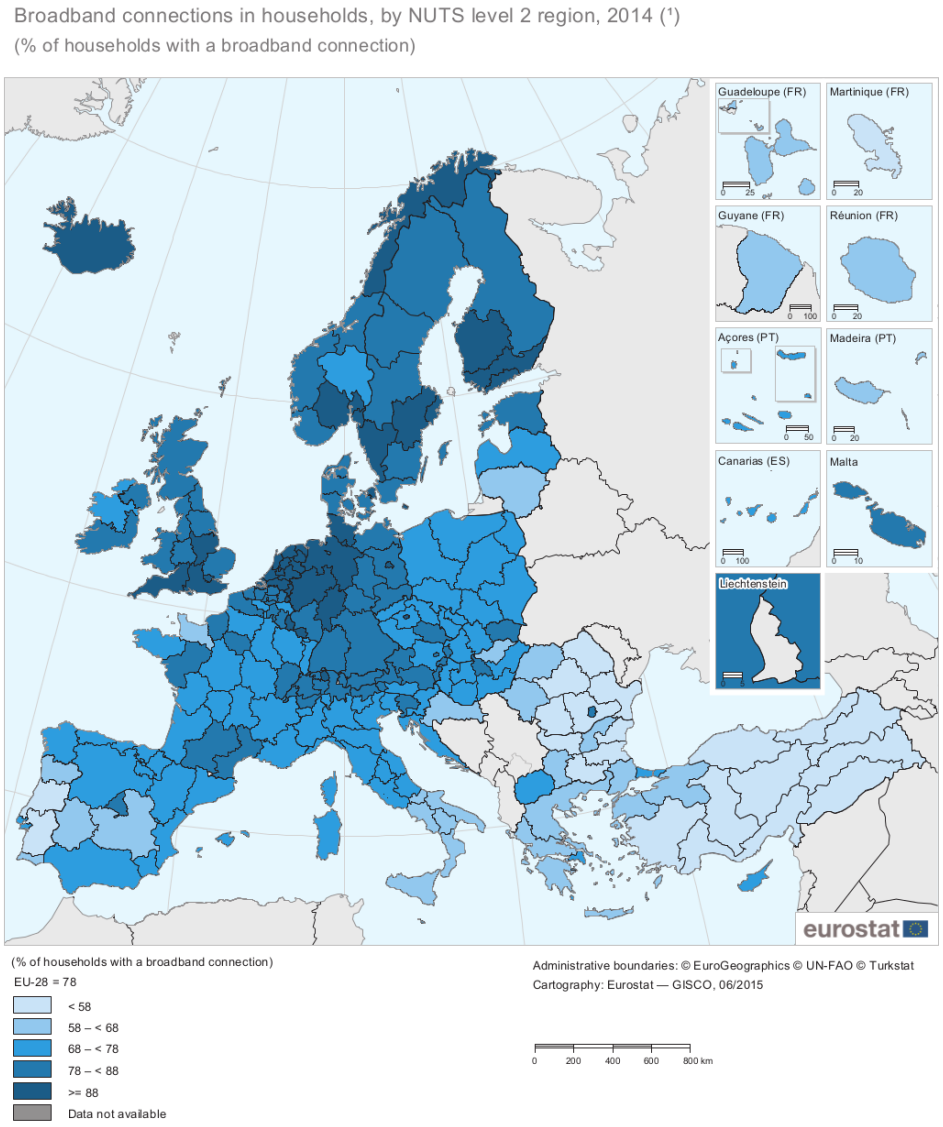

Figure 4. Percentage of European households that had broadband connections in 2014 (source: Eurostat, 2016b).

Table 3. Regions in the European Union Where in 2015 Less Than 60% of Households Had Broadband Access at Home.

Region	%
Severozapaden, Bulgaria	45
North and South Bulgaria	55
Severoiztochen, Bulgaria	56
Yuzhen tsentralen, Bulgaria	56
Corsica, France	57
Macroregiunea, Romania	57
Nord-Est, Romania	57
Sud-Est, Romania	57
Severen tsentralen, Bulgaria	58
Yugoiztochen, Bulgaria	58
Central Greece	59

Note. All data are from Eurostat (2016a).

Table 4. Regions in the European Union Where in 2015 40% or More Have Never Used a Computer.

Region	%
Severozapaden, Bulgaria	49
Campania, Italy	42
Apulia, Italy	42
Sud, Romania	40
Molise, Italy	40
Sicily, Italy	40

Note. All data are from Eurostat (2016a).

