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editorial

the digitalization of the food system

Today, more than 820 million people suffer from hunger while obesity also continues to increase across the world[1]. Biodiversity in food and agriculture is being eroded at an alarming rate by the destruction of eco-systems[2]. Climate change is accelerating: temperatures this July were the highest ever recorded; glaciers are melting much faster than predicted; and millions of young people are demanding urgent action to address the climate crisis[3].

Meanwhile governments are showing little initiative to change the industrial, fossil-fuel driven food and agricultural system. Instead, a new "silver bullet" is being presented by corporations, governments and international institutions to tackle hunger, malnutrition and climate change: digitalization, which refers to the adoption of information-communication technologies (ICT) and artificial intelligence (AI) into everyday life and across societal activities.

Digital technologies have the potential to be beneficial or harmful depending on the context. Small-scale food producers have their own technologies, innovations and knowledge[4]. However, so do corporations, who seek monopoly controls on technology. Also, digitalization is happening in an era of increasing inequalities, authoritarianism and oppression.

This newsletter presents a synopsis of the digitalization of food, and contains examples of how digitalization affects and is used by communities in different parts of the world. We hope that these articles help social movements to engage in a collective discussion about digital technologies – and particularly how to benefit from them and prevent them doing harm.

FIAN International and Focus on the Global South

1 - http://www.fao.org/3/ca5162en/ca5162en.pdf
2 - http://www.fao.org/3/CA3129EN/ca3129en.pdf
3 - https://rebellion.earth/ and https://www.fridaysforfuture.org/about
4 - See Nyéléni Newsletter no 36, *Agroecology: real innovation from and for the people* - http://www.nyeleni.org/ccount/click.php?id=133

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who we are

In the last years hundreds of organisations and movements have been engaged in struggles, activities, and various kinds of work to defend and promote the right of people to Food Sovereignty around the world. Many of these organisations were present in the *International Nyéléni Forum 2007* and feel part of a broader **Food Sovereignty Movement**, that considers the Nyéléni 2007 declaration as its political platform. **The Nyéléni Newsletter wants to be the voice of this international movement.**

Organisations involved: AFSA, Brot für die Welt, Development Fund, FIAN, Focus on the Global South, Food First, Friends of the Earth International, GRAIN, Grassroots International, IPC for Food Sovereignty, La Via Campesina, Marcha Mundial de las Mujeres, More and Better Network, Oxfam Solidarity, Real World Radio, The World Forum Of Fish Harvesters & Fish Workers, TNI, VSFJusticia Alimentaria Global, WhyHunger, World Forum of Fisher People.

now is time for food sovereignty !

The digitalization of food

Digital land registries; gene sequencing and editing; sensors in robotized agricultural machines; fruit picking robots; blockchains[1] ensuring traceability in global value chains; 24-hour health control of livestock; intellectual property rights (IPR) protection through digital platforms; AI in plant breeding; satellite-supported location of fish resources and allocation of fishing rights; automated trade and distribution; e-commerce of food products; personalized nutrition and fitness with smartphone apps – the brave new world of digital technology is transforming all aspects of our food systems for better and worse. This incomplete list is a small sample of the range of application of digital technologies. Over the past decade, digitalization has become increasingly visible and influential in food production, processing, storage, packaging, retailing and trading.

Actors, initiatives and narratives

Governments, corporations and policy institutions present digitalization in food and agriculture as a solution to the main problems the world is facing. Corporations and financiers see it as an enormous opportunity to generate profits.

Over the past ten months, the Food and Agriculture Organisation (FAO) organized two international events on digitalization and technology[2]. In 2018 "e-agriculture" was on the official agenda of the regional FAO conferences for Europe and Central Asia. The World Bank dedicated special panels on digitalization and blockchain technology for land administration in its annual Land and Poverty Conferences[3]. Megamergers between the world's largest seed and agrochemical companies (especially the Bayer-Monsanto merger) have raised public awareness about the high level of corporate concentration in the industrial food chain, and the massive investments by agrochemical, farm machinery and food retail companies in big data, and ICT[4]. In several countries, e-commerce giants such as Amazon, Uber, Walmart, Alibaba and GRAB have expanded into online food retail. Corporate competition over food retailing in India[5] and the battle for control over 5G technology between China and the USA are indicative of the large amounts of money at stake in digital technologies and infrastructure.

