18

Our Fragmenting World

Introduction

In this chapter, I will place the information and communications technology (ICT) revolution and some of the changing patterns of information processing and communication in our current societies in their historical and socioeconomic context. Considering these longer-term developments must, in my opinion, be an integral part of any attempt to consider the socioenvironmental transition needed to mitigate or (in part, maybe) avoid exceeding too many of the planetary societal and environmental boundaries and causing a disintegration of our current societies.

To devise ways to avoid that disintegration of our current societies might appear to some as impossible as trying to avoid, in 500 CE, the disintegration of the Roman Empire. The rationale for avoiding such a disintegration in our own future is without doubt exceedingly difficult to construct, particularly from a complex systems point of view. Yet that is exactly what we are being urged to do, both as scientists and as citizens. It seems essential to attain some form of sustainability. The crucial questions are whether we love our current societies enough to want to try; and if so whether we have the tools to do it and which changes we are willing to accept.

Answering these positively implies we have to think outside the box, and in this chapter, and Chapters 19 and 20, I will make a beginning with that. In doing so, not being a specialist in either information technology or economics, I will lean heavily on others, in particular Friedman (2016), Brynjolfsson and McAfee (2011), Haass (2017), Ito and Howe (2016), and a range of other authors whose work underpins or relates to their

Published online by Cambridge University Press

approaches, without necessarily referring to them in each instance. Others will be cited as I proceed.

My main thesis is that the digital revolution has fundamentally accelerated a number of longer-term ongoing dynamic trends in our societies, with both positive and negative effects for different parts of our communities. These new dynamics must therefore be taken into consideration in trying to find a way out of the current sustainability conundrum.

The Race of the Red Queen

To begin with, we have to look again at the impact of the Industrial Revolution, and notably the virtually unlimited availability of relatively cheap energy. As mentioned in Chapter 14, in around 1800 a combination of mining fossil energy and inventing the equipment to exploit it set in motion a long-term trend in which it became ever cheaper (in energy terms) to innovate, lifting a major constraint on innovation and enlarging our knowledge and the value space that maintained society in a more or less coherent form. The process that emerged, following the feedback loop responsible for the coevolution of population, knowledge, and cognition driven by innovation, engendered multiple profound systemic changes, institutional and financial for example, ultimately improving overall health, wealth, knowledge, and resource use, but only in a limited number of places on Earth, where the social conditions were favorable.

A second transition began in the early twentieth century, when mass-production met the newly emerging field of psychology as applied to advertising, triggering a fundamental change in the development of capitalism, toward ever more competition on price, quality, and novelty by exploiting the potential of advertising. The focus of many industries shifted toward mass production and mass marketing, and that drove companies to lower prices further and further, increasing productivity, lowering cost, and gaining larger and larger parts of their markets. Ultimately this produced the consumerist society that we currently see in many parts of the world.

From our theoretical perspective, that development is part of the expansion of the value space necessary to keep a rapidly growing population interested in being part of the European (and later western) socioeconomic system. The competition involved drove innumerable inventions and innovations in all domains of our society, and in the process mechanized a large part of our daily life and its

Published online by Cambridge University Press

information-processing by creating – even before the impact of information technology – a very large array of technologies, artifacts, procedures, and institutions that were dedicated to particular kinds of tasks. This development began the acceleration of innovation in western societies that we are currently experiencing.

The ICT revolution is in this sense nothing new. It removed a major remaining constraint on innovation by enabling computational information-processing. It is (for the moment) the culmination of a process that began when humans took up the challenge of creating artifacts. But the feedback loops between knowledge, innovation, population increase, and resource use have accelerated to the point that one of my colleagues referred in this context to "The Race of the Red Queen" (Carroll 1999, chapter 2). We have to innovate faster and faster simply to keep the current socioeconomic dynamics more or less on track. As part of that process, major multinational corporations have grown in size to the point that their turnover now equals that of small and medium-sized nation-states, and that in turn has enabled these corporations to cross the borders of many such states and insert themselves in their socioeconomic fabric, creating a powerful transnational economic and political web. I discussed some unintended aspects of this process in Chapter 15.

The Growing Dissolution of Our Global Governance System

One of the corollaries of the growing extent and power of corporations is the dissolution of the power of nation-states when faced with a very different, often equally powerful, kind of player. But there, too, the dynamic is partly a longer-term one, independent of the multinationals or the ICT revolution.

Political scientists and diplomats, such as Bull (1977), Kissinger (2014), and Haass (2017), describe a longer-term development that passed a tipping point in 1991, just after the Cold War. To understand this development, it is relevant to go back a further few centuries, to the Treaty of Westphalia (1648) and the Congress of Vienna (1815), which laid the foundations for the current organization of the European nation-states as well as for the general philosophy that shaped it. These two events, and particularly the Treaty of Westphalia, had many consequences that are often overlooked. They created, for example, the conditions for the development of large-scale industry and business by laying

Published online by Cambridge University Press

the foundations for national systems of justice that could arbitrate in conflicts.

Up to and including the period of the Cold War (1945–1991), Haass argues, relations between nation-states were governed by a set of rules that were more or less generally accepted. Foremost among them is the idea that governments are sovereign, free to act as they see fit within their territories (states), and that other governments accept this without interference. International political history is about the interaction between this principle and the moments that it led to disagreement, friction, and aggression. Such moments were very often triggered within the nation-states concerned, and it is fundamental for our understanding to keep that interaction between processes within and between nation-states in mind. Just as fundamental is the fact that such a system would not have worked without a degree of balance of power between states. Together, the rules and the balance of power created a kind of order that governed Europe throughout much of the eighteenth and nineteenth centuries, but collapsed in the twentieth century when individual states started pushing the system out of balance, leading to the two world wars and the collapse of several major empires (Russia, the Ottoman Empire, and the Austro-Hungarian Empire after World War I, and the British, Dutch, and French (colonial) empires after World War II). In the process, the "rules" that had governed the interactions between states were sacrificed, presumably without regrets.