Given the existence of a digital divide in Europe between poor citizens and regions on the one side and rich citizens and regions on the other side, the question arises whether an approach that fosters private ownership and for-profit operation of Internet networks is suited for overcoming such divides. *For profit* means that operators charge for network access. Access is organized as a commodity. Given income inequality, people with lower income are less likely to afford the same level and speed of access than those who are better off. Capitalist markets necessarily bring access inequalities with them.

The EU, however, predominantly follows a market approach in the creation of fast broadband networks. In 2014, the EU announced the European Fund for Strategic Investments (EFSI), a plan of investing €315 billion into broadband infrastructure, transport, education, research, and innovation in 2015–17 as a combination of public funding and private investment (Jackson, 2014). About 80% of this amount comes from private investors, and the rest comes from the European Investment Bank and the European Investment Fund (European Commission, 2016):

> The Investment Plan for Europe adopted in November 2014 as the first major initiative of the Juncker Commission has the potential to bring investments back in line with its historical trends. Via the EFSI, the European Investment Bank is able to respond quickly to financing needs in areas where alternative sources of financing are scarce or unavailable. The Bank's presence often provides reassurance to other financiers to provide co-financing. The EFSI projects need to be economically and technically viable, consistent with Union policies, provide additionality (i.e. they could not be realized without the backing of the EU guarantee), and maximise the mobilisation of private sector capital. (p. 3)

The president of the European Commission, Jean-Claude Juncker, commented:

> We need to pursue fiscal responsibility and keep public finances sustainable. We also need to restore investment levels to overcome the crisis, to kick-start growth and sustain it. . . . We have to . . . stimulate private capital. We cannot spend money we do not have. So this is an offer to the private sector where the money is . . . to join the efforts we are developing. (European Commission, n.d.)

The discussion reveals a policy regime in Europe that tends to foster Internet infrastructure and access as commodity. There is not just unequal access to the Internet in Europe, but large market concentration in the broadband market. Since 2012, more than €60 billion was spent on mergers and acquisitions of telecommunications operators in the EU. In eight of 28 EU countries, the incumbent controls more than 50% of all broadband subscribers: Luxemburg, Cyprus, Austria, Denmark, Estonia, Latvia, Croatia, and Lithuania. For all of Europe, incumbents control 41% of the subscribers (European Commission, 2015). Table 5 provides an overview of the dominant market player's share in broadband subscription for all European countries.

The Herfindahl-Hirschman Index (HHI) is a measure of market concentration. It is calculated as follows:

$$HHI_j = \sum_{i=1}^{f} S_{ij}{}^2,$$

where f = number of firms participating in an industry, and
S_{ij} = each firm i's market share in the industry j.

HHI < 1,000 indicates low market concentration.
1,000 < *HHI* < 1,800 indicates moderate market concentration.
HHI > 1,800 indicates high market concentration. (Noam, 2009)

Table 5. Market Share of the Incumbent in Fixed-Line Broadband Subscriptions and Minimum Level of the Herfindahl-Hirschman Index, 2015.

Country	Market share (%)	HHI >
Luxembourg	69	4,761
Cyprus	64	4,096
Austria	58	3,364
Denmark	58	3,364
Estonia	58	3,364
Latvia	58	3,364
Croatia	53	2,809
Lithuania	51	2,601
Malta	49	2,401
Portugal	48	2,304
Italy	48	2,304
Spain	45	2,025
Belgium	44	1,936
Hungary	44	1,936
Greece	43	1,849
Germany	42	1,764
Netherlands	41	1,681
France	39	1,521
Sweden	39	1,521
Ireland	37	1,369
Slovenia	35	1,225
Slovakia	34	1,156
United Kingdom	32	1,024
Poland	32	1,024
Czech Republic	29	841
Romania	27	729
Bulgaria	23	529
Average in EU	44	2,106

Note. Data are from European Commission (2015). HHI = Herfindahl-Hirschman Index.

The calculations of the HHI in Table 6 show minimum levels. We can infer from them that in at least 15 of 27 EU countries for which data are available, the broadband market was highly concentrated in 2015. The average EU HHI in the broadband market is at least 2,106, which is a very high level.

Mobile broadband has a relatively small share of the broadband market: In 2014, only 8.3% of the homes in the EU used mobile Internet connections for accessing the Internet (European Commission, 2015). Table 6 shows that the average minimum HHI for the mobile communications market in 25 EU countries in 2014 was 1,753. Given that this is a minimum value based on the market share of only the incumbent, we can assume that the actual value is higher than 1,800 and that the European mobile communications market is highly concentrated.

