DIGITIZATION IN AGRICULTURE: A TIMELY CHALLENGE FOR ECOLOGICAL PERSPECTIVES

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Abstract

The main focus of political debates on digital agriculture has been on environmental sustainability. So far, the literature has primarily ignored social sustainability, notably labor issues. This is worrisome because digitization may fundamentally alter farming techniques and labor processes, potentially affecting rural development, rural communities, and migratory workers. It examines how digital technology affect labor on horticulture and agricultural fields. To incorporate labor into the debates around agriculture and digitalization, this article provides a detailed picture of how digital technologies affect agricultural labor. Results suggest new forms of labor management, intensification of work processes, and risks of working-class fragmentation along age lines. Digitalization has not resulted in worker or farmer deskilling. The claim of greater worker dependency due to reduced agricultural employment possibilities is disputed. The importance of creating agricultural policies that promote fair and equitable working conditions.

Key words

Digitization, digital agriculture, ecological sustainability

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INTRODUCTION

In digitalized agriculture, autonomous tractors drive themselves, robots harvest, drones and sensors measure and monitor every plant, and all farm components automatically exchange data and communicate. Healthy plants and rich soils usually illustrate the sustainability of digital agriculture (Adusumalli, 2016a). If a farmer is shown in these photographs, she is usually alone, using a smartphone or tablet (type 'digital agriculture' and 'sustainability' into Google's image search engine to see examples). Agricultural laborers or any indication of agricultural labor other than staring at a screen are conspicuously absent from these images.

Agricultural labor is still vital. Agriculture employs over 1.3 billion people globally, or roughly 25% of total employment. Agriculture employment has fallen dramatically in the OECD countries where mechanization and digitization are most advanced, to just 4.7 percent of overall employment. Agricultural employment is still vital in certain rural communities for economic and social development. Labor is vital in sustainable farming approaches like agroecology and organic farming, which require extra labor owing to the lack of pesticides and other chemical inputs. Embracing ecological ideals does not necessitate embracing fair labor practices. The agricultural sectors of Western Europe, the US, and Canada rely heavily on seasonal migrant laborers, and reports of exploitative and unlawful labor practices are common. That is why, in the context of digitalization in agriculture, a focus on labor and labor relations is critical.

The pros and drawbacks of digital agriculture have been hotly debated in academic and public forums. But the social implications, particularly on labor, have received less attention. Agrarian labor relations have changed little with the introduction of mechanization and chemical inputs. A few studies have examined the impact of digitalization on agriculture jobs. Digital technologies may help create new highly skilled jobs in agriculture while also replacing some low-skilled migrant labor. Such disparities in labor and skill development may be reinforced. However, highly trained individuals such as farm advisers and self-employed entrepreneurs may lose their employment or clientele if machines make autonomous, evidence-based judgments without human input. It has been noticed that greater use of digital technology may lead to loss or marginalization of farmers' experiential knowledge, resulting in loss of enjoyment and work satisfaction. New forms of labor control may be enabled by technology (Pasupuleti, 2016a). However, additional research into how digital technologies shape work and labor processes in agriculture is needed.

So this study investigates how digital technology are affecting labor processes on German horticulture and arable farms.

This research issue was addressed through the construction of an exploratory case study on labor relations in the German horticulture and arable farming sectors. German agriculture makes for an interesting case study because of its diverse farm structure, its early engagement with digitalization in agriculture that dates back to the 1980s, and the German government's recent efforts to explicitly promote digitalization in agriculture as a key strategy for rural development and ecological sustainability (Adusumalli, 2016b). Germany is also home to a number of companies that develop and sell digital products and services for agriculture, ranging from the multinational Bayer to several small and mid-sized businesses and a thriving start-up scene. As a result, Germany is at the forefront of digitalization in agriculture in Europe, and is the world leader in digital agriculture. This study adds to the few existing studies on labor and digital agriculture that have primarily focused on countries where large-scale industrialized farming is the norm, such as Canada or the United States, whereas Germany's farm structure, particularly in the western parts, is generally more varied and of a smaller scale, as evidenced by the findings of this case study.

The purpose of this article is to integrate labor into the arguments surrounding agriculture and digitalization, as well as to provide a complete picture of the impacts of digital technology on labor in the agricultural industry. The labor process theory (LPT) from industrial sociology, which has already been successfully adopted and applied to examine work in the agriculture sector, serves as the theoretical foundation for my research (Pasupuleti, 2016b).

TECHNOLOGIES AND CONTROL OVER LABOR

LPT emphasizes the concept of labor control, and technologies have been identified as a crucial element in this control. Taking as its starting point the distinction between labor powers, i.e., the ability to work, and labor, which is defined as the entity that enters the manufacturing process, LPT assumes that employers must establish and maintain control over labor.

Worker performance monitoring and control are typically done through management systems, and they are generally made easier by technologically-based labor surveillance and close measurement of worker performance.