After World War II, all efforts on both sides of the Atlantic (i.e. the "Western world") were directed toward reestablishing stability, reinforced by institutions such as the United Nations and its many agencies, the International Monetary Fund, the World Bank and the Development Banks for the Americas and Asia, but also the International Court of Justice and later the European Coal and Steel Community (which evolved into the European Community and the European Union, EU), as well as the General Agreement on Tariffs and Trade (GATT) and the World Trade Organization (WTO). Whether miraculously or not, this effort ensured the survival of a more or less stable geopolitical order for another forty years, mainly thanks to the Cold War between the USSR and the USA, including the threat of so-called mutual assured destruction and the interaction between the North Atlantic Treaty Organization and the Warsaw Pact. With the collapse of the USSR, this order began to fall apart, both between states and within them. As a result, since about 1990, we have seen a growing dissolution of the power and coherence of nation-states.

Published online by Cambridge University Press

What happened after the disintegration of the Soviet Union? How did that event trigger changes that destabilized the global order? What were the underlying dynamics, and why is it that on the surface this destabilization was not immediately tangible?

First of all, the collapse of the USSR led to readjustments in the relationships between the USA, Russia, and China, with Russia taking a step down and China one or more steps up on the global power scene.[1] These adjustments of course engendered numerous tensions, but Haass argues (2017) convincingly that in circumstances where the US military completely dominated the scene, competitive activity shifted to the economic sphere, where the BRICS nations in particular (Brazil, Russia, India, China, South Africa), but other nations as well, focused on internal economic development. That in turn required economic interdependence between nations, including the fostering of closer and closer trading relationships. Global increases in wealth became the major goal, rather than territorial conquest; that was where win-win opportunities emerged. As a result, much of the friction between states also shifted to the economic domain, where they could more or less peacefully be negotiated in the context of the GATT, its successor the WTO, and a number of bilateral and multilateral trade agreements.

With the growing interaction and interdependency between nations, the relationship between domestic and international dynamics came to the fore, and this created other potential points of friction, as it increasingly eroded the basis of the Westphalia and Vienna systems – the principle that no nation should interfere in the internal dynamics of other nations. At the same time, many other players, not just large multinational corporations, became involved in international relations, such as the major international non-governmental organizations. They had both ideals and networks within many states, and therefore became players that crossed borders. This hugely complicated the diplomatic system, and helped transform it from a bipolar to a multipolar one as more and more parties gained the wealth and self-confidence to play their own roles.

We see this in the emergence of a number of regional hotspots, such as the Near and Middle East (including parts of North Africa), South Asia (India, Kashmir, Pakistan, and Afghanistan), East Asia (China, the Koreas, Japan, and more recently other countries bordering the East and South China Seas), East Africa (Ethiopia, Somalia and Sudan), as well as Eastern Europe (the Balkans and now Ukraine). In each of these, competition between important regional players led to (potentially) explosive tensions of a mixed economic, nationalist, religious, ethnic,

Published online by Cambridge University Press

and tribal nature. In some cases these were aggravated by attempts to shape societies along western, democratic, lines where that was clearly highly unlikely to succeed, such as in Iraq.

What was the role of ICT in this transformation? Even before the emergence of the Internet, the ease with which telecommunications such as press, radio, television, and now cellphones crosses boundaries, as well as – in certain areas – the huge explosion in tourism, acquainted people with lifestyles they had often not even dreamt of, and thus created visions and desires that were in many ways unattainable in a short time frame because of their geographic, economic, and social situation. This inevitably accelerated the emergence of many tensions, on the one hand facilitating globalization and on the other generating substantive reactions against it. In my own work in Southern Europe this became evident as soon as we realized that much of the increase in unused, eroded, surfaces was not so much due to environmental factors as it was due to the desire of the traditional farmers in those areas to adopt a different, urban lifestyle (van der Leeuw 1998). The recent ICT revolution, by facilitating horizontal communication across regions, borders, social classes, and various other divides has further accelerated this tendency.

The Spectacularization of Experience

Within individual states, radio and television are among the earlier precursors of full information technology, driven by electronic transmission of information. Their impact on communications had some dimensions that I think are of relevance here. The first of these is that they enabled one-to-many communication, thereby providing a powerful tool to control values and opinions, and thus to align very large numbers of people, many more than could have been reached until then. For one, people did not have to be literate to peruse them, and secondly their visual nature greatly enhanced their impact. In their imagery, they continued a tradition that had its origins in photography and film, greatly enhancing their efficiency because these were now detached from any material substrate.

Another dimension of their spread is the fact that they hugely widened people's capacity to listen to and see fiction, thus enabling people to escape from their everyday existence and live, albeit for a short moment, in a fantasy world.

An early visionary of the challenges this would pose in our societies was Guy Debord, a French author who as early as 1967 argued that

Published online by Cambridge University Press

"All that once was directly lived has become mere representation" (Debord 1967, thesis 1) and that the history of social life can be understood as "the decline of being into having, and having into merely appearing" (Debord 1967, thesis 17). In doing so, he pointed to the fact that these media promoted confusing sincerity with authenticity, and substituting emotional images for emotions.

Initially film, radio, and television had as their main goal making people laugh, feel happy, or at least forget their sorrows by watching song and dance, or experiencing a wealthier world in which dramas always end happily. But as the tele-amusement industry developed, it slowly but surely began to address more complicated situations and a wider range of different worlds, some of which were frightening, dystopian, or completely unrealistic. Altogether, this tendency habituated more and more people to live, at least in part, in a fantasy world – a world, moreover, where the consequences of one's decisions and actions could be avoided simply by switching off the electricity.

Economically, this trend was driven by the need to advertise more and more, to create the demand for new products. Over the past half-century or so, this combination of economic necessity and artistic potential has thus led to a blurring of the boundaries between fantasy and reality, as is evidenced in the infomercials that were deliberately intended to associate those two worlds, initially principally in the minds of small children watching early-morning television to allow their parents a couple of hours of rest, but increasingly also by adults who were watching later in the day. More recently this trend has come full circle in the "reality shows" on television that attempt to imitate real-life situations in the media that are traditionally devoted to the world of fantasy. The computer games industry is in some ways a continuation of this trend, but with one major difference: the opportunity to escape into a fantasy world is no longer centrally controlled, nor is the way in which individuals interact with the fantasies thus created.

In that sense, this recent development is part of the overall trend at individuation that ICT has enabled, which many people experience as freedom without realizing that, when an unforeseen calamity occurs, they are dependent on each other and the communities in which they function – and that they thus must operate within the norms of their community to be able to call upon its support when they need it.

