The Dark Side of Digitalization:

Will Industry 4.0 Create New Raw Materials Demands?

PowerShift

ROSA LUXEMBURG STIFTUNG

STOP MAD MINING

Imprint:

Publisher: **PowerShift e. V.**, Greifswalder Str. 4, 10405 Berlin, Germany
Author: Hannah Pilgrim
Editing: Merle Groneweg, Hannibal Rhoades, Michael Reckordt
Layout template: Monika Brinkmöller
Final layout & title artwork: Tilla Balzer | balzerundkoeniger.de

This fact sheet is based on *„Ressourcenfluch 4.0 – Die sozialen und ökologischen Auswirkungen von Industrie 4.0 auf den Rohstoffsektor" (PowerShift 2017)*

Berlin, November 2017

This publication has been produced with the financial assistance of the European Union. The contents of this report are the sole responsibility of PowerShift e. V. and can under no circumstances be regarded as reflecting the position of the European Union.

Published by

Digitalization – a rising star in times of global crises?!

The digitalization of production processes, in Germany also known as Industry 4.0, promises economic growth in times of stagnation. According to business organizations and market-liberal politicians, digitalization will provide solutions for current global challenges like economic stagnation, (youth) unemployment, post-financial crisis or climate change. From buildings and cars to entire supply chains, everything will be connected. We will live in yet another "*brave new world*", also known as the Internet of Things (IoT).

But is economic growth what we need? And will it ever be possible to decouple economic growth from resource consumption? The predominant economic system already exceeds our planetary boundaries. Climate change is driven by high greenhouse gas emissions, over-fertilized agricultural land, massive loss of forests and grasslands, overfishing of oceans and the excessive use of raw materials. All of these phenomena exemplify that which Ulrich Brand and Markus Wissen describe as the "*imperial way of life*"[1].

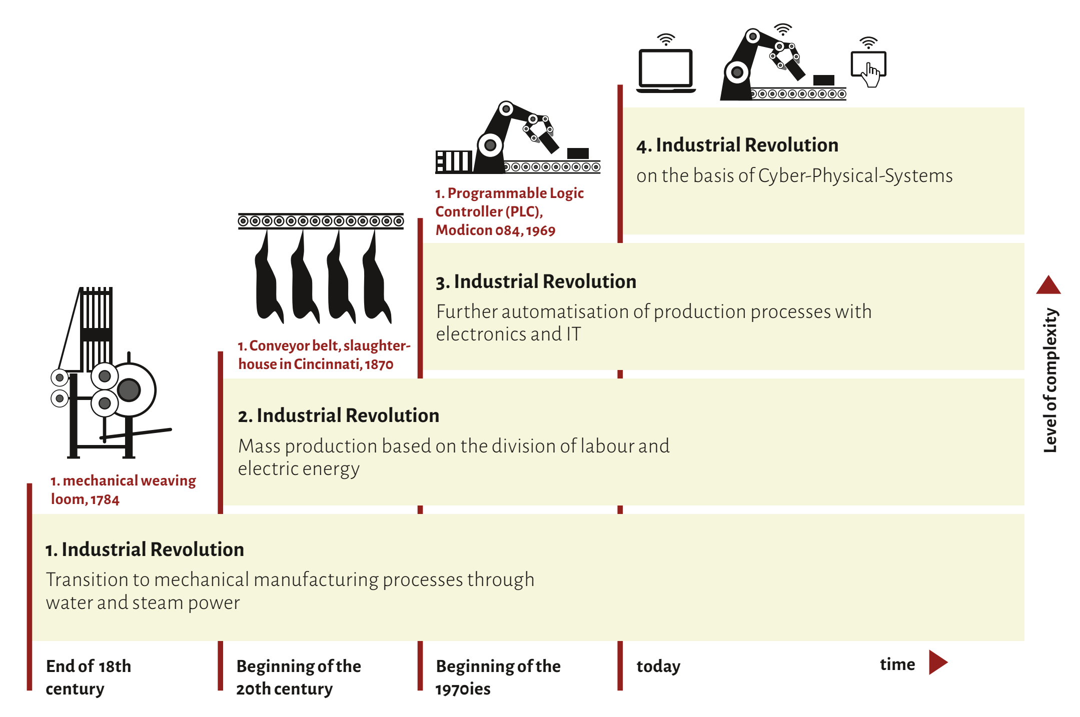
Some hope that a digitalization of the production – or Industry 4.0 – will help to increase resource efficiency, thus eventually decreasing resource consumption. Overall, however, the issue of raw material demands is mostly absent from public debates about digitalization and future technologies. This fact sheet thus sheds light on precisely these interlinkages between new technologies and specific raw material demands. Furthermore, the social and ecological consequences of mining will be outlined, followed by demands towards a democratic and globally just resource policy.