Table 6. Market Share of the Incumbent in Mobile Network Subscriptions and Minimum Level of the Herfindahl-Hirschman Index, 2014.

Country	Market share (%)	HHI >
Cyprus	66	4,338
Luxembourg	55	2,973
Slovenia	48	2,345
Portugal	47	2,246
Croatia	46	2,146
Hungary	45	2,049
Malta	44	1,968
Romania	44	1,933
Lithuania	43	1,815
Austria	42	1,776
Latvia	42	1,769
Slovakia	42	1,734
Estonia	41	1,665
Finland	40	1,587
Czech Republic	39	1,556
Denmark	39	1,524
Ireland	38	1,439
Bulgaria	37	1,369
Germany	37	1,369
Sweden	36	1,299
France	33	1,106
Spain	32	1,025
Italy	32	996
United Kingdom	30	900
Poland	30	888
European Union	41	1,753

Note. Data on digital key indicators are from Eurostat (2016a). Data for Germany and the United Kingdom are from Ofcom (2015). HHI = Herfindahl-Hirschman Index.

Strong market concentration means that economic power is asymmetrically distributed. Single companies have economic advantages at the expense of workers in other companies in the same sector, whose economic survival is threatened. Market concentration also enables price control. An economy characterized by corporate monopolies or oligopolies can therefore not be considered sustainable. The EU is

dominated by a profit-oriented telecommunications and Internet model, in which large telecommunications corporations have a lot of power. Given that the capitalist development of the Internet market has resulted in high broadband market concentration, the question arises whether it is wise to further foster the market model in building new infrastructure or whether alternative models are needed. The EU's strategy to try to stimulate private investments into Internet infrastructure can easily enforce further market concentration: Investments into communications infrastructure is very expensive because it involves the digging of trenches and the laying of fiber cables and ducts. Only companies with vast amounts of capital can undertake such investments. Given a high concentration of communications markets, as in Europe, the most likely investors into new communications infrastructure are the incumbent players, which strengthens their market advantages and makes it more likely that they also dominate the new markets, which then reinforces capital concentration.

The EU example shows that fostering private investments with the help of public aid in an overall highly concentrated economic realm such as communications tends to reinforce concentration. We can therefore speak of a vicious cycle of capital concentration in the communications infrastructure market. Furthermore, communications corporations such as Verizon, Vodafone, EE, O2 (see Garside & Griffiths, 2013a, 2013b; Syal, 2013), Hutchison, Tele Columbus, Tele2, and Telecom Italia (Galizia, Cabra, Williams, Díaz-Struck, & Rudder, 2014) seem to have avoided paying taxes in Europe. The argument that private investment is needed because public finances are under strain overlooks the fact that public funding could certainly be increased if tax avoidance structures could be overcome and large corporations be made accountable.

Such processes constitute together a vicious cycle of neoliberalism that operates in the communications market and other markets (see Figure 5): Neoliberal policies and ideology foster the commodification of services, society's resources, and infrastructures (Harvey, 2005). The result is the emergence of capitalist markets. Markets in general have a tendency to concentrate and form oligopolistic and monopolistic structures. Communications markets are affected by concentration in a particular way: Investment into network infrastructures and information technologies is expensive, which fosters concentration. Advertising-funded media tend to attract advertisers if they attract large numbers of viewers, readers, listeners, and users, which fosters the concentration of advertising via an advertising–audience share spiral (Furhoff, 1973). Selling media content is a high-risk business, in which survival is difficult. All of these mechanisms foster concentration of communications markets. Neoliberalism also fosters a tendency for corporate tax avoidance that, together with concentration tendencies, strengthens the power of corporations. Building, maintaining, and operating communications infrastructure is expensive. Given market concentration, especially existing incumbent operators tend to be able to afford necessary investments so that dominant market actors tend also to control new communications infrastructures. Corporate tax avoidance not only strengthens the financial power of corporations but also puts pressure on public finances to further foster neoliberal policy agendas. Increasing corporate power fosters the tendency that corporations are enabled to threaten state institutions to withdraw or outsource their capital, which may result in unemployment. The neoliberal competition state competes with other states for attracting capital and so tends to foster ever more commodification, privatization, and market liberalization. The outcome is a vicious cycle of neoliberalism, in which neoliberal policy and ideology, capitalist markets,

market concentration, and corporate power are reinforced. The example analysis shows that such a vicious cycle operates in the European Union's information society.