The recent push for digitalization comes from the business-driven Fourth Industrial Revolution (4IR) aggressively promoted by corporations in the World Economic Forum (WEF), who describe it as a "fusion of technologies that is blurring the lines between the physical, digital, and biological spheres[6]." While 4IR goes beyond food, it has replaced the paradigm of the 'Green Revolution,' which was legitimized by the need to increase agricultural production. Digital technologies and big data are key aspects of the new paradigm, and enable the consolidation of corporate control over the global food system.

Digitalization of food-agriculture ranges from relatively simple applications such as drones for land mapping and direct online marketing to more complex digital agriculture. Digital agriculture refers to the integration of advanced technologies (AI, sensors, robotics, drones, etc.), devices and communications networks into one system, and applying them to production, management, processing and marketing. The narrative of the new paradigm promises greater efficiency in food production and resource and energy use, sustainability, transparency, accuracy and the creation of new markets and economic opportunities. Developing countries, especially in Africa, are lured by promises from donors, international agencies and corporate foundations that digitalization will enable them to "leapfrog" their way to progress with climate friendly pathways. However, the technology and infrastructure for this rosy scenario will come from corporations, who are in it for profits, not public benefit.

Implications for people and the environment

Proponents of digitalization emphasize the supposed benefits for marginalized people and small-scale food producers: digitalized land administration will increase tenure security; satellite-supported allocation of fishing rights will ensure transparency and security for small-scale fishers; blockchains will link producers to consumers directly, eliminating exploitation by intermediaries; digital agriculture will reduce input costs and increase the efficiency of irrigation and production. E-commerce is widely touted as the gateway for creating new markets and ways of marketing agricultural products[7].

Certainly, small-scale food producers and marginalized groups can benefit tremendously from digital technologies. But we must remember that these technologies are deployed in a context of high national-global inequalities of access to essential goods and services, as well as to information and digital technologies (the digital divide)[8]. Unless these inequalities are effectively addressed, new technologies will reproduce and deepen existing patterns of discrimination. Also, the manufacture and use of ICT/AI hardware (e.g, micro-chips, semiconductors, liquid crystal displays, mobile phones, computers, batteries, etc.) have large environmental impacts. These include impacts from mining, emissions of volatile compounds, acid fumes, solvents and metals into the air and water, high energy consumption, waste generation/ disposal and greenhouse gas emissions from transportation and storage.

1 - For the definition of blockchains and other key terms check the **GLOSSARY** at page 6 and 7 of the ETC Group report, Blocking the Chain, 2018 https://www.etcgroup.org/content/blocking-chain

2 - International Symposium on Innovation for Family Farming in November 2018, International Seminar on Digital Agriculture Transformation in May 2019.

3 - Pilot experiences are being carried out in Brazil, Georgia, Ukraine, Sweden, India, Australia, Dubai, Honduras, USA and Ghana. See: Graglia, J.M., Mellon, C. *Blockchain and Property in 2018: at the end of the beginning*. Paper presented at the Annual World Bank Conference on Land and Poverty, 2018. Available at: www.conftool.com/landandpoverty2018/index.php/02-11-Graglia-864_paper.pdf?page=downloadPaper&filename=02-11-Graglia-864_paper.pdf&form_id=864&form_version=final

4 - http://www.etcgroup.org/sites/www.etcgroup.org/files/files/etc_group_blackrock_and_a_hard_place_october_2018.pdf

5 - *The Changing Face of Food Retail in India in When Food Becomes Immaterial: Confronting the Digital Age.* https://www.righttofoodandnutrition.org/files/rtfn-watch-2018_eng.pdf

6 - https://www.weforum.org/focus/fourth-industrial-revolution

7 - See, for instance: http://www.fao.org/3/ca4985en/ca4985en.pdf?utm_source=linkedin&utm_medium=social+media&utm_campaign=faolinkedin.