What does the "*digitalization of production*" mean?

After the mechanization of production (1. Industrial Revolution), mass production due to division of labor as well as the assembly line (2. Industrial Revolution) and the automatization of production (3. Industrial Revolution), the Fourth Industrial Revolution – also known as the Internet of Things or Industry 4.0 – is defined by digitalization. While digitalization is a term used to describe changes in various fields (e. g. smart homes, smart city, smart grids, smart cars, etc.), Industry 4.0 refers to the digitalization of manufacturing processes, meaning that all steps of the production process will be connected.

What technologies are needed to connect the "*things*", and what metals are processed?

Industry 4.0 or the Industry of Things do not describe one type of technology but refer to a



The four industrial revolutions (Source: Own diagram, modelled after Plattform Industrie 4.0)

1 Brand, Wissen (2017): Imperiale Lebensweise. Zur Ausbeutung von Mensch und Natur in Zeiten des globalen Kapitalismus.

Raw Material	Demand for the 42 future technologies/t		Demand in relation to the amount of global production		End-of-Life recyclingrate (percent)
	2013	2035	2013	2035	
Lithium	610	110.000	0,0	3,9	< 1
Heavy Rare Earth	2.000	7.400	0,9	3,1	< 1
Light Rare Earth	29.000	64.000	0,8	1,7	< 1
Tantal	500	2.100	0,4	1,6	< 1
Cobalt	5.000	120.000	0,0	0,9	> 50
Germanium	60	120	0,4	0,8	< 1
Platinum	0	110	0,0	0,6	> 50
Tin	180.000	150.000	0,6	0,5	> 50
Palladium	20	100	0,1	0,5	> 50
Indium	230	360	0,3	0,5	< 1
Gallium	90	130	0,3	0,4	< 1
Silver	5.800	8.300	0,2	0,3	> 50
Copper	120.000	5.300.000	0,0	0,3	> 50

Estimates of the amount needed of certain metals for 42 future technologies (Source: modelled after DERA 2016, UNEP 2011)

combination of different knowledge-based information systems and technologies. Central to Industry 4.0 are Cyber Physical Systems (CPS), as they combine the physical production process with the virtual world. Materials, devices and other components in the production chain are connected to the internet via small computers which are equipped with sensors and actors.

A 2016 study by the German Mineral Resources Agency (DERA) examines the probable demand for raw materials caused by different future technologies.[2] According to the DERA study, in 2035, the examined 42 future technologies will require the quadruple of the present lithium production, a threefold increase in heavy rare earths and one and a half times increase in light rare earths and tantalum. It is furthermore estimated that, due to the increased use of electronics, the global demand for copper will grow between 231 and 341 percent until 2050.[3]

In the following, we will introduce a few of the technologies examined by the DERA study that are essential for digitalized production processes:

Sensors are a key technology. In the production process, sensors can measure the position or temperature of machines, product components, etc. In the past years, the use of sensors sharply increased. Although it is difficult to make scientifically valid statements about the future demand of sensors, it is clear that metals are used for the production of sensors, such as tin, tungsten, tantalum and platinum.

