The Discourse and Dangers of Digital Agriculture

By: Taylor Rose

The end of harvesting season was getting closer and colder. As some fields were already tucked beneath fresh cover crops, others were filled with root vegetables waiting to be unearthed. Soon, thousands of pounds of potatoes and carrots would need to be pulled up, washed, and saved for the winter. Samuel Oslund, a farmer in Quebec, recalled the year before, cleaning the caked-on dirt from the carrots and potatoes. He wrung his hands together, his bones feeling the memory of the freezing water. Hand washing thousands of pounds of root vegetables just wasn't possible anymore.

Oslund started shopping for a root washer that could clean all of the vegetables from a harvest in large batches. The technology existed, but the price tag was double his designated budget. He wondered if he could build something similar on his own, maybe find some DIY plans and enlist the help of a friend or two. While rifling through the internet for a schematic to use as a starting point, he came across a website called FarmHack that would lead him to an eye-opening experience.

Oslund found precisely what he was looking for: a large wooden washing machine-shaped device that turned with the assistance of a motor. After reviewing the plans, he felt he could handle the woodworking side of things but decided to call in backup from his friend Ried for the electric work. After talking about the project to other farmers for a while, the two found that 14 other farms needed something similar. They decided to build 14 root washers all at once and all together.

The morning of the build, dozens of farmers carried armfuls of tools and hardware across the parking lot of a local agriculture university. Oslund had stayed up the night before making pots of chili for everyone to share. Ried found donated motors for the washers and the space to physically build them, since assembling them on the farm proved to be too muddy. The group came together like an assembly line. By the end of the day, they built each washer then disassembled all into small enough pieces to fit into the trucks and cars headed off to each farm.

The reason why Oslund and so many farmers like him are drafting, sharing, and creating these DIY-open-sourced pieces of agricultural technology is simple — there aren't many other options for small farmers. The technology and tools found on farms are rapidly changing. Most farming technology is created for industrial agriculture and the big mono-crop farmers. Smaller scale farms, like Oslund's, are usually ignored — despite small farms accounting for the lion's share of the world's food supply.

"There's been an increasing amount of people interested in environmentalism and food security," says Oslund, commenting on the growing number of small farmers like himself. "They're entering with this vision of small-scale, community-based farming systems. And so what's happened is there's an obvious gap between the way technology has evolved towards large scale and the way that these people are entering the desire for small scale."

The DIY nature of tools like Oslund's root washer is the antithesis of how technology is snowballing on the industrial farm. Today, the technology on a large farm is far more than tractors or combines. AI (artificial intelligence) programs gather data from sensors in the ground, telling a farmer when to plant. Drones, data sensors, and DoorDash are all a part of a new field called digital agriculture.

Tech Is The Number One Ingredient In Our Food

Digital agriculture is pervasive, intimately woven into our daily lives, and growing fervently. Digital tech on the farm touches many areas, but the joystick is in the hands of just a few companies. According to a 2022 report by ETC, a research non-profit that "monitors the impact of emerging technologies and corporate strategies on biodiversity, agriculture and human rights," just four to six dominant firms control most of the industrial food chain. Corporate consolidation is one of the ominous avalanches falling from digital agriculture. The "big 5" of tech (Google, Amazon, Meta, Apple, and Microsoft) are no exception.

Tech giants, like the "big 5," are investing heavily in farming, food production, and delivery. Their hope to press their digital footholds into the food industry. Microsoft has made extensive agreements with Bayer (formerly Monsanto), national agriculture ministries, and other big agribusiness players. In 2020, Google pledged to invest $10 billion in India over the next five to seven years to help the country adopt more digital technologies in its food systems. Amazon acquired Whole Foods and has invested more than $500 million in food stock. Amazon Web Service (AWS) now creates precision agriculture technology — such as sensors and soil monitoring systems — for farmers. Two of the top five tech companies (Microsoft and Amazon) are publicly focusing not just on the newest phone or self-driving car but on how our food is grown, processed, and consumed.