8 - https://opendocs.ids.ac.uk/opendocs/bitstream/handle/123456789/14147/Emerging%20Issues_LNOBDW_final.pdf?sequence=1&isAllowed=y. The World Bank acknowledges that there is a triple divide: rural, gender and digital.

Local communities are also experimenting with new technologies to assert and strengthen their rights. In Brazil, indigenous women are using drones as part of their strategies to map and protect their territories. Other communities are using satellite images to monitor and draw public attention to deforestation by agribusiness companies[9]. In the USA, small-scale farmers see potential in using sensors, chips (which have become substantially less expensive in the last years) and open-source software to eliminate the scale advantages that industrial agriculture has had over small-scale producers. In some Southeast Asian countries, small-scale producers are selling agroecological produce to consumers through online retail.

The rapid development and application of digital technologies have significant implications for living conditions, work, production, societal interaction, commerce, the environment, public policies and governance. In order to formulate strategies to deal with digitalization, we need to increase our own understanding and engage in critical reflections and debates.

We hope the questions below will boost these processes.

1. Who are the actors developing develop digital technologies and for what purposes?
2. Who has access to and control over digital technologies and for what purposes?
3. Who owns the huge amount of data that is created everyday by all of us, and who has the right to use and draw economic benefit from it?
4. How should the applications and impacts of digital technologies be monitored and assessed? How should these technologies be governed and regulated for the public good?
5. How should the risks deriving from digital technologies be assessed, and their application be monitored?
6. How can we challenge the dominant narrative that equates innovation with technology, to underline and promote peasant and indigenous innovations, practices and knowledge[10]?
7. What are the relationships between peasant and indigenous innovations, practices and knowledge, and digital technologies?
8. How can we use digital technologies to advance food sovereignty and agroecology? What kinds of technologies, under what conditions and how should they be governed?

These are complex questions, and finding answers will require time, energy, critical reflection and creative thinking. However, the time has come to take up this challenge.

9 - When Land become a global financial asset in When Food Becomes Immaterial: Confronting the Digital Age. - https://www.righttofoodandnutrition.org/files/3._eng_when_land_becomes_a_global_financial_asset.pdf

10 - See Nyéléni Newsletter no 36, Agroecology: real innovation from and for the people - http://www.nyeleni.org/ccount/click.php?id=133

Box 1 - The Internet of cows[1]

It sounds like a joke, but it is one more aspect of the invasion of digital technologies into agriculture and food, whose ultimate aim is an agriculture without farmers - industrialized from seed to plate or glass of milk, and controlled by large agribusiness companies, machinery and computing.

Companies like IBM, Microsoft and Huawei offer technology packages for what they call the "Internet of cows." These are digital devices (collars and / or chips) that are placed in each cow to measure their pulse, temperature, peak fertility and other health conditions related to the digestive system. The data is transmitted over the internet to a cloud owned by the companies themselves, which stores them in Big Data systems, analyzes them with artificial intelligence and sends the information that the program deems pertinent to the computer or telephone of the agricultural company, farm owner. There are also interactive chips that can direct the cattle for milking when it is time, connected to an automated milking system previously installed to suit the cow in question. Each device is associated with a particular cow.

For a decade there have been satellite systems for monitoring livestock in certain areas. The difference now is that the data collection is much broader, the data is about each animal, and all the information goes into a cloud owned by those companies, or according to the contracts shared clouds with Bayer-Monsanto or agricultural machinery companies such as John Deere.

There is also the internet of pigs and sheep, which are similarly structured. The idea is not that the process ends at each farm, but that the monitoring follows each animal, including on the hoof livestock transactions, through the use of blockchain and crypto currencies, to the slaughterhouse, certification chains that include processing, sale tracking retail and even as far as the refrigerator.