Overall, the example of broadband markets in Europe confirms the analysis that the EU's Digital Agenda is based on a neoliberal economic reductionism that fosters the market and capitalism in the realm of digital media and sees the market as primary force for sustainability (for a critique of neoliberalism, see also Harvey, 2005; Saad-Filho & Johnston, 2005).

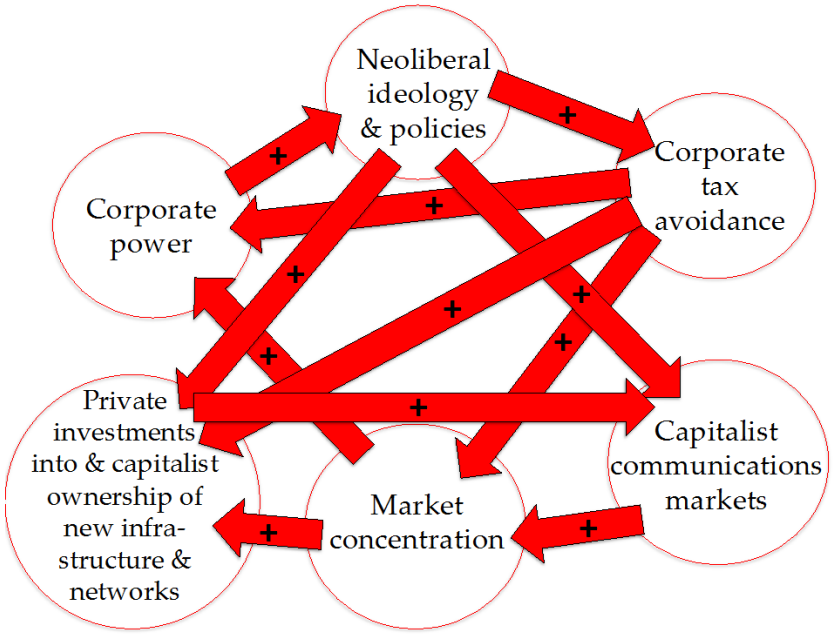

Figure 5. The vicious cycle of neoliberalism.

Dualistic Understandings of Sustainability in the Information Society

A third type of information society policy discourse is dualistic in character. WSIS was a summit that the United Nations organized. It took place in two phases with one event in 2003 in Geneva, Switzerland, and another in 2005 in Tunis, Tunisia.

WSIS identified the potential of ICTs to eradicate hunger and poverty and foster education, gender equality, health care, environmental sustainability, peace, prosperity, freedom, democracy, human understanding, cultural diversity, and human rights (WSIS, 2003a, Sections 2, 3, 51). It argued that GDP growth and social equality can be advanced at the same time through ICTs:

> Under favourable conditions, these technologies can be a powerful instrument, increasing productivity, generating economic growth, job creation and employability and improving the quality of life of all. They can also promote dialogue among people, nations and civilizations. (WSIS, 2003a, Section 9)

WSIS's logic of argumentation is dualistic because it assumes that, through ICT development, both capitalist growth and social equality can be achieved at the same time. ICT development is seen as a realm of capitalist investment, both in developed and developing countries: WSIS promoted ICT and Internet development in developing countries through the support of foreign direct investment and transfer of information technology (WSIS, 2003a, Section 40; see also WSIS, 2005a, Sections 54, 90b). It encouraged "private-sector participation" (WSIS, 2005a, Section 13) and identified a "powerful commercial basis for ICT infrastructural investment" in developing countries (Section 14). It wanted to "promote and foster entrepreneurship" in the realm of ICTs in developing countries (WSIS, 2005a, Section 90b) and wrote of "sustainable private-sector investment in infrastructure" (Section 20). We find here a peculiar understanding of sustainability as "private-sector investment in infrastructure." Sustainability is not related to the common good that benefits all, but to the growth of the profits of private companies that own Internet infrastructure. In a comparative passage, WSIS called for "adequate and sustainable investments in ICT infrastructure and services" (WSIS, 2005a, Section 8). WSIS simultaneously calls for both private ownership and social benefits for all.

In contrast to WSIS, the winners of the Noble Prize in Economics, Joseph Stiglitz (winner in 2001) and Amartya Sen (winner in 1998), argue that capitalist growth is no guarantee for social justice as an aspect of sustainability. Stiglitz, Sen, and Fitoussi (2010) write that the GDP is of limited use for measuring social progress and that it is "an inadequate metric to gauge well-being over time" (p. 8). Measuring well-being by the GDP could, for example, "send the aberrant message that a natural catastrophe is a blessing for the economy, because of the additional economic activity generated by repairs" (Stiglitz, Sen & Fitoussi, 2010, p. 265). They call for a shift in emphasis "*from measuring economic production to measuring people's well-being*" (p. 12, emphasis in original) in policy making and research in the context of sustainability.