A Map of Digital Agriculture

Digital agriculture lies at a complicated crossroads between environmental, labor, and data rights. We can follow a single crop through the agrifood value chain to grasp just how vast digital agriculture's impact really is. Say a farmer in the Midwest grows wheat. That wheat seed may be genetically engineered using 'biodigital' data-design platforms, and the

wheat itself planted using a self-driving tractor and monitored by soil sensors, which actively gather data about the crop and land. The wheat is then harvested, sold, and made into feed for algorithmically-managed industrial livestock or perhaps ground to flour — all assisted by various digital tools. That flour is again purchased and made into AI-designed fake meats or a hamburger bun — possibly by robots in a digitally controlled food factory. Eventually, that bun sits in a warehouse until it is ordered by a restaurant, likely using a digital ordering system. The bun is then neatly placed on of the burger you order from DoorDash — the app hundreds of people in your area use to order their dinner. Eventually, that delivery might come from self-driving robot delivery systems. For now, the delivery driver is monitored and instructed where to go by AI.

The agrifood value chain is increasingly integrated with digital technology, at each step, a lot of information, or data, can be gathered, processed, and used. Big tech sees a unique opportunity in partnering with traditional farm tools. By redesigning tractors, planters, etc., to have sensors and other "smart" features, it's easy to gather data along the way. Big tech can now analyze food production using massive computing power. Big tech can tell a farmer when to plant, power the equipment that processes food, then nudge a consumer to order something specific for dinner. The insight that big tech companies can gather through the entire food value chain is beyond measure. And as climate change continues to impact food supplies, digital agriculture is an ever-profiting industry, from fertilizer to food ordering apps.

Robots and Berries

Earlier this year a European farm technology company introduced the world to a massive robot programmed to do a delicate task — individually harvest strawberries. Picking fruit can be fragile, especially when it comes to easily damaged produce like berries. This is why until recently, most fruit is

harvested by actual people, farm workers, bending low and pulling back tufts of leaves to reveal ripe fruit.

So it was truly remarkable when a company called Agrobot rolled out a machine that could harvest an entire field of berries without a single soul present. A spider of mechanical arms extending from the underbelly of a large tractor twist and bend to clip, grab, and drop each berry into a collection bin as it rolls through rows of strawberries. What makes this hefty piece of machinery possible is AI. Harvesting done through the guide of AI is just a tiny taste of how technology is finding its way into even the most intricate farming practices; and where it will further develop.

Digital agriculture is not limited to robots harvesting crops or mechanical arms tucking seeds into the earth. The ever-growing agriculture industry has everything to do with the same AI capabilities that power the search engine on your computer. Big Tech is also finding a home in agriculture by providing cloud services to farm companies for data storage and processing. At its core, digital agriculture is the interweaving of technology into the production, consumption, and control of our food.

Finding Red Flags

One of the biggest selling points for integrating more technology into farming tools, is the potential ability to increase production. Farmers being able to grow more food sounds like a godsend, so what is the concern with tech companies becoming a farm-hold name? If you open Google and search for "digital agriculture," some of the first things you will see are phrases like "new frontier" and "opportunity." Near the top of the page is a dropdown list of benefits, things like reliable management and insights into crop production — both of which would help a farmer get more out of each harvest. At first glance, digital agriculture seems to be the next wave of technology ready to improve how we connect with the earth and increase food production. But what do these benefits really mean? The initial

rose-colored hue around digital agriculture is no accident. Google and other large technology companies want to show an idyllic picture of digital agriculture. However, every claim has a thumb on the scale when measured.

Understanding the scope of digital agriculture requires, well, a team of experts and practitioners. Today, it is not uncommon to find representatives of tech companies bellying up to the tables of digital agrifood think tanks worldwide. Foodtank, for example, set up a group called "Refresh," a committee on digital agrifood they filled with reps from Google, Facebook, tech startups, and big agribusiness players like Bayer and Barilla. When one food activist saw that, he knew that they were likely to miss part of the story — particularly the perspective of food sovereignty. Food sovereignty is the "right of peoples to healthy and culturally appropriate food produced through ecologically sound and sustainable methods, and their right to define their own food and agriculture systems," according to the U.S. Food Soverignty Alliance. The term often applies to movements that advocate for environmental sustainability, worker's rights, women's rights, and racial justice.