Another aspect of this trend is the emergence of the twenty-four-hour news cycle, which presents major events in an abbreviated, simplified, "bite-size" form that is easily digestible. Initiated by CNN in the 1980s,

Published online by Cambridge University Press

it has now spread around the world and throughout electronic media. The setup of most websites follows the same pattern, leaving it up to the user/reader whether he or she is ready to digest the full message or only a highly simplified form of it, potentially leaving much to the peruser's fantasy.

To summarize, and again referring to Debord, everything that people have thus far experienced directly – in their relations with the natural and social world – has been analyzed, chewed upon, and converted to images. In the process, many of the hidden dimensions of reality have been removed, so that the consumer is presented with a simplified image that has been created according to the vision of the originator of the images concerned. This process has created a growing distance between "real life" experiences and Debord's "spectacularized" experiences.[2]

But there has also occurred another trend, driven by the interaction between the media and the capitalist system based on competition. Since World War II, we have seen the proliferation of different sources of mass communication. In the 1950s and 1960s, each country had just a few television channels. In many countries, these were controlled by government (France and the UK, for example), in others by private organizations with different religious perspectives (the Netherlands), and in yet others by private for-profit organizations (Italy, the USA). Beginning in the 1980s the number of sources of information multiplied, initially by means of cable and satellite TV, leading to a situation in which people could choose between hundreds of channels, many of which were dedicated to a particular kind of information (geography, history, mystery, science fiction, etc.). In the 2000s this proliferation of sources was further facilitated by the emergence of websites. In effect, everyone can now be a source of information for everyone else, on a global scale.

Although this process seems at first sight to be innocuous and directed at providing freedom of information to everyone, it has in recent years contributed to the fragmentation of our worldview and our society by creating and reinforcing different visions of just about any socioeconomic or political issue. In a later section, I will return to the social significance of this phenomenon. For the moment, suffice it to signal that this is another element in the process of effacing the alignment of societies' values, and the distinction between signal and noise that I mentioned in Chapter 17.

Democracy under Pressure

In many developed countries, at least since World War II, the basis of the governance system has been democratic – the population periodically

Published online by Cambridge University Press

elects representatives who constitute the government. These systems differ. In Switzerland, for example, the government must consult the population by referendum on every important issue. In most other western countries, elections determine the composition and the power to be distributed among a number of parties, ranging from two (in the USA), to three (the UK), or several more of which only the top two have real impact (France), or up to ten or fifteen who then form a coalition that governs according to a compact (The Netherlands). In essence, whatever the system, and whatever the level at which democracy is practiced, individuals delegate their political power to an elected elite, who make decisions for a limited amount of time.

This system works well, once it is institutionalized, as long as the internal tensions in the society are such that they can be worked through by discussion, debate, or vote. If this is not the case, the system is in trouble. I would argue that over the last sixty years or so, in most Western countries, this has worked in part because the inhabitants experienced an increase in comfort and wealth. There seems to have been a connection between the adequate functioning of the democratic system over that period and the rise of the consumer society, including the huge increases in use of raw materials, energy, and human capital not only in the countries concerned, but also in those other parts of the world from which the natural and human resources were extracted to serve these "developed" countries.

This relationship between democracy and exceeding planetary boundaries clearly needs to be investigated and taken into account when looking for ways to deal with our sustainability challenges. Randers (2012) and others have suggested that sustainability is difficult to achieve for democracies because when they have to deal with conflicting interests, decision-making is very controversial and complex. This raises the question whether one could implement a democratic system that did not have an expanding consumerist context.

But there is also an information-processing aspect to the functioning of our democracies: the fact that information flows were to some extent controlled through the media, which limited the diversity of opinions among the population of a country or smaller democratic unit. I referred to this briefly in the last section. The ICT revolution changed that fundamentally, by facilitating communications bypassing any state-related institutions and media. As a result, the Internet is now threatening our democratic institutions, and that threat is accentuated by growing wealth differentials inside and across regions and countries. Edsall (2017)

Published online by Cambridge University Press

recently drew attention to this phenomenon, quoting Hindman (2008) as saying that the USA may be "transitioning towards a hybrid democratic regime which would keep the trappings of democracy, including seemingly free elections, while leaders would control the election process, the media and the scope of permissible debate by electronic means."

We are seeing this in China, Russia, Turkey, Hungary, and other countries. The recent Brexit referendum and election campaigns in Europe and the USA also demonstrate that the mainstream media and political party organizations have lost much of their power. The vacuum has been filled by populist organizations that find their base in social networks, such as the Five Star movement in Italy or the alt-right movement around the Breitbart website in the USA. Samuel Issacharoff, an authority in this domain, is quoted by Edsall (2017) as pointing to four processes already going on before the impact of the ICT revolution:

> The current moment of democratic uncertainty draws from four central institutional challenges, each one a compromise of how democracy was consolidated over the past few centuries. First, the accelerated decline of political parties and other institutional forms of engagement; second, the weakness of the legislative branches; third, the loss of a sense of social cohesion; and fourth, the decline in democratic state competence. [...] Technology has overtaken one of the basic functions you needed political parties for in the past, communication with voters, [...] Social media has changed all of that; candidates now have direct access through email, blogs and Twitter, along with Facebook, Instagram, Snapchat and other platforms.

But the decay of the role of political parties and the traditional media is only one part of the story. As I write this (early 2017), one of the most salient implications of the information revolution that has suddenly come to light is the issue of "alternative truths," as highlighted in the Brexit and Trump campaigns. This seems to be a direct consequence of the multiplication of sources of information, including websites, television stations, and radio talk shows, as well as of the blurring of the boundary between signal and noise. We have seen that the distinction between the latter two has a direct relationship to the value space of a society, group, or culture. As subsets of the members of that society or group increasingly focus on a narrow set of sources for their information, this leads to different conceptions of truth, signal, and information, in effect fracturing the overall alignment of a society on a specific value space. Hence, as so elegantly formulated by one of President Trump's team (Kelly-Anne Conway), "We [i.e. the Trump team] merely offer alternative truths" (in an interview on

Published online by Cambridge University Press

NBC television's "Meet the Press" in the USA on January 22, 2017). It is not surprising therefore that the Trump team considers the media their principal opposition. For them, documenting and corroborating "facts" is no longer a prerequisite for presenting them; the conviction and charisma of the person who presents them, coupled with reference to a particular subset of information sources, appears to be enough. If unchecked, this sets in motion a tendency toward fragmentation and polarization of a society around different categories and values. (This phenomenon is currently summarized under the idea that people live in different information bubbles).