Radio Frequency IDentification-Tags (RFID-Tags) are another type of sensors. RFID-Tags enable the localization of objects through radio waves. They are used in the supply chain management. Calculations indicate that, in 2035, up to 85 trillion RFID-Tags could be sold per year. Compared with 6.3 billion in 2014, this is a huge increase. Metals needed for the production of RFID-Tags are silver, copper and aluminum.

The digitalization of production also depends on flat screens and touch screens. They consist of indium tin oxide, which in turn mainly consists of indium oxide. According to the DERA study, in 2035, up to 34 percent of the worldwide indium production may be used solely for the production of displays.

Industrial robots are machines capable of working autonomously in the production process. They consist of a manipulator (robotic arm), control instrument and the effector (gripper or tool). Robots are increasingly equipped with different sensors. Research of the International Federation of Robotics shows that global sales in industrial robots has increased in the past years. According to the International Federation of Robotics, in 2020, more than three million robots will probably work in industrial production.[4]

2 DERA (2016): Rohstoffe für Zukunftstechnologien 2016.

3 Elshkaki et al. (2016): Copper demand, supply, and associated energy use to 2050.

4 *„Die Roboter kommen"*, 27.09.2017, Deutsche Welle. *http://www.dw.com/de/die-roboter-kommen/a-40713066*

The metal-, plastic- and electronic industry in particular rely on automated production. Robots – which are also equipped with a number of sensors – primarily consist of steel, copper, tin and silicon.

High-performance microchips are mainly used for mobile phones and WLAN chips. However, they are now being integrated in more and more devices. Within the context of Industry 4.0, the extended use of wireless communications in spacious production facilities will certainly increase the quantity of chips needed. Compared with 'traditional' chips, high-performance microchips are smaller, more efficient and can also be used at high temperatures. They consist primarily of gallium.

"Green" future technologies: Electric Mobility and Renewable Energies

Besides the technologies used for the digitalization of the production process, it is necessary to look at new technologies for electricity generation and mobility.

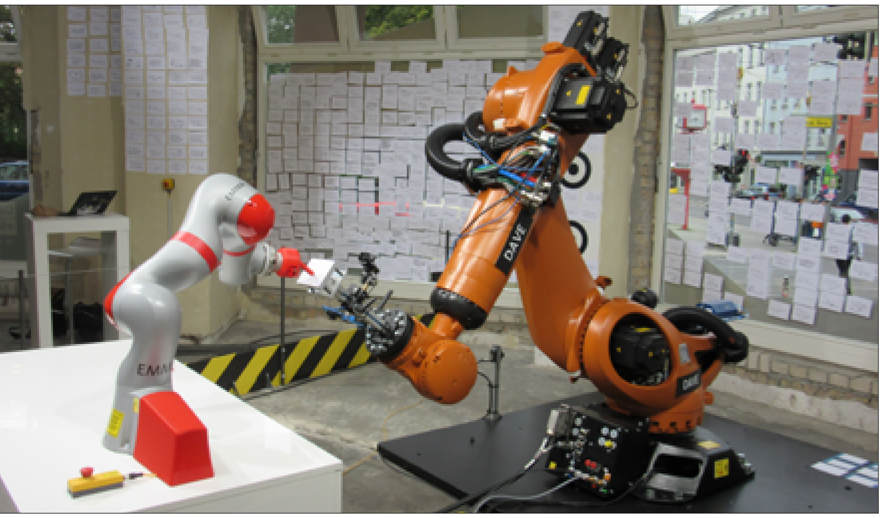
The widespread individual use of automobiles has devastating consequences for the environment. With its lithium-ion batteries, recharged with renewable energy, Electric Mobility seems to offer a solution: CO2-emissions and the consumption of fossil fuels may be reduced whilst the current mobility model can be maintained. However, compared to *"old"* engine technologies, electric motor technology needs the fourfold of copper and also larger quantities of other metals like cobalt, lithium and heavy and light rare earths. Additionally, a large part of lithium-ion batteries consists of graphite. Thus, with the production of electric cars, the material consumption by the automobile industry will certainly not decrease. In fact, the opposite is the case. The replacement of diesel and gasoline engines with electric cars leads to a deadlock. Instead, research and implementation of mobility concepts based on public transport, biking and shared vehicles must be supported.