The WSIS meetings in 2003 and 2005 were based on a neoliberal policy agenda that advances a dualistic agenda that sees social sustainability and capitalist growth of profits as achievable by capitalist ownership and development of ICT infrastructure. Since the rise of neoliberal politics that advanced privatization, the commodification of common goods and public services: market liberalization, and the deregulation of social policies, inequality understood as the distribution of income between labor and capital and between the rich and the poor, resource inequality, and inequality of health and death has increased:

> In March 2008, before the bubble burst, *Forbes* magazine listed 1,125 of the world's billionaires. Together, they owned $4.4 trillion. That was almost the entire national income of 128 million Japanese or a third of the income of 302 million Americans. (Therborn, 2012, p. 584)

The WSIS propagated a so-called multistakeholder approach that in Internet governance fosters the cooperation of "governments, the private sector, civil society and other stakeholders, including the

international financial institutions" (WSIS, 2003a, Section 60; see also WSIS, 2005a, Sections 29, 34, 80, 83, 97, 98). Such formulations create the impression that these actors possess equal shares of power in the world. Transnational corporations have significant shares of money, reputation, and influence and may therefore be more capable than civil society actors of being heard in policy debates and policy formulations. It is therefore not a surprise that, in contrast to the official multistakeholder documents published by WSIS in 2003 and 2005 that have a corporate-friendly character, the 2003 Civil Society Declaration to the World Summit on the Information Society formulated a different vision:

> Full participation in information and communication societies requires us to reject at a fundamental level, the solely profit-motivated and market-propelled promotion of ICTs for development. Conscious and purposeful actions need to be taken in order to ensure that new ICTs are not deployed to further perpetuate existing negative trends of economic globalisation and market monopolisation. (WSIS, 2003b, p. 7)

WSIS saw public-service investment and provision of Internet access as feasible only in poor regions: "We recognize that public finance plays a crucial role in providing ICT access and services to rural areas and disadvantaged populations including those in Small Island Developing States and Landlocked Developing Countries" (WSIS, 2005a, Section 21). It did not consider that capitalist ownership of communications infrastructure tends to be, as we have already seen, economically highly concentrated, which means a high concentration of power and private wealth. Public service infrastructure in a world of high inequality and concentrated capitalist ownership may therefore be a feasible alternative not just for developing regions. The argument that the public should only step in where private investors cannot easily make profits overlooks the fact that the market also fails in other areas, where transnational corporations make large profits and such accumulation results in market concentration.

Ten years after the WSIS, the WSIS+10 High Level Event conducted a progress review (Geneva, June 10–13, 2014) and published outcome documents. The approach had not changed after 10 years, and it remains dualist: ICTs are "cross-cutting enablers for achieving the three pillars of sustainable development" (WSIS, 2014, p. 10). WSIS+10 recognizes some problems, such as the gender digital divide, the lack of youth empowerment, the lack of Internet access in the least developed countries, that the voluntary digital solidarity fund does not work, e-waste, and privacy issues resulting from mass surveillance. But overall it is just like the WSIS outcome documents in 2003 and 2005—overconfident that capitalism and the market are the right way to social and economic progress.

The WSIS agenda is still dualist: "ICTs should be fully recognized as tools empowering people, and providing economic growth" (WSIS, 2014, p. 12). And it is also still neoliberal, although the new world economic crisis has shed doubts on this approach. "To attract private investment, competition and adequate market liberalization policies to develop the infrastructure, financing, and new business models need to be studied and deployed, taking into account national circumstances" (WSIS, 2014, p. 36). "We recognize the critical importance of private sector investment in information and communications technology infrastructure, content and services, and we encourage Governments to create legal and regulatory frameworks conducive to increased investment and innovation" (United Nations General Assembly, 2015, Section 38).

WSIS simply ignores certain important issues that concern the development of the information society and show the latter's contradictions in capitalism: the concentrated wealth of the rich (including the owners and chief executive officers of the largest transnational communications corporations), precarious labor (especially in the younger generation), computerization- and automation-induced unemployment, the crisis of capitalism, profit/wage inequality, income and wealth inequality, the concentration of ownership in the communications industries, unpaid and precarious digital and crowdsourced labor, communications corporations' tax avoidance, and so on.