"The conversation about how to address policies for food systems and tech was being driven by big tech," says Jim Thomas, settling back in his chair after just getting off of a three-hour Zoom session. Thomas is a Research Director with ETC Group. The meeting he just wrapped up was a video chat between a labor rights organizer and a policy analyst in DC. The meeting was a whittled-down version of the think-tank ETC created as a response to Foodtank. ETC decided to work with civil society allies to form a collective response; and they called it the North American Digital Agriculture Working Group (NADAWG). To Thomas, it was essential to discuss how digital agriculture can impact farmers, workers, and consumers collectively. The group is a roundtable discussion to counter and engage with what they see as a one-sided push in favor of a digital food system.

The tools of digital agriculture are developed quickly, making it hard to know what works, what claims are valid, and the true cost of using these tools. NADAWG hopes to open up critical discussions about big tech's presence — what tools are simply a ripple, and which ones are a tidal wave that might hurt worker's rights, farmer's ownership, and the environment as a whole?

Thomas also fears that these discussions and critiques are only being heard by those who stand to benefit from digital agriculture. "Unless civil society organizes itself to understand the digital changes underway, these corporate-dominated groups might be mistaken as speaking for the food movement," says Thomas. NADAWG now has several dozen members drawn from civil society and food sovereignty organizations, ranging from technology, trade, farming, indigenous rights, and racial justice.

"On the other side, the big tech and agribusinesses have billions of dollars to spend on how they're gonna frame this technology and how they're gonna sell it, and to try and create how it's thought about," says Thomas. "The food sovereignty and food justice movement needs to… examine together this momentous shift in the food system. To be able to decode it and understand it together from our values — with the principles of food sovereignty to food justice — right at the heart of how we critique it."

There are several think tanks, or working groups, out there. Midwest Data Hub and the FCC each have one similar to Foodtank. Think tanks like these often strive to devise the dominant discourse around technology and food, usually splicing together fact and fiction in their reports, saying things like robots can save farmers backbreaking labor. It's a morsel of truth wrapped in an assumption that the companies making said robots are concerned for workers' wellbeing.

In reality, this kind of technology has a complicated aftershock socially, environmentally, and economically. What is concerning is when only one perspective is widely shared. Groups like ETC note the broader impact of new

technologies and how they often have dire consequences on natural ecosystems and can harm poor rural communities.

Corporate Control In Data Mines

Many activists, small farmers, and others connected with the food sovereignty movement see big tech's control over digital agriculture not unlike a storm rolling in — one that is unlikely to be stopped outright but requires preparation and mitigation, especially for those most impacted. One of the universal concerns is the value of agricultural data and that it's accelerating corporate power in our food systems. And power maintains its grasp through manipulation.

"In the last five to 10 years, and particularly in the last two years, people have understood how digital production systems have come to dominate their lives," says Thomas. He notes that, especially with the COVID-19 pandemic, more people than ever before rely on digital systems like remote classrooms, ordering groceries online, and social gatherings through Zoom. "This digitization has, in a very real way, touched every part of our lives," says Thomas. "And now it's happening to the food that keeps us alive, connects us to the land, us to each other, and to our cultures. It's not just happening in a passive way; it's driven by extremely powerful companies who want the food system to be digitized so that they can manipulate the behavior of consumers, farmers, traders, and so forth."

Corporate manipulation comes in many forms. Thomas notes that one of the most common methods is "hypernudging." The term comes from the ability of corporations to nudge or push people toward certain behaviors based on targeted data models of their behavior. Companies are increasingly able to track every part of our food, from how it is grown to our buying patterns — thus actively contributing to surveillance capitalism. "The more you have extremely powerful players who get to grab data and land, take over

the underlying resources of food production, move peasants and small farmers off the land, and reorganize the food system," says Thomas. "All of that undermines food sovereignty, food, security, health, and local democracy."

Access to food-related data presents an opportunity to redirect buying behavior. It also creates both problems and solutions on the farm. Controlling evolving systems like food is a prime opportunity for corporations as the climate changes. "Having control over our food is absolutely essential to our rights, freedom, and the strength of our communities and our democracy," says Thomas. "Corporate digitization runs entirely in the other direction."