This also raises a question about whether the tendencies presented in the last section, including the spread of interactive computer games, have had an effect on the capacity of the younger generations to distinguish between reality and fantasy. Would living for many hours a day in artificial worlds where the interaction between people's decisions and actions on the one hand and their consequences on the other is artificially enabled and constrained favor a reduction in the capacity to distinguish between fiction and reality? And finally, we need to consider the impact of globalization on our democracies. Recently, Reno (2017) expressed this as follows:

> Globalism poses a threat to the future of democracy because it disenfranchises the vast majority and empowers a technocratic elite. It's a telling paradox that the most ardent supporters of a "borderless world" live in gated communities and channel their children toward a narrow set of elite educational institutions with stiff admissions standards that do the work of "border control." The airport executive lounges are not open and inclusive.

In effect, here we see the result of the fact that a small, and now increasingly narrow, elite in our societies has been able to make the transition toward a (partly ICT-based) globalized society, whereas a very large majority of citizens worldwide has been left behind, focused on their local community and thus resistant to expanding the spatial extent of their identity to communities elsewhere. Here again, the roots of one of the ICT-accelerated processes have been laid long before, in our case in the form of democratic systems in which a small bourgeoisie directed the society as a whole. But the ICT revolution is exacerbating the inherent tension between the governing and the governed by the rapid acceleration of information processing itself.

The Deconstruction of Communities

Now let us look at the next scalar level – that of communities. To introduce this topic, I will go back to a series of classic works in the

Published online by Cambridge University Press

anthropological and economic literature. First are those of Karl Polanyi, the anthropologist who first developed the substantivist approach to economic anthropology. According to Polanyi, the modern market-driven society was not an inevitable stage in the evolution of western societies, but was planned. He came to this conclusion because he did not see economics as a subject closed off from other fields of enquiry. He saw economic and social dynamics as inherently linked, and noted a major transformation in their relationship as part of the Industrial Revolution. In his *The Great Transformation* (1944, 2001) he makes the distinction between "markets" as an auxiliary tool for ease of exchange of goods in many small-scale societies – in which, generally, exchange is a mechanism to maintain social relations – on the one hand and "market societies" on the other, which are those societies in which markets are the paramount institution for the exchange of goods through price mechanisms, to the point that the substance of society itself becomes subject to the laws of the market. According to Polanyi, roughly from the 1830s in the UK the market began to subordinate the substance of society itself to the laws of the market's "invisible hand." This led to the separation of society into economic and political realms, and the subjection of societies' dynamics and requirements to those of money and the economy. This, he argues, resulted in massive social dislocation and spontaneous moves by society to protect itself. In effect, Polanyi argues that once the "free" market is disembedded from the fabric of society, social protectionism is society's natural response, a spontaneous reaction to the social dislocation imposed by an unrestrained "free" market. To rephrase this in terms I introduced in Chapter 16, it is in the emergence and evolution of the free market that a financial, unidimensional logic was progressively disembedded from the wider, multidimensional, sociocultural logic. Similar arguments have been made by such economists as Keynes (1930) and Frieden (2006).[3]

David Graeber, another economic anthropologist, builds upon these ideas (which were anathema to most macroeconomists, but found wide support in anthropology, sociology, and related disciplines) in his researches into the theory of value (which I referred to in Chapter 16). Graeber (2001) contrasts the multidimensional conception of value among many small-scale societies (Tobrianders, Malagasy, Kwakiutl, Iroquois) with the unidimensional conception of value in economics in the modern world. In his opinion, "The market was a creation of governments and has always remained so" (Graeber 2001,10; Mazzucato 2015). Modern economics, in its emphasis on modeling the value-driven behavior of the (modern) individual, "...relies on trying to make anything

Published online by Cambridge University Press

that smacks of "society" disappear. But even if one does manage to reduce every social relation to things [...] one is still left to puzzle over why individuals feel some objects will afford them more pleasure than others." (Graeber 2001, 9)

It is implicit in this argument that the formalist economists' approach, which only distinguishes individuals and populations, cannot grasp the concept of value because values are accorded according to the social networks in which people participate. We have seen earlier that "value" is a social creation, shaped by the social context of individuals – the ideas shared by the network(s) in which an individual is active. It is therefore generally determined at a different scale than that of the whole population. To include values in our approach, we must move from a population perspective, which treats individuals as statistical units in a population, to an organization perspective, in which the different configurations of relationships between individuals are taken into account (Lane et al. 2009), as can be done in a multilayered network approach to society (White & Johansen 2004; White 2009).

Ronaldo Munck (2004) contributes the third step in this argument when he posits that globalization is at the root of the destruction of social communities as it undermines the multidimensional spectrum of values that keep communities together. In doing so he echoes Polanyi's original assertion that it was the imposition of one-dimensional economic thinking in finance, in the form of the gold standard, that ultimately drove nations to competition, colonization, an arms race in Europe, and finally the world wars. Munck sees globalization as an extension of the attempt at financial global unification that drove the imposition of the gold standard to a number of other economic domains. We are thus reminded of Maruyama's statement (Chapter 16) that on a highway cars can only compete in terms of speed. If wealth is the dominant standard, competition between individuals, groups, and nations tends to be measured mainly in wealth.

But we have to emphasize that, important as it is, the slide toward wealth as an increasingly dominant standard by which people, groups, and nations measure their performance and identity is only one trend among many others. The others have of course also been in existence for a very long time, and continue to play an important role in our societies through the many other values that societies and individuals embrace. Yet they have in some way been eclipsed in public attention by economic values. The important question is whether this is temporary or will be of longer duration. However this may be, an important task ahead is to look

Published online by Cambridge University Press

more closely into the noneconomic dimensions of the dynamics that are driving societies.

The Transformation of Globalization

In an interesting book, Richard Baldwin (2017) links the transformations in globalization to changes in the movement of goods, information, and people. In the 1880s globalization first emerged, he argues, in the form of (increasingly bulk) trade in raw materials and industrial goods owing to the availability of novel, relatively cheap, and dependable modes of transportation (railroads and steamships). The resulting fall in trade cost enabled the geographic separation of production and consumption, leading to the global expansion of markets while industry grew locally. This fueled a feedback loop of trade, industrialization, and growth that boosted the western (mechanizing) nations' economies in contrast to the economies of other parts of the world. It is the source of the west's huge wealth and the income differences between the north and the south.