Both IBM and Microsoft have advanced digital systems that cover all the agricultural production of a farm. The package offered by Microsoft, called "Farmbeats", offers a system of permanent monitoring of the condition of soils, humidity and water, condition of the crops (if they need irrigation, if there are diseases, pests, etc.), climatic data, up to date weather data (wind direction, rains, etc.), to provide indications when and where to sow, apply irrigation, fertilizers or pesticides, when to harvest etc - all from the Microsoft cloud.

To solve the issue of rural connectivity, a key element of the system, but which is lacking in rural areas, Microsoft uses the "white spaces of TV", which are disused television bands. This allows a router to be installed in each farm, connecting sensors, drones, chips, phones and computers to the Internet within a radius of a few kilometers and sending the information to the company's cloud.

The largest agribusiness companies such as Bayer, Syngenta, Corteva and BASF have digital divisions with projects of this kind and since 2012 they have collaboration agreements or joint ventures with the largest machinery companies (John Deere, AGCO, CNH, Kubota) for big systems data, clouds for storage and computing, and drone companies. For example, PrecisionHawk, Raven, Sentera and Agribotix are new companies created in collaboration between multinationals manufacturers of agrotoxic seeds and machinery.

Again, as with transgenics, companies claim that this is necessary to feed a growing world population, to increase production, save water and be "sustainable." In reality, it is about agriculture without farmers, aimed at replacing small farms with large companies, where from the seed to the plate, the control is carried out by a chain of transnationals that leave no decision to the farmers.

Each farm also provides a large amount of data that companies appropriate, building maps over entire regions, which allows them to visualize and negotiate projects far beyond each farm, passing over farmers and peasants. They are projects that move forward, but it does not mean that they work. The true knowledge about fields and animals, which is what gives food and sustenance to most of the planet, come from the peasant way of life itself. These technology packages are new forms of attack against her.

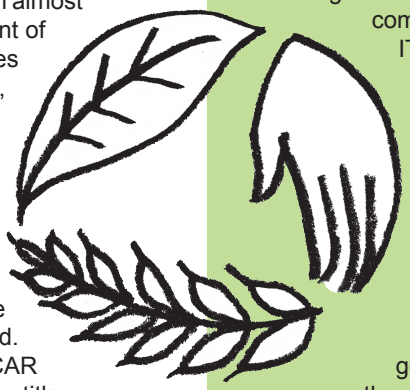
1 - ETC Group's contribution, more information on this in the ETC Group report, *Blocking the Chain. Industrial food chain concentration, Big Data platforms and food sovereignty solutions*, 2018 - https://www.etcgroup.org/content/blocking-chain

Box 2

Digital green grabbing in Brazil[1]

The Cerrado region in Brazil, one of the most biodiverse in the planet, has been witnessing the rampant expansion of agribusiness, especially in the region called MATOPIBA[2], which has been called "ideal" for soy plantations by agribusiness due to its terrain comprised of plateaus and lowlands.

Since some areas of the MATOPIBA region (especially the lowlands) still have a cover of native Cerrado vegetation, industrial farmers and agribusiness companies are now staking a claim to those lands, in order to comply with Brazilian legislation. The Brazilian Forest Code (Law 12651/2012) requires landowners to keep at least 20% of their land in the Cerrado biome –the so-called "legal reserves". Because the plateaus have been almost completely deforested for the establishment of soy plantations, agribusiness companies are expanding their farms to the lowlands, where the local villages are situated.



Land grabbers use the Rural Environmental Registry (Cadastro Ambiental Rural, CAR) as an instrument to formalize their land claims. The CAR is an online system, in which anybody can register environmental and land use information; no proof of property is required. Although according to the legislation CAR does not have any value as a property title, agribusiness companies are attempting to utilize it as proof of their land occupation and use. This is the case of the "legal reserves areas'" – most of them covered with native vegetation; that are registered as part of their property, although those lands are traditionally used by the local communities.

Communities who try to register their lands in the CAR often find out that they have already been registered by plantation owners. Despite the flaws of the CAR, unfortunately several initiatives have promoted this system, such as a project coordinated by the UNDP and Conservation International with the objective of encouraging "sustainable" soy production in the Cerrado.