In 2015, there were 241 information companies among the world's 2,000 largest transnational companies.[2] Together they had combined profits of US$537.3 billion (Forbes, 2015). These profits exceeded the combined GDP of the world's 33 least developed countries (US$474.0 billion) and the combined GDP of the world's 74 smallest economies (US$536.2 billion) (United Nations, 2015 [GDP at market prices in current U.S. dollars]). Table 7 lists the world's 10 most profitable transnational information corporations in 2015.

Table 7. The World's Most Profitable Transnational Information Corporations, 2015.

	Forbes rank	Company	Industry	Profits 2015 (billion US$)
1	40	Vodafone	Telecommunications	77.4
2	12	Apple	Computer hardware	44.5
3	18	Samsung Electronics	Semiconductors	21.9
4	25	Microsoft	Software and programming	20.7
5	20	China Mobile	Telecommunications	17.7
6	39	Google	Computer services	13.7
7	44	IBM	Computer services	12.0
8	67	Intel	Semiconductors	11.7
9	88	Oracle	Software and programming	10.8
10	22	Verizon	Telecommunications	9.6
				Total: 240.0

Note. Data are from Forbes (2015)

The combined profits of the world's 10 largest transnational information corporations (US$240.0 billion) are larger than the combined GDP of the world's 16 least developed countries (US$229.2 billion) and larger than the combined GDP of the world's 54 smallest economies (US$234.2 billion; United Nations, 2015 Data [GDP at market prices in current U.S. dollars]). Vodafone was, in 2015, the world's most profitable transnational information corporation. Its profits amounted to US$77.4 billion. Vodafone's profits were larger than the individual economic performance of 114 of the world's countries (World Bank Data, GDP at market

[2] The following industries were for this purpose classified as information industries: advertising, broadcasting and cable, communications equipment, computer and electronics retail, computer hardware, computer services, computer storage devices, consumer electronics, electronics, Internet retail, printing and publishing, semiconductors, software and programming, and telecommunications.

prices in current U.S. dollars for 2015), including populous countries such as Ethiopia (100 million inhabitants), the Democratic Republic of Congo (75 million), Tanzania (52 million), Kenya (45 million), and Uganda (38 million) (United Nations, 2015). Vodafone, a British telecommunications company that uses "a Luxembourg entity to reduce tax bills," according to reports, paid no corporation tax in 2014/2015 (Ungoed-Thomas, 2016, p. 14).

These data show the power of transnational information corporations. They are very profitable companies. Their individual economic power is often larger than that of entire countries. Their profitability is often enhanced by tax avoidance. At the same time, there is large inequality between profits and wages, and neoliberalism and austerity measures have resulted in cuts of social expenditures and the rollback and privatization of public services. Talking about the sustainability of the information society without talking about the profits of information corporations and the wealth of the rich, as the World Summit on the Information Society does, has a quite ideological character. Dualistic thought formulates the goal of corporate profitability together with a wish list of social equality goals and ignores the contradiction between the first and the second. Can there be an alternative, critical understanding of sustainability in an information society and information technology context?

Conclusion: Toward a Critical, Dialectical Understanding of Sustainability in the Information Society

This article argues that there are two dominant versions of ICT sustainability discourse: neoliberal reductionism and neoliberal dualism. They have in common a similar role in society as ideologies that try to legitimize the dominant way of how corporations and politicians organize information technologies as instruments for corporate and bureaucratic control.

Habermas (1968/1989) stresses in this context, based on Herbert Marcuse (1964), that technology becomes a form of technological rationality that is a form of domination and ideology. The analysis presented in this article reveals that Marcuse and Habermas's insights about technological rationality remain highly relevant in the time of social computing, the Internet, cloud computing, the Internet of things, and big data. Reductionist and dualist versions of ICT sustainability are one-dimensional and instrumental concepts of the relationship between information technology and society. They are means for domination and ideological legitimation. Langdon Winner (1986) speaks of "mythinformation" as the "conviction that a widespread adoption of computers and communication systems along with easy access to electronic information will automatically produce a better world for human living" (p. 105). My thin formation is the ideology of those "who build, maintain, operate, improve, and market" (p. 113) as well as regulate and analyze computing systems in an instrumental manner. Reductionist and dualist versions of ICT sustainability believe in specific versions of mythinformation—namely, that the combination of computing and capitalism will produce a better world.