From the 1970s, the West's share of global manufacturing declined, and this trend accelerated in the 1990s. Baldwin points to the fact that owing to the ICT revolution there was a sudden decrease in the cost of moving information, and he argues that the ensuing increased facility to coordinate complex activities from a distance facilitated the spread of production into global supply chains. In the process, manufacturing was outsourced from the developed to the developing countries. As this involved the transfer of important know-how, it led to what Baldwin (2017, 5) calls "the global value chain revolution," redefining the international boundaries of knowledge. In particular, it closely linked developed nations' know-how with developing nations' labor into the core of commercial competition and moved industrial organization from a territorial to a network organization.

Baldwin attributes the fact that this shift remained confined to six developing nations (China, Korea, India, Poland, Indonesia, and Thailand) to the still high cost of moving people, and in particular the time-cost of moving relatively well-paid personnel. By concentrating production in a few low-wage countries the cost of moving personnel could be contained, and the more so if the new production countries were relatively close to the older ones. This reorganization led to an industrial expansion that created a huge demand for raw materials and thus caused rapid increases in income and wealth both in the new production countries and in the countries that provided the raw materials.

Published online by Cambridge University Press

In the future, Baldwin argues, facilitating people movement by promoting the virtual presence of people at a distance, through improved telepresence and telerobotics technologies, could cause a third fundamental shift, leading to virtual immigration and telecontrol of production, thus further blurring the spatial boundaries between nations. The potential consequences of such a shift are yet to be examined.

The Emergence of the Developing World

I also need to point here to the impact of the emergence of the developing nations on the globalized scene. They are undergoing many of the developments referred to in this chapter without the institutional framework within which they are occurring in the developed world.

Until the 1980s, in most of the developing world, the political and economic systems were still predominantly neocolonial, geared toward furthering the interests of the colonial powers on which the countries involved had depended (Nederveen Pieterse 1989). But from the 1990s several of these countries, profiting from the new wave of globalization just mentioned, could develop their respective economies in ways that challenged the hegemony of their colonial masters and the post-World War II international agencies. This led to the emergence of a wide range of different postcolonial development strategies, based on the natural and social capital of the countries themselves.

East Asia (Japan, South Korea, the Philippines, China, now also Vietnam) was the earliest region in which this happened, followed by some countries in Latin America (Mexico, Brazil, Chile, Venezuela), South Asia (India), and finally Africa (in particular Nigeria and South Africa). This transition can profitably be looked at from the perspective developed by Wallerstein (1974–1989), referred to in Chapter 14. Some countries, in which for political reasons these developments began first (Japan, South Korea), have managed to join the exclusive club of developed nations, while others are on the way (China, Brazil, Turkey, South Africa, Indonesia).

It is clearly outside the scope of this section to go into any detail on these developments, but from the 2000s ICT played an important role in them, and I will try to briefly summarize some of the factors favoring that role, as well as some of the difficulties the development of ICT encounters in these countries. A first difference with the developed world is that whereas wireless telecom and web markets in the developed part of the world are approaching saturation, this is not the case in developing

Published online by Cambridge University Press

countries. In effect, 2014 data show that the developing countries substantively lag behind ICT impacts in the developed world.

Part of this difference is a question of investment capacity and national choice (wireless or wired), but an important other aspect is the lack of ability to use the opportunities offered by ICT. Thus, in large parts of Africa, notably, mobile phones are mainly used as a means of telephoning and text messaging, rather than to access the web. This difference in use of ICT is particularly tangible between cities and the countryside, as a result of linguistic and educational differences. According to a report to the European Parliament (STOA 2015), the economic and social returns of ICT in developed and developing countries alike are high, as telecommunications allow a mitigation of the negative effects of dysfunctional markets. Countries with good information technology (IT) infrastructures and abundant IT-skilled labor forces benefit most from the ICT revolution in terms of increased national production, export, domestic and foreign investment, and new employment opportunities.

However, there seems to be insufficient evidence that such wealth creation is contributing to poverty reduction. Here, technical, political, educational, and cultural factors seem to play a role. For one, as long as mobile phone use is limited to communication, it does not necessarily move people out of poverty (STOA 2015). Access to the mobile Internet, on the other hand, does make a difference. Evidence shows that high penetration of modern ICT is an effective driver of socioeconomic development, but this is only the case in a very limited number of countries (e.g., Tunisia, South Africa). Moreover, Africa has the largest number of worst performing countries in terms of establishing regulatory frameworks for ICTs and often has slow, unreliable, insufficient, and expensive telecommunication services.

Basic computer literacy is still not part of the primary education curriculum in most developing countries. The development of local content and of applications designed to address the needs of the poor has also progressed relatively slowly. The nature of ownership of ICT is relevant as it makes developing countries that own their ICT infrastructure more active in introducing technologies that are tailored to the needs of their populations. Notably, as far as internet service providers remain in developed countries, the benefits of ICT to developing countries are limited, because this creates a divide between producers and users of technologies to the advantage of the former. Most of the ICT potential thus remains to be fully exploited, especially for the advantage of lowest income groups. There are of course exceptions, in particular in developing

Published online by Cambridge University Press

countries where ICT is not owned by corporations in developed nations, and in sectors such as finance, insurance, agriculture, and health, where they do indeed rapidly remove barriers.

To conclude, penetration of ICT can in theory be seen as an unprecedented opportunity to reshape the political and institutional landscape of many developing countries, promising to improve accountability and transparency of governmental actions, and to increase participation in political decisions. But in reality the processes involved in democratic participation are so complex, and driven by societal dynamics of which communication is only a – poorly understood – part, that much more needs to happen. And in view of the prevalent regimes, one has to be aware of the fact that in many countries, for the time being, there is at best the kind of hybrid democratic regime that "keeps the trappings of democracy, including seemingly free elections, while leaders control the election process, the media and the scope of permissible debate by electronic means" (Edsall 2017).