One of the concerns for food sovereignty activists is the unbridled power that just a few companies will have over the entire food system when they gather and control agricultural data. Also, the list of companies considered "big players" in this space keeps getting smaller as more companies merge. ETC notes that four firms, Bayer (Monsanto), Corteva (Dow+DuPont), BASF, and Syngenta, currently control over half the world's commercial seed and almost two-thirds of the global pesticide business. Corporate consolidation guts competition, democratic process, and, in this case, biodiversity. Digitization developments are supercharging that consolidation.

Thomas notes that one of the methods for this volume of corporate control is data collection. A perfect example of how precision agriculture technology is gathering massive amounts of data is Bayer's Climate Field View technology which uses seed genetics, soil sensors, and tractor monitoring to create a single view for farmers to understand their land and crops. However, Bayer uses this information in aggregate to tailor their products, guaranteeing production and tying farmers into lengthy contracts. Under some 'outcome-based pricing' arrangements, if the crops get a higher

price at the market than expected, Bayer takes a portion of the profits — up to 50%, as noted by one report.

Data on its own is useless without the social quantification sector — the ability to generate, capture, and analyze data. One of the ways this is done is through the internet of things (IoT), an intersection between hardware and software through sensors attached to devices. These devices could range from tractors to home appliances or Amazon's Echo. According to authors Nick Couldray and Ulises Mejias, the number of connected devices will skyrocket from 27 billion in 2017 to 125 billion by 2030. The real profit of this data steps onto the stage with two players — data analytics firms and data brokerage firms. The end goal of both is the surveillance, analysis, and sale of people's behavior. Couldray and Mejais put it well in their book *The Costs of Connection,* "digital platforms give gatekeeping power to their owners, much as the navigation routes of historical colonialism empowered the towns near where goods had to land."

Agriculture and food data is becoming more and more valuable. When we gather massive amounts of data along the entire agrifood value chain, that information becomes a goldmine for tech and agricultural companies that can improve their bottom line or sell it to data brokers. This was why the CEO of Monsanto (now Bayer), Rob Fraley, noted in 2013 that "I could easily see us in the next five or ten years being an information technology company." In fact, that is exactly what happened. The power of farm, ecological, and consumer data allows corporations to control the end-to-end production of food and creates a new revenue stream.

Agricultural data can provide farmers valuable insight into crops and livestock. Access to that information is the carrot on the stick for many farmers. While the benefits of precision agriculture are accurate, there are hidden costs. One of which is the data that precision agriculture collects, farmers typically are not allowed to own even though it comes from their

land. Still, like anything of value, data can be used to further the profits of some or the collective knowledge of all. Data is becoming the new oil with rising value and vast reserves quickly emerging.

Facts and Fictions

The creation of ETC's working group reminds us just how complex this topic is. It started as a roundtable discussion to compare what farmers are hearing, what policymakers are told, and what academic and civic researchers are finding. There are dueling viewpoints amongst the group. Even in circles primed for a critical lens, not everyone agrees on what to do next.

What is clear, is there are very specific narratives that proponents of digital agriculture often raise as a banner. Tech companies are eager to share ways digital agriculture can solve economic and ecological problems. Microsoft believes FarmBeats — a farm sensor, drone, and machine learning algorithm tool — is how farmers will be able to amp up production to feed twice as many people by 2050, for example. The list of benefits that tech companies typically cite is often reused over and over. Things like: robots will save farmers from back-breaking labor; precision agriculture can help soften the blow of industrial agriculture on the environment; pata insights will lead to higher crop yields, thus helping address world hunger; and more buying options can meet the needs of consumers.

Food sovereignty activists frequently ask one another, are these claims valid or just hype? And why are the largest tech companies in the world elbowing their way to the front of the line in our grocery stores?

The tech behind digital agriculture often looks like a magic wand — with one wave, significant contributors to climate change fade while simultaneously halting a looming hunger crisis. This narrative is actually not without foothold; there are serious concerns about how our present-day

agriculture will evolve alongside a changing planet. The UN and other international research entities warn us about the ever-strengthening bond between global food security and climate change. Food systems are threatened by degrading ecosystems, and unsustainable industrial farming is no minor contributor to greenhouse gasses. The EPA estimates that agriculture accounted for 11.2 percent of U.S. greenhouse gas emissions in 2020.