To reach the 2.0 degrees, possibly even the 1.5 degrees goal as stated in the Paris Agreement, we have to phase out the exploitation and use of new fossil resources, which are mainly responsible for CO2 emissions. Generating power via renewable energy certainly is a welcome development. But specific devices such as permanent magnets for wind turbine generators or lithium-ion batteries for the storage of electricity in photovoltaic plants will in turn create specific raw material demands (aluminum, copper, indium, gallium, tellurium, heavy rare earths, lithium, graphite or nickel). Hence, the following still holds true: The most environmental friendly kilowatt hour is always the one which is not consumed at all.

Alliances, networks and platforms: An international look at digitalization policies

The digitalization of production is a global trend. Hence, several global initiatives, alliances and platforms dedicated to the research and support of Industry 4.0 policies have come into existence. A few shall be outlined in the following:

New, extra parking lots for electric cars. "Electric mobility" dates back more than 100 years. (Photo:Glenn Wallace / Insomnia Cured Here)



The new robotic arms of Industry 4.0 (Photo: Michael Reckordt)

Global

The Industrial Internet Consortium (IIC) is an open membership organization founded in Massachusetts in 2014 by international companies like Cisco, General Electrics or Intel. It comprises more than 250 member worldwide, mainly global players from the electronic and communications industries. Furthermore, universities from Asia, Europe and North America joined the IIC to "*accelerate the growth of the Industrial Internet by identifying, assembling and promoting best practices*". The IIC cooperates closely with the German Plattform Industrie 4.0 (see 3c. EU)[5].

Industry of Things World (IoTW) and related event formats like IoTW USA or IoTW Asia want to bring together the "*Industrial Internet of Things scene*". They portray themselves as an "*international knowledge exchange platform*", with the aim of supporting each other and thereby increase their benefits from the global digital transformation[6]. In September 2017, an event from IoTW took place in Berlin, Germany. More than 1,000 executives from business and technology companies as well as experts from science were invited.

China (Made in China 2025) and Japan (Industrial Value Chain Initiative and Robot Revolution Initiative) are likewise preparing their industries for the digitalization.

OECD and G20

At the level of OECD, the "*Committee on Digital Economy Policy*" deals with topics like the digitalization of the economy and society, mobile communication and cyber security. The OECD is a key partner of the G20. Before and during the last summit in Hamburg, several meetings and conferences about the "*Key Issues for Digital Transformation in the G20*"[7] were held. The "*G20 Digital Economy Ministerial Declaration*"[8] presents the outcome of the digital ministers' meeting. They agreed on a joint digitalization policy with a focus on "*harnessing the potential of inclusive growth and employment*", "*digitizing production for growth*" and "*strengthening trust in the digital world*". The increase in metals demand has not been addressed at the level of the OECD nor at recent meetings of the G20.

EU

At the level of the EU, the Commission/DG Connect deals primarily with digital issues. In April 2016, the Commission announced to support the digitalization of the European industry through national initiatives and increased investments.[9] Günther H. Oettinger, the former European Commissioner for Digital Economy and Society, emphasized the logic of economic competition. In order for the European industry to maintain its leading position in the global economy, digitalization processes must be supported.

„*Europe has a very competitive industrial base and is a global leader in important sectors. But Europe will only be able to maintain its leading role if the digitization of its industry is successful and reached fast. Our proposals aim to ensure that this happens. It requires a joint effort across Europe to attract the investments we need for growth in the digital economy.*"

The European Commission is operating according to a logic of growth and progress that allows hardly any space for discussions about socio-ecological challenges caused by digitalization.