Big Data and Individuation

I will now return to the novel capability to collect, store, and process "big data" that is one of the major technical transitions in information processing. First of all, it has led to huge concentrations of information, and processing tools, in the hands of a very small number of corporations, such as (notably) Tencent, Weibo, Apple, Facebook, Google, Amazon, Ebay, and Yahoo. These corporations were the first to see the huge advantages, both for their prospective clients and for themselves, of facilitating information access and collecting vast amounts of behavioral information from their customers. For a few years, there was a lag in tools to process such information, but the number of tools to do so is currently (2019) exploding. They enable, for example, the identification and analysis of patterns that have thus far been difficult to observe because the statistical samples that could be collected and analyzed were too small. Such analyses have led to customized web-mediated advertising, highly efficient mobilization of relevant voters in elections, automated scrutiny of job applications, monitoring of billions of communications in the search for terrorists, and many more applications, too many to list here. Manikya et al. mapped this process as early as 2011, and their guide, while quickly outdated in terms of details, remains relevant in terms of its general description of the dynamic. Somewhat more forward-looking is a collective work published by the BBVA Foundation in 2013, and to keep

Published online by Cambridge University Press

abreast of these developments one can rely on magazines such as *Wired*. As an overall trend, the capacity for processing huge amounts of information in great detail is transforming many aspects of our lives – wherever until now calculations were based on generalization from (limited) statistical samples – because we now have the capacity to enhance resolution to deal with each individual entity directly and separately. This not only impacts the insurance industry, but also medicine in its trend toward individualized diagnosing and treatment, and elections in the way one can now determine individual voting patterns by means of big data analysis, etc. Ultimately this development may well have an effect on economics by enabling the use of much more detailed data in its models, or even agriculture by enabling such detailed spatial analysis that techniques of exploitation can be better suited to local circumstance. The examples are plentiful, but they all share the fact that drilling down to the level of the individual, the smallest possible spatial or temporal entity, the individual instance of a phenomenon or process, will improve our understanding of societal and environmental phenomena at the cost of hugely (exponentially?) increasing the need for processing power. This is one of the major trends driving the computer industry toward high-performance computing (aggregating computer power to deliver much higher performance). To give the reader a sense of how quickly this trend is growing, I cite the French newspaper Le Monde (June 7, 2017): "the [European] data economy (from e-commerce to traffic management to personalized medicine) was worth 272 billion euros in 2015, and could increase to more than 640 billion by 2020."

We should never forget that this trend enables a major concentration of information processing, and thus political and financial power, in the hands of a very small elite, aided by sophisticated software and major computerized information processing capacity. The fact that these corporations use these data in completely opaque ways has favored a backlash in the domain of privacy protection, prompting the European Commission to adopt in 2018 a completely new legal and institutional framework, the General Regulation of Data Protection, intended to create full transparency and thus reestablish trust. Its efficiency remains to be demonstrated.

Mass data treatment also stimulates the development of the capability to automate many structured, repetitive tasks, from the very simple ones, such as maintaining bank accounts, to more complicated ones, such as the work of paralegals in lawyers' offices (routine document production and processing). As usual, this novel capability can serve constructive as well as deconstructive purposes, depending on the slant that the users of such

Published online by Cambridge University Press

information desire to give to their interpretations. Friedman (2016) gives both constructive and deconstructive examples of "big data" processing as resource. O'Neill (2016) gives numerous examples of socially deconstructive uses, in particular when automated, algorithm-based data analysis uses criteria that exclude parts of society (for example from jobs).

Much attention has recently been drawn to the consequences that these (and subsequent) innovations might have for employment, as automated information processing and manufacturing reduce the need for certain kinds of labor (Brynjolfsson & McAfee 2011; Purdy & Daugherty 2014; White House 2014; The Economist 2016).

Automation and Artificial Intelligence

Robots have long been a favorite science-fiction topic, as in the work of Isaac Asimov (1950) and others. But the last sixty years have seen such advances in information processing that increasingly complex mechanical tasks in industry are being automated to reduce labor costs, for example in car manufacture. As long as information-processing capacity was limited, these robots were very specifically designed to perform relatively simple, monotonously repetitive tasks. But that, too, is changing, notably by means of the introduction of machine learning in automation.

Artificial intelligence has been another dream, this time of informatics enthusiasts, for at least fifty years, but over much of that period computing power was still insufficient to instantiate it in a meaningful way. Over a period of just a few years, in the early 2010s, that situation changed dramatically as a consequence of developments just mentioned, and in particular the "cloud." Yet there was little success until an intellectual change in perspective made a fundamental contribution. Most early work, for example on languages and on chess, programmed sets of rules derived from expert opinions, according to which meanings and moves were to be construed. This worked to a reasonable extent for chess. Language, however, is too flexible and fluid, as well as complex, to assign meaning based on such rules. Contemporary artificial intelligence (AI) is based on one or other form of machine learning, which requires the computer to learn from the ways in which language is used by analyzing very large numbers of texts in ways that resemble "fuzzy set" approaches – in which initial approximations of meaning are refined many times until they come close to correct understanding (Zadeh 1965, 1975). This is the approach that transformed Google Translator from being a crutch to a more or less efficient and smooth translation

Published online by Cambridge University Press

machine (the story behind this is nicely told by Friedman 2016). It is reasonable to expect that this breakthrough – reflexive learning based on analysis of very large datasets – will enable computers to conquer important other domains of information processing, including sophisticated moving robots capable of nonroutine tasks, many relatively complex analytical tasks, etc. A summary of developments leading to the current state of AI and some ideas about its future impact can be found in a report recently issued under the Obama administration by the (US) White House Office for Science and Technology (2016a).[4]

In thinking about the future of AI it is important to distinguish between different ways of applying its basic principles. On the one hand, one can distinguish between narrow and general AI. The former is increasingly widely available now, and is used to address specific application areas, such as playing strategic games, language translation, self-driving vehicles, and image recognition. Narrow AI also underpins many commercial services, such as trip planning, shopper recommendation systems, and advertisement targeting, and is finding important applications in medical diagnosis, education, and scientific research. Narrow AI is not a single technical approach, but rather a set of solutions for discrete problems that relies on a toolkit of specific methods along with problem-specific algorithms.

The White House report (OST 2016a) defines as general AI systems that exhibit apparently intelligent behavior at least as advanced as a human being across a full range of cognitive tasks. It argues that it will be at least several decades before this can be achieved. The diversity of narrow AI problems and solutions, and the apparent need to develop specific methods for each narrow AI application, has made it unfeasible to "generalize" a single narrow AI solution to produce intelligent behavior of general applicability. Hence, attempts to reach general AI by expanding narrow AI solutions have made little headway over many decades of research.