Environmental groups often hear that digital agriculture is a golden-one-way-ticket to regenerative farming, carbon reduction, and a tap into the lucrative world of carbon credits. Big tech companies often frame digital agriculture as a way to make food systems more resilient against disruptions like pandemics. In one of ETC's recent reports, they note that "in 2020, the U.K. Research and Innovation agency awarded £2.5 million to a consortium of academic and private sector firms developing the world's first robotic farm, dubbed 'Robot Highways.' The project claims that its autonomous tech will enable a 40 percent reduction in labor and help move the sector toward a carbon zero future."

The idea that if we improve efficiency, the problem is solved is nothing new. Samir Doshi, a scholar who at the time of this article was a race and technology fellow at the Stanford Digital Civil Society Lab, points out Jevon's Paradox — a concept from the energy sector. Jevon's Paradox states if energy is produced more efficiently, carbon emissions will not fall, unlike most assumptions. He notes roughly 40 years of data show this paradox to be true. "Years of data show that even though you might increase the energy efficiency of a household or residence you're still increasing consumption," says Doshi. "So you actually don't reduce consumption overall. You're still increasing it. You're just having a more efficient means of increasing it."

Researchers with civil society groups are concerned that many digital agriculture claims are built on assumptions or, worse, are creating problems

that do not exist. Ahna Kruzic, organizer and Associate Director for the Regenerative Agriculture Foundation, notes how distorted our views are around food production and climate change. "We're seeing these arguments used all over again with digital ag, like efficiency and the increased yield we need to solve climate change and feed the world," says Kruzic. "You know, for example, I think it was the World Economic Forum had said that if 15 to 20 percent of farms adopt precision agriculture, we could increase global yields by 15 to 20 percent. That would decrease greenhouse gas, emissions, and water by like 10 to 20 percent on top of that." EPA estimates that agriculture accounted for 11.2 percent of U.S. greenhouse gas emissions in 2020. However, greenhouse gases are not the only measurement of environmental health. Industrial agriculture greatly contributes to freshwater use, pollution, and soil erosion.

Caddy corner to environmental discussions, one of the common justifications for digital agriculture is population growth. Many proponents say that by 2050, Earth will be home to 10 billion people. Therefore we won't have enough food, much less means of food production that isn't destroying ecosystems. In theory, we would need to increase food production anywhere from 50 to 70 percent to supply that many additional people on the planet. Tech companies often claim that digital technologies are a way to feed a starving future.

"And this argument of 'produce more, more efficiently,' because there's not enough food isn't solving the problem of hunger or of climate change," says Kruzic. "We presently produce enough food for every human on the planet. Most of that is produced by small farmers, and hunger is not a yield problem — it's a political problem. People aren't hungry because food doesn't exist or because farmers need to produce more or need to produce more efficiently. People are hungry because food and agriculture are a commodity, and people don't have access to capital to buy food."

Doshi also debunks the idea that if we can produce more food, many social issues will fade away. "Needing increased production [is] a recycled narrative over decades, and we can start picking it apart. So the first part of it states that, by 2050, you'll have this amount of population. That is an assumption that we are going to continue the level of gender inequity that we see around the world. If we increase family planning and education for girls and women around the globe, we have decreased fertility rates. You have a decreased projected population with increased equity." Doshi points out that many proposed agricultural solutions actually may not even be needed if the problem itself can be avoided.

The basis of this symbiotic argument — that food systems will adversely harm the environment and that agriculture is a massive contribution to climate change — assumes that our current food system remains unchanged. Yes, on the current course of climate change and industrial agriculture, both will continue in a cause-and-effect cycle with one another.

Labor Rights and Racial Justice

While many of us will feel the impacts of digital agriculture in the near future, farmers are in check — they must decide quickly what technologies to adopt and which to sidestep. ETC's report *Food Barons 2022: Crisis Profiteering, Digitalization and Shifting Power* states, "IHS Markit estimates that the global digital farming market was worth US$5-7 billion in 2020 – less than 5% of the total farm equipment market – but it is forecast to increase to US$15 billion by 2027." Farmers must make their decisions quickly.

Similar to the narrative distortion of digital agriculture and climate change or solving world hunger, farmers often hear that the more technology they implement the fewer workers they will need on the farm — which is true. The hidden cost of that truth is many farmers then become dependent on

the brands of tech they are using and the connected products. Certain planters only work with certain seeds, etc.