Winner (1986) describes how, in respect to computing, political questions such as "How can we live gracefully and with justice?" (p. 162), "Are we going to design and build circumstances that enlarge possibilities for growth in human freedom, sociability, intelligence, creativity, and self-government? Or are we headed in an altogether different direction?" (p. 17), or "How can we limit modern technology to match

our best sense of who we are and the kind of world we would like to build?" (p. xi) are often simply not asked. Today, the moral values of computing are discussed in the context of buzzwords such as sustainability and corporate social responsibility. Corporations, managers, bureaucrats and instrumentalists can no longer simply ignore moral philosophy. Today, moral questions tend to be asked, but the answers remain one-dimensional and naive, often stressing that information technology will fix society's problems (technological reductionism), or capitalist adoption of information technology will fix society's problems (economic reductionism), or we want to have capitalism, capitalist information technologies, and a good society (dualism).

Critical theorists of technology and society share the insight that alternative models of technology and society that transcend instrumental reason are needed. Marcuse writes in this context of the need for dialectical rationality (Marcuse, 1964) and technologies of liberation (Marcuse, 1969), Habermas (1968/1989) of communicative action, Illich (1973) of convivial tools, and Raymond Williams (1976) of democratic communications. Winner (1986, Chapters 4 and 5) reminds us in his critique of decentralized, appropriate technologies that there is no alternative technology fix and no alternative consumer culture fix to society's problems. "Appropriate technologists were unwilling to face squarely the facts of organized social and political power" (Winner, 1986, p. 80). The implications for alternative computing, networking, and online and Internet technologies today are that centralized power exists in a technologically decentralized world and that alternative digital technologies require not just alternative designs that foster democratic alternatives but also struggles for the democratization of the institutions, contexts, and society in which alt-tech is used. The struggle for alternative technologies must at the same time be the struggle for an alternative society, a participatory democracy.

A dialectical perspective on the information *society* is based on these insights and sees unsustainable development as the result of contradictions in society that are mediated by information technology and result in destruction and inequalities. Table 8 gives an overview of the dimensions of un/sustainable ICTs and an un/sustainable information society.

What do we mean if we speak of a dialectic (for a more detailed discussion, see Fuchs, 2011, Chapter 2.4; Fuchs, 2014a)? A dialectic is a contradictory relationship between two entities. They simultaneously are identical and different. They require and exclude each other. Dialectical logic challenges classical binary and reductionist thought. It questions the reduction of the world to just one dimension. It is, however, not just relational and multidimensional; it also sees the world as being in flux and development. Development potentialities emerge out of poles that contradict each other. At a certain level of organization, everything constantly develops. There are, however, also continuous processes that change only at specific critical points. Dialectical development includes situations of crisis and change and the emergence of novelty at such critical points. In society, there are two basic forms of the dialectic: One has to do with the very basic conditions and the basic development of society. So, for example, there is a social dialectic among humans: In order to exist, humans have to communicate with one another. They are different individuals, but they can only inform themselves by mutual symbolic interaction. The second form of societal dialectic has to do with power relations. In a power dialectic, we find conflicting interests and conflicting structures.

Table 8. A Dialectical View of the Un/Sustainability of ICTs and the Information Society.

Dimension	Dimension of sustainability	Question	Dimension of unsustainability	Question
Nature	Environmental sustainability of ICTs: biodiversity (questions concerning e-waste and the energy consumption of ICTs)	To what degree does ICT use respect the protection and preservation of natural resources so that the survival of nature and society is guaranteed? To what degree is there an equitable distribution of ICTs' environmental harms and benefits to certain groups and places?	Environmental unsustainability of ICTs: contradiction between nature and society (environmental pollution, degradation, and depletion)	To what degree does ICT use result in the depletion of nonrenewable natural resources, the consumption of nonrenewable energy resources, the production of nonrecyclable (e-)waste, and in pollution? To what degree is there an unequal and inequitable distribution of ICTs' environmental harms and benefits to certain groups and places?
Society: Economy	Economic sustainability of ICTs: wealth for all (questions concerning power, monopolies, labor, access, affordability, and resource availability in the digital media industry)	To what degree is a social system that produces, uses, or provides access to ICTs organized in a way that fosters wealth for all and a fair distribution of wealth?	Economic unsustainability of ICTs: contradiction between digital capital and digital labor (poverty, inequality, economic crisis)	To what degree is a social system that produces, uses, or provides access to ICTs organized in a manner that does not guarantee the satisfaction of the needs of all humans (poverty), that results in unfair distribution of need satisfaction (inequality) or the irreproducibility of the economy (economic crisis)?