In considering the societal impact of AI it is also important to distinguish between the three different roles that AI can (and does) play: (1) automation, (2) autonomy, and (3) human–machine teaming, which have different impacts on society. Automation occurs when a machine does work that might previously have been done by a person. The term relates to both physical work and mental or cognitive work that might be replaced by AI. This is a long-standing trend that has already permeated very many economic and social activities in our societies. Autonomy refers to the ability of a system to operate and adapt to changing

Published online by Cambridge University Press

circumstances with reduced or even without human control. An autonomous car, for example, can drive itself to its destination without detailed human control. Autonomy is, of course, a more recent trend that is in many ways still under development.

In contrast to automation and autonomy, human–machine teaming refers to cases in which a machine complements human work. In many cases, a human–machine team can be more effective than either one alone, using the strengths of one to compensate for the weaknesses of the other. This is a particularly important recent development that opens the road to employment opportunities that are not likely to disappear in the next few years. But filling these slots requires a focus on training people who have the specific skills to deal with electronic information processing and the capability to fully use their broad spectrum human information processing capacity.

From Production to Distribution

In the current economic system, the focus is on a production economy that derives its profitability from the gap between cost of production and perceived value of the product in the eyes of the consumer. This drove the European colonial trading system and its sequel, large-scale agricultural and industrial production in the colonies profiting from very low wages. It has also driven the search for ever-cheaper production methods worldwide over the last century or so, adopting ever more efficiency in all aspects of production: human, financial, logistical, technological, organizational, etc.

Yet a potentially important horizon is looming: worldwide limits to cheap labor enabling large-scale industrial production. Although there remain pockets of relatively low labor cost (Bangladesh, India, Indonesia, Africa), the wage advantage is globally eroding. The profitability of the traditional production economy, and thereby its existence under the current market-based regime, may well come under increasing stress. Major industries are beginning to see that this will affect them in the future, especially if they have to weigh the cost of labor against the risk of social instability, corruption, investment, etc.

Automation will no doubt mitigate some of this as robotics and AI replace human activities. Whereas until now human thinking directed machine information processing, machines can increasingly associate information into patterns, which enables them to figure out an appropriate response to changing circumstances. Hence, the use of information is

Published online by Cambridge University Press

now increasingly becoming external to human beings, rather than internal, and this will lead to yet another quantum jump in information processing in which many more – economic and other – activities are managed by computers.

Economist and technologist Arthur (2017) has summarized his view of what this might do to the economy as follows. Once it is possible to produce enough goods and services for everyone by automated means (if we can do so in environmentally sustainable ways], we are about to witness a major shift from an economy in which production is the bottleneck to one in which the next challenge is to ensure general access to what can be produced. Arthur argues that this will bring about the following major changes:

- The criteria for developing and evaluating policies will change. Gross domestic product and productivity are relatively good measures of the physical economy, but are much less effective in measuring the virtual economy;
- The free-market philosophy will be less suitable to the new situation because the focus shifts to more or less equitable distribution of value, away from the idea that the more is produced, the better it is;
- The new era will not be an economic, but a political one. The paradigm of society at the service of the economy, which has increasingly dominated since the 1840s and 1850s, will have to be inverted (again) to place the economy at the service of society, at least if we are to avoid major societal upheaval.

The transition to the distribution economy is likely to cause a period of major upheaval, in which a number of social questions need to be answered. How will we find meaning in a society where jobs no longer provide it? How will we deal with privacy in a society where every bit of information about everyone is concentrated in databases? Will we abdicate individual learning in favor of computer data and algorithms? The changes and the upheaval, Arthur concludes, will be as important as those that accompanied the Industrial Revolution, and may well take as long. Who knows?

Our Perception of the World

One of the intriguing aspects of the ICT revolution is how it changes our perception of the world. In dealing with that topic, we have to distinguish

Published online by Cambridge University Press

two different, almost contradictory, trends: complexification and simplification.

In the pursuit of knowledge, the mass of new data and the development of AI enable us to scrutinize in much greater detail many of the dynamics that we have thus far only been able to perceive in relatively general terms. In that sense, the ICT revolution will in many ways have the same kind of effect as the discovery of lenses in the second half of the seventeenth century, which enabled scientists to begin studying the world of the very small and that of the very distant.

Current developments enable us to develop ever finer scales of measurement, from the subatomic on the one hand to distant galaxies on the other, but also to focus on relationships rather than entities, and take a much wider set of contextual dimensions into account. The recent emergence of network approaches is one result of that, and so is the emergence of modeling as a technique to explore dynamics in a wide range of domains, from the environmental to the societal and the extraterrestrial. These developments have been fundamental in enabling the emergence of complex systems thinking as a practicable approach to conceiving the dynamics of the world around us. But they have, for example, also contributed vastly to our understanding and intervention in biological phenomena, whether through microsurgery or genomics. Such developments are in the process of changing our scientific and scholarly worldview from static to systemic and dynamic. In the natural and life sciences that perspective is now generally accepted, but in many of the social sciences and humanities this is not yet the case.

A second impact of the ICT revolution has been, and continues to be, the global unlocking of very large stores of data in all kinds of domains to research that is happening in all parts of the world. This creates a kind of transparency in science that is novel in many domains, but also allows for stretching the timeframes studied, for example through the opening of archival and archaeological data.

Third, the ICT revolution has fundamentally changed the ways in which we practice science and scholarship, enabling us to do so collectively across wide distances in space and time, and moving us from individual science and scholarship to collective, team-based, and interactive approaches to discovery and understanding, This has vastly accelerated the development of new knowledge by mobilizing more brain power and more tools for thought and action on specific challenges, but also by making it much easier to delve into the global store of knowledge across as many disciplines as is desirable. Hence, collective science is now

Published online by Cambridge University Press

mobilizing hundreds or thousands of scientists around the main themes, for example climate change and its interactions with our societies. No discoveries are nowadays accepted unless corroborated by several independent teams working on the data concerned.