1 - https://www.fian.org/fileadmin/media/publications_2018/Reports_and_guidelines/The_Human_and_Environmental_Cost_of_Land_Business-The_case_of_MATOPIBA_240818.pdf
2 - MATOPIBA is the acronym for a land area of 73,173,485 hectares across the States of Maranhão, Tocantins, Piauí, and Bahia.

Voices from the field 1

Dematerialization of seeds

Alimata Traoré, President of the Convergence of Rural Women for Food Sovereignty (COFERSA), Mali

"What if there were a power cut after putting all our seeds into a computer, what then?" This is how the women of my organization, COFERSA, reacted when I explained to them what governments discussed at the seventh session of the Governing Body of the International Treaty on Plant Genetic Resources for Food and Agriculture (ITPGRFA) in Kigali in October 2017.

We, the peasant communities, work with living beings in our fields. This is how we preserve biodiversity. My community has selected a variety of sorghum that is drought resistant if grown using a farming technique called zaï[1]. And now, a company would become its owner because it masters IT? Until recently, researchers or companies had to come to our villages to ask us for seeds, in order to further develop them and then sell them. Recent developments in biotechnology and genetic sequencing have changed this: breeders in the industry no longer need access to material seeds. They now analyze the digitized representation of genetic sequences on their computer screens.

When we talk about the "dematerialization" of genetic resources, we refer to the sequencing of the genome of living organisms, the massive gathering of peasant knowledge about the characteristics of these organisms, and then the digitizing and storing of this information in huge electronic databases. Companies then file patents on these genetic sequences, which allow them to force us to pay licensing fees if the same sequence is found in our seeds. "Dematerialization" is therefore the new way of capturing the wealth that has been created by peasant communities over the centuries, bypassing international texts that recognize our rights.

We the peasants of Africa are not backward, nor against technology. We use it when it serves to strengthen our struggles, but we demand that our rights be respected and protected. Those who can use all these computer technologies and databases are large multinational companies. It's not for us. Because of this, we oppose patents on genetic information. And we fight for the protection of our peasant seed systems, which allow us to play our role as guardians and guarantors of the biodiversity and life. No machine or software can ever replace our peasant knowledge.

1 - *Zaï* is a West African traditional farming technique whereby pits are dug into micro-basins using a pick-axe with a small handle (known as daba), and then the seeds are sown. This particular type of cultivating allows for the concentration of water and manure in arid and semi-arid zones.

to read, listen, watch and share

- Right to Food and Nutrition Watch, *When Food Becomes Immaterial: Confronting the Digital Age*, 2018 - https://www.righttofoodandnutrition.org/files/rtfn-watch-2018_eng.pdf
- ALAI, *Social Justice in a Digitalised World*, 2019 - https://www.alainet.org/sites/default/files/alem-542-en.pdf
- ETC Group, *Blocking the Chain. Industrial food chain concentration, Big Data platforms and food sovereignty solutions*, 2018 - https://www.etcgroup.org/content/blocking-chain
- UN Global Compact, *Digital Agriculture*, 2017 - http://breakthrough.unglobalcompact.org/disruptive-technologies/digital-agriculture/

Voices from the field 2

I *campesino*: digital, rural, self-determined

FarmHack.org community reflections on digitization in the USA alternative agriculture movement

Even in this hyper connected world, we, young and youngish farmers in the US agroecology scene, spend most of our time outside, connected more of the time to the ecosystem than to the internet. It is a straddle, between subsistence and the marketplace, between the wild, feral and domesticated ecologies, sometimes farming or caring for children or running equipment while holding the smart phone in our teeth! Many farms in the USA rely on smartphones for record keeping, for marketing, for managing orders and customers, as web-shops and market portals – to stay in daily touch with our networks of collaborators and a customer base increasingly accustomed to direct relationships with their growers.