Germany

In Germany, the three big business associations ZVEI, VDMA and BITKOM (from the electronics industry, machinery and plant engineering as well as the digital industry) promote the debate about "*Industrie 4.0*". They are supported by the German Ministry of Economics and the Ministry of Education and Research. In 2013, the three business associations initiated the Plattform Industrie 4.0, which cooperates closely with the French Alliance Industrie du Futur, Italian Initiative Piano Industrie 4.0 and global platforms

5 http://www.iiconsortium.org/ (30.08.2017)

6 http://industryofthingsworld.com/en/ (30.08.2017)

7 https://www.oecd.org/g20/key-issues-for-digital-transformation-in-the-g20.pdf

8 https://www.bmwi.de/Redaktion/DE/Downloads/G/g20-digital-economy-ministerial-declaration-english-version.pdf?__blob=publicationFile&v=12

9 European Commission (19th April 2016): Commission sets out path to digitise European industry

like the ICC (see 3a.)[10]. The aim of the German Plattform Industrie 4.0 is to give policy and industrial recommendations, hoping for Germany to remain the world's leading exporter. Although the platform works together with some research institutes, it does not cooperate with environmental and development organizations. The platform is part of the government's High-Tech Strategy[11], which includes research and infrastructure projects, such as the expansion of the broadband infrastructure.

As the following examples will illustrate, today already, mining causes, among others, serious human rights violations and environmental pollution. An increase in the use of metals will only further exacerbate the damages of mining.

Social, ecological and human rights challenges in metal mining

Financing of violent conflicts: Mining and trade with raw materials harbor the risk of financing rebels, armed groups or corrupt army commanders in countries like Afghanistan, Myanmar, the Central African Republic or Zimbabwe. The eastern part of the Democratic Republic of the Congo has become known for the connection between bloody conflicts and the extraction of metals. For more than 15 years, armed groups have funded a violent war with the trade of tin, tungsten, tantalum and gold (in short 3TG). The abundance of raw materials in the region is of course not the main cause for the conflict, but the wealth promised by trading these metals certainly help to fuel conflict. The 3TGs are needed not only for basic components of the IoT technologies and mobile phones, laptops or tablets, but also for renewable energy technologies like wind power plants.

Human rights violations such as extremely exhausting and dangerous working conditions or child labor are likewise associated with the extraction of metals. According to a report by Amnesty International in 2016, approximately 40,000 children worked in informal mines in southern provinces of the DRC in 2014.[12] In the artisanal and small-scale mining sector, where metals like cobalt or the 3TG are extracted, workers often suffer from life-threatening working conditions.

Our phones are linked to bloody civil wars. (Source: Stop Mad Mining)

Reports from Global Witness in 2015 and 2016 give shocking numbers of land and environment defenders murdered in the last two years.[13] Extractive industries are linked to a large percentage of the killings. Besides the alarming numbers of killings, the criminalization of mining opponents has also reached new dimensions. In connection with large scale mining projects (e. g. copper) in Peru, activists and local communities are often being criminalized. Organized workers are likewise under threat, as the

10 Plattform Industrie 4.0 (20th June 2017): Deutschland, Frankreich und Italien treiben gemeinsam die Digitalisierung der Produktion voran.

11 BMBF (2014): Die neue Hightech-Strategie - Innovationen für Deutschland.

12 Amnesty International (2016): This is what we die for.

13 Global Witness (2016): On Dangerous Ground. / Global Witness (2017): Defenders of the Earth.

We need global resource justice! (Photo: Friedrich Ebert Stiftung)

Massacre of Marikana in August 2012 shows. 34 striking miners of the world's third largest platinum mining company Lonmin were shot by the police after protesting for better working and housing conditions.

The extraction of metals is often related to high land usage and water demand. This can be seen in Argentina or Bolivia where global companies and politicians have a strong interest in extracting lithium. The increasing demand for lithium is met with resistance against the water-intensive industry. Activists expect that the regional agriculture will be endangered due to a lack of water. In Brazil, the energy-intensive processing of bauxite in aluminum led to large scale dam projects that destroy the Amazon region[14]. The land-intensive lithium or copper operations in Latin America exemplify how the promise of wealth, created by the monetization of an abundance in raw materials, often leads to the destruction of land formerly used for agriculture.[15] Thus, many people lose their basis of existence. In the context of planned mining projects, the affected communities often did not have the chance to make their interests heard. On the contrary, reports about copper, silver and gold projects in Peru, Bolivia or Indonesia demonstrate the frequency of land conflicts and forced displacements linked to resource extraction.[16]

14 Ruettinger et al. (2016): Umwelt- und Sozialauswirkungen der Bauxitgewinnung und Aluminiumherstellung in Pará, Brasilien.