When we look at the reverse of this trend, the increase in simplification that is directly linked to mass consumption of information, one is struck by the huge, and rapidly increasing, gap between the scientific understanding of very complex phenomena that the new methods are facilitating and the oversimplification of such phenomena that is ultimately communicated to the general public. This is clearly related to Debord's spectacularization and the mediatization of our perceptions of the world that I discussed in Chapter 17, as well as to the growing discrepancy between those who have been trained to understand the complexity involved and those who do no more than consume the images and simplified narratives that they have been presented with in the media. In a world that is increasingly divided into "information bubbles," it raises the question whether scientific endeavor will not, at some point, simply be drowned out by other perspectives. In that context, it is ominous to note that in December 2017 the US administration forbade the Centers for Disease Control and Prevention from using the terms "science-based" and "evidence-based" in any budget justification.

How These Trends Are Developing

How will these developments impact our daily lives? That is hard to know in the long run, but every day brings news that is relevant to this question in the form of large or small changes that have to do with ICT. Among the major changes that are now being discussed everywhere are of course "alternative truths," the hacking by foreign nations and others of databases and websites to steal information, or the use of social media to plant it. Other news concerns the evolution of the capabilities of IA, such as the battle between one of IBM's machines and the top player of the game of Go (Koch 2016). But there are many more, seemingly innocuous, changes that illustrate some of these recent developments in information technology. I will briefly refer to some papers I noted recently (January 11–15, 2017). The first of these (Reuters, January 15, 2017 by Suzanne Barleyn) summarizes how insurers are beginning to collect microdata (for the moment on a voluntary basis) of individuals' daily habits, such as the length of time they brush their teeth, the things they buy at the grocery

Published online by Cambridge University Press

store (and presumably eat), their daily exercise regime, their driving, and much more, all presented as an opportunity to reduce the cost of their insurance. But underlying such efforts is ultimately the opportunity to charge certain individuals much more for their insurance if they do not behave "appropriately." In this manner, the information revolution is destroying the statistical basis of insurance thinking – that one person's good fortune compensates for another's misfortune in what is essentially a collective approach.

The second example is less visible, but certainly of great importance. It is raised in an article in the *Japan Times* of January 14, 2017 by David Howell, and concerns the fact that development of the digital economy since the 1980s has on the one hand caused the emergence of millions of small companies, with the result that traditional measures of the economy are no longer adequate, while on the other hand the large information giants can no longer be controlled because they are essentially global, so that no government has the capacity to constrain them. As a result, the traditional ways to steer an economy are becoming less and less effective. The same incapacity to apply the results of opinion polls to the management of the political process is currently hampering any top-down governance because the samples on which these polls were based are too narrow to reflect opinions in an interactive digital society. Howell concludes: "and where data and facts about the world become either unreliable and misleading or unascertainable, a new phenomenon steps into the vacuum. Enter the age of fake facts, bogus statistics and dud forecasts. . ."

The third case, by Noah Barkin, also published by Reuters (January 15, 2017), concerns the fact that the top leaders of the developed and developing worlds, congregated in Davos in early 2017, were thrown into disarray by the unexpected political developments of 2016, including the UK vote to leave the EU, the US election of Donald Trump as president, the unreliability of elections owing to cyberwarfare, etc. Barkin cites Moises Naim of the Carnegie Endowment for International Peace: "There is a consensus that something huge is going on, global and in many respects unprecedented. But we don't know what the causes are, nor how to deal with it."

This seems a prime example of a crisis due to an accumulation of unintended consequences that creates a groundswell in favor of change.

In an opinion page in the *New York Times* a few days earlier (January 11, 2017), Friedman summarizes the situation as he sees it:

Published online by Cambridge University Press

"And so it came to pass that in the winter of 2016 the world hit a tipping point that was revealed by the most unlikely collection of actors: Vladimir Putin, Jeff Bezos, Donald Trump, Mark Zuckerberg and the Macy's department store. Who'd have thunk [*sic*] it? And what was this tipping point? It was the moment when we realized that a critical mass of our lives and work had shifted away from the terrestrial world to a realm known as "cyberspace." That is to say, a critical mass of our interactions had moved to a realm where we're all connected but no one's in charge.

In explaining the tipping point, he cites Alan S. Cohen, chief commercial officer of the cyber security firm Illumio, saying that:

...the reason this tipping point tipped now was because so many companies, governments, universities, political parties and individuals have concentrated a critical mass of their data in enterprise data centers and cloud computing environments. [...] As more creative tools like big data and artificial intelligence get "weaponized" this will become an even bigger problem. It's a huge legal, moral and strategic problem, [...] and it will require a new social compact to defuse.

His conclusion is all the more important because in our current and future world, policies, whether economic, political or social, will be more and more decided on the basis of information in the major databases that are emerging in the cloud.

Conclusion

In this chapter I have presented some among the many examples of how ICT is impacting on our societies and their information processing. A more complete overview, which is nevertheless compact (but of course already out of date), is found in Hanna (2010). My aim is to drive home the fact that in considering ways to meet some of our sustainability challenges, we must take the present and future impact of ICT into account. What we nowadays call the ICT revolution is the continuation of a number of trends in our global societies that have caused these challenges, but it is adding new, important, and unintended consequences to the predicament in which we find ourselves.

These consequences are often ambiguous, and can both contribute to sustainability or hinder it. Many of them are not generally taken into account in sustainability-related discussions, and certainly not in the detail and with the knowledge that is required. That is in my opinion one of the major challenges for the sustainability community in the coming years!

In meeting that challenge, we have to remember that the instances of the impact of the ICT revolution that I have given above are only a few of

Published online by Cambridge University Press

the popularly known ones; every day brings new examples, such as the following I found on October 6, 2017: AI can predict suicidal tendencies in people with 80–90 percent accuracy, much better than trained professionals (Walsh, Ribeiro & Franklin 2017). We are only in the very first stages of the changes the ICT revolution will bring to our societies.

NOTES

1 An interesting, and to my knowledge thus far absent, investigation would look at the acceleration of the collapse of the Soviet Union between 1986 and 1989, which took place after some forty years of stability. Much attention has been paid to the role of the USA in this process, but much less to the internal dynamics that must have been part of the process.
2 It is in that field of tension that Debord and others place the role of artistic creation, as expressed by various artistic currents such as COBRA (post-) surrealism, etc. But in this field of tension one also finds the origins of certain social tensions.
3 I owe a debt to Armin Haas for drawing my attention to these authors' arguments.
4 Downloaded from https://obamawhitehouse.archives.gov/sites/default/files/whitehouse_files/microsites/ostp/NSTC/preparing_for_the_f uture_of_ai.pdf.

Published online by Cambridge University Press