In the US, we have some convergent social movements, which have shaped the culture and practices of our open source agricultural tools ecosystem. These include a co-incidence with a boom in open internet infrastructure, including Wikipedia, Creative Commons, Craiglist, Napster, Tor-Drupal and more. As a generation brought up since grade school with computers, we are quite adept at finding information with keywords online, from videos on Google's YouTube to historical documents protected in the commons at www.archive.org.

We are also quite adept at building our own infrastructure where there is none, of which FarmHack.org is a prime example. FarmHack.org was born in 2008 from a community of farmers that convened at the Massachusetts Institute of Technology (MIT) and worked together to build a platform to host a farm tool sharing service, through a very simple website, in-person meet-ups, and a diffuse international community of practitioners working together online. FarmHack.org has sought to become the open-source platform through which farmers can share their innovative approaches to addressing existing equipment gaps[1] with their fellow smallholder farmers[2]. Today, the young farmers' movement, the open source software movement, and the "right to repair" movements[3] converge in FarmHack and Gathering for Open Ag Tech (GOAT) communities. This is not only happening in the US, in Quebecois Canada there are strong collaborations going on as well.

Agribusiness' vision of agriculture without farmers is "precision agriculture." Both the agro-input companies and the farm machinery corporations (e.g. John Deere) have been investing massively in big data and information and communication technology in recent years. "Precision agriculture" entails a model of extreme mechanization in agricultural production, enabled by the convergence of powerful new digital technologies and algorithmic processing of big data. In this "vision," technology and data are used to further consolidate corporate control over the food system, and monopolies. Farm machinery companies – just as agricultural input companies – are nowadays big data companies. They equip their machines with sensors and chips that collect and analyze all kinds of data, all the time – weather records, soil moisture, pests, crop history etc. These are turned into big datasets that are run through machine-learning algorithms that then inform automated farming machineries.

In reply, we propose a strong community vision for "decision agriculture," which puts forward our autonomy and rights. In addition to building our own tools/hardware, which we can control (e.g. bike-based farm equipment, do-it-yourself tractor mounted equipment "à la Atelier" etc.), we develop our own open source software and apps (e.g. an adaptive management software called "farmOS"). We have also started to use drones, sensors (e.g. for monitoring greenhouses, fencing, etc.), big data and tech-enabled observation to improve our farming systems and adapt them to local conditions and changing climate. Many of these practices share thinking and approaches with Citizen Science communities such as Publiclab.org, and work helping communities hold their elected officials accountable to environmental justice using low cost monitoring tools. Publiclab has emphasis areas in do-it-yourself soil testing (for contamination) and carbon monitoring (using spectrometry). Our strategies focus on communicating and sharing locally relevant agricultural knowledge across cultural, geographic and language boundaries.

We are at an interesting crossroads where the cost and accessibility of digital tools is being turned on its head. The next generation of open source micro-controllers and internet connected devices and associated batteries and motors is far lower cost and more accessible and scalable for small-scale producers, and may even already have economic advantages over large-scale proprietary systems. Low cost climate control, simple automation, animal monitoring, and on-farm value added processes are but some sample use cases with interesting potential for small-scale farmers.

Low cost communications tools are also crucial for sharing and improving practical knowledge related to the complexities of regenerative agriculture, and form the foundation for valuing ecosystem functions. Even simple hardware designs and on-farm and local manufacturing of hardware are made more effective with peer to peer communications tools to exchange and adapt designs for local conditions. We are even exploring peer to peer networks that can create functional farmer communications networks external to the internet.

1 - Small and medium scale vegetable growers in particular find that there are 'equipment gaps' as we work to re-build diversity in cropping systems and regions which had become concentrated and simplified

2 - See article on FarmHack and Atelier Paysan in Nyéléni Newsletter no 36, Agroecology: real innovation from and for the people - http://www.nyeleni.org/ccount/click.php?id=133

3 - Farmers who buy tractors from the big agricultural machinery companies are often not allowed to repair them. A clause in the purchasing contract requires that only accredited mechanics … are allowed to repair the machines. The "right to repair" movement challenges that, and asserts farmers' rights to repair their own machinery.