Society: Political system	Political sustainability of ICTs: participation and peace (questions about e-participation, e-democracy, cyberwar, online privacy, digital surveillance)	To what degree does the social organization underlying the production or use of ICTs enable humans to participate in collective decision making? To what degree does the use of ICTs guarantee the peaceful existence and interaction of societies and the guarantee of basic rights?	Political unsustainability of ICTs: contradiction between the rulers and the ruled (dictatorship and war)	To what degree is the social organization underlying the production or use of ICTs ruled by an elite that excludes others from participation in collective decision making? To what degree does the use of ICTs foster violence, the violation of basic rights, and warfare?
Society: Cultural system	Digital cultural sustainability: recognition (questions about online community and e-learning)	To what degree does digital culture enable the development of the human mind, the recognition of identities in society, and the reproduction of the human body?	Digital cultural unsustainability: contradiction between the cultural elite and everyday people (disrespect and malrecognition)	To what degree does digital culture limit mental development and production, the recognition of identities, and the reproduction of the human body?

The basic assumption, on which a dialectical concept of un/sustainable ICTs in an un/sustainable information society is based, is that unsustainability means that there are contradictory interests in the production and/or use of digital media technologies, such as, for example, a contradiction between nature and society (environmental unsustainability), digital capital and digital labor (economic unsustainability), the rulers and the ruled (political unsustainability), or a cultural elite and everyday people (cultural unsustainability).

The dimensions of sustainability do not exist independently, but are interdependent—that is, a lack of a certain dimension eventually will have negative influences on other dimensions, whereas enrichment of one dimension will provide a positive potential for the enrichment of other dimensions. So, for example,

people who live in poverty are more likely to not show much interest in political participation. Another example is that an unsustainable ecosystem advances an unsustainable society and vice versa: If man pollutes nature and depletes nonrenewable natural resources—that is, if he creates an unhealthy environment—problems such as poverty, war, totalitarianism, extremism, violence, and crime are more likely to occur. And conversely, a society that is shaken by poverty, war, a lack of democracy and plurality, and so on is more likely to pollute and deplete nature. So sustainability should be conceived as being based on dialectics of ecological preservation, human-centered technology, economic equity, political participation, and cultural recognition. These dimensions are held together by the logic of cooperation—the notion that systems should be designed in ways that allow all involved actors to benefit. Cooperation is the unifying and binding force of a participatory, cooperative, sustainable information society. The logic of cooperation dialectically integrates the various dimensions of sustainability.

The World Summit on the Information Society Civil Society Plenary (WSIS, 2005b) argues that, in the WSIS process, civil society interests were not adequately taken into account (for a critique of WSIS, see also Servaes & Carpentier, 2006).

> Internet access, for everybody and everywhere, especially among disadvantaged populations and in rural areas, must be considered as a global public good. . . . The WSIS documents also mostly focus on market-based solutions and commercial use. Yet the Internet, satellite, cable and broadcast systems all utilize public resources, such as airwaves and orbital paths. These should be managed in the public interest as publicly owned assets through transparent and accountable regulatory frameworks to enable the equitable allocation of resources and infrastructure among a plurality of media including community media. (WSIS, 2005b, pp. 4, 12)

In its own declaration—which is very different from the official dualistic WSIS outcome documents—the WSIS Civil Society Plenary (WSIS, 2003b) argues for an information society that is based on 34 inclusive principles. Among them are the promotion of free software and the establishment of a public domain of global knowledge that challenges intellectual property. The focus is on public goods and redistribution. The Plenary stresses that distributive justice is needed and that economic resources should not simply be produced within economic growth models, but rather need to be redistributed:

> We aspire to build information and communication societies where development is framed by fundamental human rights and oriented to achieving a more equitable distribution of resources, leading to the elimination of poverty in a way that is non-exploitative and environmentally sustainable. (WSIS, 2003b, p. 3)

This article demonstrates that sustainability in the information technology context has played an ideological role that aims to advance a neoliberal policy framework that conceives ICTs as a realm of private capital accumulation and advances the commodification of communications and society. The question that arises in this context is whether, from a critical theory perspective, the sustainability concept should therefore be discarded. The view advanced in this article is that a critical social theory should provide an ideology critique of information technology sustainability; at the same time, it should not discard, but sublate

the sustainability concept into a critical notion of un/sustainable information technology sustainability. Such a concept stands in the context of the quest for an alternative framework for information technology that goes beyond capital accumulation and aims to advance communications as a commons.

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