Some farmers are now part of a growing movement known as the "right to repair." Machinery companies like John Deere state that when someone buys a tractor, they are given a "license to operate the vehicle," but are not actually the owner of it; nor does the farmer own any of the software it comes with or the data that the tractor generates. Right to repair essentially asserts that if a farmer owns a tractor, they should have the right to at least be able to work on that machinery — seems a no-brainer.

Erik Nicholson, an activist who has worked with farm labor unions for over 30 years, sees the danger of farmers not owning their data or being able to work on their own equipment. "In an ideal world, I could envision that the data stays within a given ecosystem of growers," says Nicholson. "That ecosystem has the algorithms to understand it, to get the insights, to innovate … to build the economic resilience of the communities. [Companies like] John Deere and others have other plans for that data. John Deere has their tractor that is out in the field with a multitude of sensors. It's gathering data on moisture, on soil content, on fertility. It's just a whole array of data points."

By creating pieces of technology at each stage of the crop cycle, corporations like Bayer or John Deere can monopolize farms from end-to-end. "They want to be the Lyft or Uber, the ride-share program for agriculture," says Nicholson. "…They're going to get data about your farm, and you have no idea the content of it, what they're going to do with it, how they're going to aggregate it, and how they're going to use it to concentrate wealth and power. I think I perceive a certain sense of powerlessness amongst growers."

For anyone working with farmers daily, figuring out what to do next is difficult. On the one hand, farmers need to keep up with competition and

maintain their livelihoods; using the newest technology to improve crop yields or scale-up production is enticing. On the other hand, by becoming dependent on big tech, farmers are tying themselves to large corporations for the long haul. The degree of corporate reach and control on the farm quickly pulls autonomy away from those working with the land.

Not having the right to work on your equipment violates an owner's autonomy and can be considered a labor rights issue. When digital agriculture is rolled out on farms, one of the immediate impacts is on laborers, the people who help plant, pick, and maintain crops or livestock. The majority of these workers are BIPOC. According to the USDA, only 24 percent of crop laborers are white. Digital agriculture swings the hammer, starting a Rube Goldberg chain of reactions touching racism and labor rights.

Some researchers are working to track the racial implications of digital agriculture. Doshi has studied the long-term connection between farms, labor rights, and the racial history of work. "There's a well-documented 80-plus-year history of automation of technology and the intersection of labor," he notes. "It's pretty well recognized in that research that workers are always on the losing end whenever new technologies become introduced and established in the field." By the losing end, he means job loss, workplace safety, and workplace equity.

When automation tools were introduced to coal mining the technology was presented as beneficial, because automated machines would prevent miners from having to spend as long breathing in silica dust. Instead of black lung disease, miners and their families faced wide-scale pollution that coated the ecosystems from amping up coal production. "I think what's interesting is that oftentimes technology is introduced as a way to improve safety," says Doshi. "What the data shows is that health and safety were never a metric normally to start with. So you are just swapping out different health issues, oftentimes."

Part of Doshi's research focuses on racism and western agriculture. He notes that there has always been a racist dimension to agriculture in the US — starting from slavery to the cotton gin. "Then we start moving over towards the introduction of tractors [in the early 1900s] as a way to drive Black farmers off of the land," says Doshi. "What we see is that the history of agriculture in the US in North America is a history of white supremacy and exploitation. And when technology is introduced, it is actually a means to further exploit and further oppress cultures." Over and over, we see examples of automation presented as a time or health saver for workers with one hand, while the other spreads harm over those same communities long term.

Charting New Territory

The honey trap of digital agriculture is it creates the tools that make industrial farming possible — contributting significantly to climate change — then profits again when they offer a surveillance-fueled diagnosis to treat a withering planet. However, some groups hope to change the narrative and discuss a different future. For many farmers, two issues need addressing; working conditions and developing methods that further the resilience of rural communities.