Box 3

Digitalization of fisheries

In the last few decades, the collection of ocean data has developed hugely and for a range of reasons. These include tracking cargo shipments, creating digital seafloor maps, and monitoring fish stocks, resulting in the development of quota allocations and the Total Allowable Catch (TAC) system. However, the concern is around what kinds of political-economic agenda the collection of big data will mobilise and what the consequences for small-scale fishing communities around the world may be. The widespread increase in the use of data and the digitalization of the ocean space needs to be considered in light of historical political-economic shifts concerning use and control of ocean-space and in particular within the narrative of the "Blue Economy".

Data and fisheries

The use of data in fisheries emerged simultaneously with discussions around the optimal use of national fish stocks based on a discourse of environmental sustainability and economic efficiency. The production of this data resulted in the development of the TAC system which is determined by fisheries scientists through annual surveys which collect data on the population sizes of commercial fish species. The collection of these data has been increasingly digitalized through on-board GPS devices and the automatic storage of information on computers. The ability to record catches in real-time means that the TAC and remaining quotas or catches that exceed the quota can be detected immediately. Although this knowledge adds to the global understanding of species populations and distributions in the ocean, the quantitative and scientific nature of this data undermines the traditional knowledge of local fishers which allow them to protect the sustainability of ocean ecosystems.

Quota-based management systems and catch share models such as Individual Transferrable Quotas (ITQs) were made possible through the digitalization of fish stock data. These types of management systems are supported by environmental organisations that advocate for the implementation of these models for the advancement of conservation efforts in the oceans. However, they are often contentious as they are a result of privatization of public resources and are associated with inequitable allocation of fisheries resources.

Data and the Blue Economy

The increasing role of data in ocean management is being emphasised as part of the growing pressure on the ocean and ocean resources to act as a new economic frontier to solve a myriad of crises in our food, energy, and climate systems. The expansion of big data turns the ocean into a financial asset to be exploited for economic profitability rather than a point of access for variable and nutritious food and ecosystem to be respected and nurtured. The market-based agenda of the blue economy focuses on private sector involvement in ocean-based extractive developments. According to the blue economy discourse, emerging ocean-based industries have high growth, innovation, and job creation potential, and can contribute to energy security, climate change management, and food security. However, these discourses are also associated with dispossession and the appropriation of ocean resources and spaces.

A variety of developments have been facilitating the increased gathering of data for ocean management in growing the blue economy. Satellite data has been growing exponentially and is set to double by 2020. With increased spatial and spectral resolution, more data per instrument will be recorded with fewer limitations to observation. Drones and unmanned airborne vehicles are allowing for cheaper and easier data collection. In order for big data to contribute to growing a rich information ecosystem, advanced application programming interfaces are being developed to allow for quick and cheap processing of the huge amounts of data that are being collected.

Impacts

Fishers have a deep-seated knowledge of fish species populations, breeding cycles, migration patterns, and fishing techniques which they use to protect fish stocks. The quantitative and scientific nature of the calculation of the TAC overlooks this knowledge, reducing information to scientific data rather than holistically combining this with existing traditional knowledge. The vision of nutrition has become technical in nature and food is increasingly viewed as a commodity rather than part of the commons. This reductionist, fragmented and individualist view of food lacks a human rights perspective.

Digitalization widens the gap between producers and consumers; it results in an increasingly automated and delocalized process of food production, and dispossesses fishers of their knowledge and access to ocean resources. This shifts the power from physical food production systems and fishing activities in favour of often-unknown financial actors with access to and control over these technologies. It concentrates political and economic power in the hands of remote actors who engage in the immaterial realm of information and financial means, reaffirming class struggles and oppressive inequality. Additionally, all of this big data feeds into policy decisions such as determining the use of ocean space with technical tools such as Marine Spatial Planning. These data are being mobilised to support a certain type of political-economic agenda and, if this includes the increasingly dominant discourse of Blue Economy, the consequences for small-scale fishers with marginal political power across the world may be devastating.

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