15 Heinrich-Böll-Stiftung/Wuppertal-Institut (2012): International Resource Politics. New challenges demanding new governance approaches for a green economy.

16 Exner et al. (2016): Kritische Metalle in der Großen Transformation. / Kampagne *„Bergwerk Peru – Reichtum geht, Armut bleibt“* (2016): Fallbeispiele.

Another consequence of extractive mining projects is the water and air contamination with heavy metals. This is exemplified by zinc and rare earths mining and further processing in China. Combined with the absence of strict enforcement of environmental and social standards, the mining activities in lead to toxic gases and hazardous mining waste. The so called red mud, which is also a consequence of bauxite mining, causes serious health problems for local communities. In 2010, the bursting of a red mud tailing dam in Hungary went down in history as the Kolontár red mud disaster. Ten people died, more than 150 were injured, and approximately 150 hectares of arable land were destroyed by a corrosive mudslide. Research shows that such waste-related disasters are becoming more common as ore-grades reduce in quality. This means that mines create greater waste burdens, whilst the economic incentive to improve tailings facilities has not led to improvements in waste storage.[17]

Another ecological threat, which can also lead to social conflict, is the increasing penetration of sensitive ecosystems like the deep sea or the Arctic. Manganese nodules, massive sulfides and cobalt crusts, which are found in the deep sea of the Pacific and Indian Ocean, contain strategic metals for future technologies like cobalt, indium, germanium, copper, platinum and rare earths. Despite protests by local communities in the coastal area, the Canadian mining company Nautilus Minerals has been granted a permission to start the first industrial deep sea mining operation in history in the Bismarck Sea, close to Papua New Guinea. Marine pollution and coral death are already documented in the water off the coasts of Indonesia, where dredgers extract tin ores. Further developments in the digitalization process can have a direct influence on deep sea mining operations: With rising demand for cobalt, mining in the deep sea will become increasingly profitable. At the same time, the progressive improvement in technological knowledge, especially in the field of robotics, can help to reduce costs in maritime mining projects. Due to the rising demand for rare earths and China´s monopoly status in this field, researchers are looking for new mining opportunities. In Kvanefjeld, Greenland, not far from the Arctic, a so called multi-element deposit which contains rare earths as well as radioactive uranium is now being explored.

In addition to the social and ecological challenges, supply chains of metals are often linked to tax avoidance, transfer pricing and insufficient

17 Earthworks: *https://www.earthworksaction.org/files/pubs-others/BowkerChambers-RiskPublicLiability_EconomicsOfTailingsStorageFacility%20Failures-23Jul15.pdf*
and: *http://www.csp2.org/tsf-failures-1915-2017*

transparency concerning their origin. In most cases, transnational companies do not implement due diligence or, if they do, do not report on their methods and indicators.

False promises

Dematerialization

According to research of the Global e-Sustainability Initiative (GeSI), a network of more than 40 leading companies from the information and communication sector, digitalized manufacturing can kill two birds with one stone: Firstly, it "*creates significant economic benefits*", secondly, they assume a minimization of "*environmental impact, natural resource use, and energy consumption*"[18]. The strong belief in progress and improvement through technology must be examined critically. Despite promises of dematerialization, the global raw materials demand has increased constantly, and the needed raw materials and energy for the "*future technologies*" (e. g. RFID-Tags, chips, displays etc.) have not yet been taken into account.