Those working to chart alternative futures are often anchored by collective problem-solving. Turning to farmer-led innovation addresses many of the issues created along the agrifood value system. By allowing farmers to collaborate and design their own technology, they are creating responsive tech that is suited for their particular ecosystem. If farmers can build their own technologies, they own and control their data. By not relying heavily on corporations, growers are likely part of smaller farms, also known as peasant food webs. It should be noted that the peasant food web still feeds roughly 70 percent of the planet with far fewer resources — less than 30 percent of the

world's land, water, and agriculture. These smaller diverse systems of farming create resilient communities and can play a role in slowing climate change.

"We have to recognize the narrative that's being put forward and debunk each part of that narrative," says Doshi. "And then we also say that there's actually an established pathway that can meet the needs that we all want to meet besides capitalist production exploitation. So if we take away the focus on capitalism and instead focus on health equity, ecosystem, integrity, et cetera, then we have this pathway forward through agroecology and food sovereignty."

Tech on Worker's Terms

For many activists and sustainability experts, there is a lingering question — what pieces of technology are harmful, and which ones hold potential? To use a crude phrase, don't throw the baby out with the bathwater. Most can agree that agricultural technology itself is not inherently destructive. Consider tools like Excel that completely changed the way farmers worked, all for the better. Technological value is measured by how it's used and for what purpose.

"There's honestly ignorance in that there's a lot of tech folks who say, well, we have applications, and we want to improve agriculture," says Doshi. He speculates what would change if the design process was revamped. "We actually could engage directly with some of those folks in technology and get them to understand what issues can benefit farmers and laborers and workers all across the food value chain." Doshi hopes to see more opportunities where farmers and experts in food justice can have a hand at the drawing boards of agricultural tech.

Many justice advocates note that opposition to big tech doesn't require a Luddite approach to farming. "Technology is inevitably going to happen," says Oslund. "This stuff is going to happen. [The belief that] we just have to

get out of the way and accept it… And that kind of disempowers anyone to be critical about new technologies." Oslund notes that where there is power is if farmers like him have a say in how these technologies are developed.

"There's a bit of an issue with sort of a romanticization of the past and being like, oh, we want to keep agriculture in a certain way or something like this," says Oslund. "And I think having it purely looking at emerging technologies or innovation and [saying] we don't want any of these. We don't want this kind of technology or be opposed to innovation. [Instead, how can] we adopt these in a way that would benefit communities of people that are actually doing agriculture in more sustainable ways." Are there parts of digital agricultural tools that can help create more resilient communities? Even amongst food sovereignty groups like ETC each member would likely give a different answer. Ideally, entire systems would shift to small sustainable farming practices that empower and preserve communities long-term.

"I think part of our work is not only saying that those [negative futures] are not inevitable, but the future that we want actually exists presently," says Oslund. "[It] may not be widespread, widely adopted, or known. That's our work, trying to shine a light on these different organizations and groups that are doing technology, making technology, doing these things differently and really based in — whether it's food sovereignty or agroecology, or a justice framework — that they're already there. Really what we need to do is highlight them and support connecting these different nodes so that people understand that the inevitable future is not inevitable at all."

"The process of building the root washer, for me, was the lightbulb moment," says Oslund. Since the day in 2015 when Oslund carted home a communally built root washer, he joined La CAPÉ, a food sovereignty and farmer's rights organization in Canada. Oslund is part of a larger collective of farmers and designers who work together to build new pieces of agricultural technology. Groups like La CAPÉ and FarmHack allow growers to address

challenges together, keeping knowledge with the people working the land. Open-access blueprints found on both organizations' websites are prime examples of farmer-led solutions. Instead of corporations creating technology for farmers, those in the field can build what they need, share those ideas, and collectively develop tools.

"A farmer-led innovation or grassroots innovation model is really when people start coming together and building on that instinct to try to address a problem themselves directly, that responds directly to what they need," says Oslund. "... So it's the community itself both governing it, building it. This form of innovation is really responsive, directly to the community and directly to the environment where it's implemented." He explains that what he hears from other farmers is not an aversion to technology; it's a concern for what happens when those tools move out of the farmer's reach.

Oslund's root washer is a paragon and a glimpse into an alternate future — one of sustainable smaller scale farming and technology that serves rather than exploits. Small farms are one of many solutions to help address climate change. While technology on the farm can help make smarter choices, those who work with the land need to have a say the design process. Fueling the planet's destruction while simultaneously profiting from it will be the legacy of industrial digital agriculture unless we intercede.