Resource efficiency

In addition to promises of "*dematerialization*", the increased efficiency in the use of raw materials and energy, but also the workforce is often emphasized in debates on the digitalization of production processes. For the businesses, efficiency primarily means cost savings. The mining supplier company MIRS (Mining and Heavy Industry Robotics) illustrates this in the following quote:

"*While mobile internet, internet of things, automation of knowledge and cloud technology are expected to dramatically increase mining assets productivity, advanced robotics are expected to replace human labor for low level tasks.*"[19]

In this case, efficiency is at the expense of the few existing jobs in the extractive industry sector. With the loss of local job opportunities and the negative environmental and social impacts of mining, countries in the Global South continue to be the raw material supplier, rather than having any chance for value-adding activities.

The companies interviewed by PWC for a study on "*Digital Factories*" expect efficiency gains of 12 percentage in the next five years due to digitalized production.[20] However, the scientifically

Will future technologies lead to more abandoned sites and waste dumps, as in Rosia Montana, Rumania? (Photo: Michael Reckordt)

proven rebound effect also applies for production. Savings in resource and energy intensity make products cheaper, and hence are eaten up by increased production and consumption.

Furthermore, it is not clear to what extent the needed energy and materials to produce sensors, displays and other smart devices as well as the power consumption for the rapidly rising data amount are factored in efficiency calculations. Digitalization will contribute to rising data amounts. This in turn requires more energy and undermines the political goal to reduce our energy consumption towards a global sustainable level.

Data security

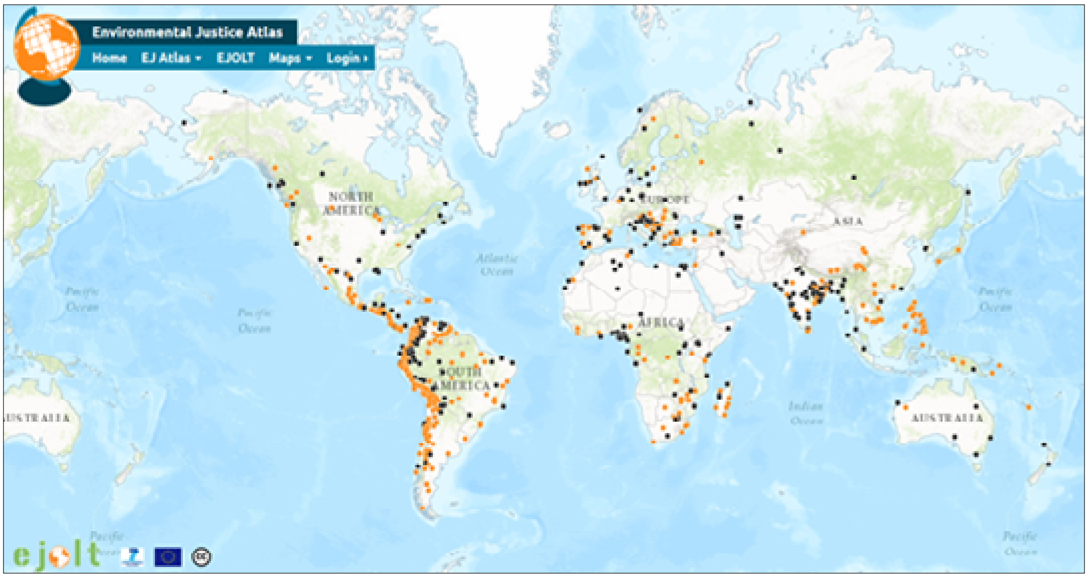
The all-encompassing digitalization also raises questions about data security. Data protectionists are apprehensive of increasing connectivity between things, persons, and processes. The metaphor of ´glass human beings´ is becoming increasingly real. With the help of chips, sensors, and RFID-Tags, even more personal data can be transmitted.

With regard to extractive industries, questions of data security and hacker attacks are often connected to matters of safety in the workplace, environmental risks and human rights violations. The consequences of potentially hacked mines and smelters are tremendous: Hazardous substances could pollute the environment, work safety would no longer be guaranteed. So far, no reliable studies exist on this matter.

18 GeSI (2015): #Smarter 2030.

19 Elias, Igor and Javier Espinoza (2016): Disrupting technologies and their impact in the Mining & Metals sector.

20 PWC (2017): Digital Factories 2020. Shaping the future of manufacturing.



Conflicts over the extraction of metal ores (orange) and fossils (black). (Source: http://ejatlas.org)

Political change in the Global North is necessary[21]

As chapter 5 shows, today already the extraction of metals leads to enormous socio-ecological problems and human rights violations in the affected regions. When talking about the Fourth Industrial Revolution, it is important to focus not only on perceived economic advantages but also on key societal challenges. The digitalization of manufacturing currently is one of the defining projects of and for the future. In order for IoT not to burden future generations and the affected communities in the mining areas, politicians and corporate leaders must take into account the following demands:

Reduce the Consumption of Resources

On a global level, patterns of consumption and production in the Global North are ecologically not sustainable and lead to increasing social inequality. The 'Earth Overshoot Day' marks the calendar date on which humanity's resource consumption for the year exceeds the planet´s capacity to regenerate those resources that year. In 1990, humanity had consumed one year's resources on December 7th; ten years later, in 2000, November 1st marked this day. This year in 2017, 'Earth Overshoot Day' already occurred on August 2nd.

The debates on the Internet of Things, Industry 4.0 or electric mobility demonstrate that both industrial and economic policies do not take into account the rising demand for many raw materials. Instead, they count on innovations and efficiency savings whilst ignoring planetary boundaries.

By phasing out the exploitation and use of new fossil resources, creating economic incentives for reduced consumption and strengthening a circular economy, governments can support a reduction in consuming resources. Bearing this objective in mind, it is necessary to renounce the extraction of metals in the deep sea and other sensitive ecosystems.

Effectively protect human rights

States have the responsibility to respect, protect and fulfil civil, political, economic, social, and cultural human rights, not only but also with regard to mining activities globally. The UN Guiding Principles on Business and Human Rights stress the duty of states to protect society from violations of human rights perpetrated by companies. Furthermore, the UN Guiding Principles also highlight the companies' obligation to respect human rights along the entire supply chain. Moreover, they call for appropriate and effective remedies when rights and obligations are breached. On the level of the EU, the regulation on due diligence for EU imports of 3TG from conflict areas is a first step in this direction, although it falls short in many respects (for instance, it focusses only on the upstream companies and four specific metals). Due diligence must be expanded to cover both the processing industry and retail trade ('downstream') and include all raw materials.

21 Most of the requested actions are based on demands of the German working group on raw materials, a network of German Human Rights-, environmental and development organizations (cf.: AK Rohstoffe 2017).

Protest against large scale mining is gaining strength. (Photo: Michael Reckordt)

To effectively protect human rights, we need binding laws on appropriate due diligence for human rights in global business. Companies must be required to examine the consequences of their activities and business relations with regard to human rights and the environment along the entire value-added chain. They must develop measures to counteract any negative implications. Audits within the framework of human rights due diligence must be documented transparently and be publicly accessible.

Protect and strengthen civil society worldwide

An active civil society is crucial for exposing human rights violations and environmental destruction in mining areas, for advocating the interests and participation of communities affected by mining, and for holding human rights violators to account. We call upon governments to prioritize the protection of civil society and human rights over economic interests. They must demand the protection of civil society in all international agreements related to mining projects and trade, as well as monitoring its implementation.

Mining projects often occur in regions belonging to and inhabited by Indigenous Peoples, and hence are often synonymous with the displacement of local people from their ancestral lands. ILO Convention 169, which confirms the essential role of Indigenous Peoples in decisions concerning their territories, has still not been ratified by many countries. This must change immediately.

It is important that politics make the most of their scope for action in the field of resource policies. Long-term concerns must not be sacrificed in favor of short-term interests. Along with global civil society, unions, and other stakeholders, policy-makers have to ensure global just rules to prevent a burden for many people. The digitalization must not exacerbate the already existing resource curse.