The assembly line method of pacing labor was combined with technologically enabled constant surveillance and performance measurements, as well as small-scale tasks and detailed instructions based on a machine-enabled division of labor, hierarchical control, and close supervision of workers—a system popularized by Frederick Taylor and later referred to as Taylorism—to create Fordism.

As a result, control is frequently associated with the goal of increasing the intensity of the work process. Braverman is renowned for his theory that technical growth and the division of labor contribute to the intensification of the labor process when studying the Fordist production model. According to Braverman, the advent of the Fordist assembly line acts as a crucial technological innovation in order to pace the actions of workers and increase their production. Many other authors have agreed that technological advancements have a propensity to intensify the labor process in capitalist production, as a result of the urge to cut labor costs. Several scholars contend that post-Fordist production models promote various forms of labor control, including a strategy focused on cooperation, the evaluation of inventiveness and qualifications, and, in many cases, an increase in worker autonomy within the production process. According to recent research into the implementation of digital technologies in labor processes in the service and industrial sectors, these technologies have in fact given rise to new forms of Taylorist methods of workplace surveillance and control, which have been dubbed "neo-Taylorism" and "digital Taylorism."

DEPENDENCY AND WORKING-CLASS FRAGMENTATION

Controlling labor also seeks to make workers dependent on their employers. Dependency is defined by two broad factors: employees' ability to organize and their access to other sources of wants satisfaction, i.e., if they can find job elsewhere. By replacing low-skilled workers with equipment, new technologies create the reserve labor army that must compete for the few remaining jobs. Digitalization in agriculture has also been linked to the loss of low-skilled jobs. Jobs with higher skill levels may eventually replace low-skilled jobs, however this is debatable (Selwyn, 2009).

According to labor process analysis, new technology may exacerbate workforce dispersion, limiting workers' ability to organize. The working class is divided by gender, color, ethnicity, and age. However, skill, task, and occupation fragmentation within a labor force is possible. New technologies necessitate new abilities, which may lead to new categories of workers with varied incomes, tasks, and union representation. A more fragmented labor force is more difficult to organize and increases worker reliance on employers.

Several aspects determine whether or whether technology exacerbate capital's hold over workers, increase labor productivity and deskilling, and contribute to class fragmentation. Impacts vary depending on the technology, economic sector, and manufacturing techniques used, as well as the political institutions and power relations that shape the employee-employer relationship. The latter emphasizes worker agency in examining control. While workers' agency is lacking from LPT's early texts, the second wave emphasizes its role in influencing control and the labor process. Workers can and do oppose control tactics by collectively organizing and unionizing, as well as individually, by working slowly or destroying machines.

While no comprehensive statistics exist on the usage of digital technologies in German agriculture, a 2015 survey of 500 farms, including cattle farming, reveals that over 80% of farms employ digital technology in some way. The most widely utilized digital agricultural technology in Germany are GPS-enabled farm machinery (45%) and smartphone applications (apps) (used by 40 percent of respondents). Smart machines provided site-specific pesticide and fertilizer treatments for 32% of respondents, while sensors were employed by 28%. Robotics and drones were employed by 13% and 11%. Digital farm management tools like digital communication tools and digital field management systems were also widely employed by around half of the respondents.

On farms with big permanent or seasonal workforces, workforce management software is extensively employed (Adusumalli, 2017a). One company claims their software manages seasonal workers' contracts, wages, and social security needs for over 40% of all seasonal workers in Germany. Many other employers probably utilize comparable tools. This usually includes mobile or desktop software for contracting, timekeeping, and work documentation. Some firms offer both software and harvesting devices. The data is automatically delivered to workforce management software to compute each worker's total work time. Using barcode or QR scanners to link each box of harvested vegetables to a specific worker is becoming more popular. Some farms use computerized scales to weigh boxes, and others use optical sorting devices. It can then be digitally transmitted into the workforce management system, which calculates each worker's total wage based on their working hours and harvested produce.

This overview demonstrates the wide range of digital technologies utilized in agriculture, each influencing labor processes in unique ways. The following section can only provide general trends regarding the impact of digital technologies on labor processes in German agriculture, as these impacts vary greatly depending on the technologies used, the crops farmed, farm size, employee count, farming process organization, and farmer, employer, and worker agency (Adusumalli, 2017b).

Digital Technologies and Transparency

Apart from the potential for intensification of the labor process, digital technologies have the potential to enhance the vulnerability of seasonal workers to pay thievery. According to organizations that seek to support and organize seasonal workers, a growing number of seasonal workers are reporting that they are concerned that their employers may be using digital tools to defraud them when it comes to calculating their earnings. Seasonal workers are less able to understand how calculations are done and measurements are taken as a result of the arrival of digital scales and gadgets that automatically record and compute labor hours for them. There is currently no evidence that digital technologies are being used to facilitate wage theft in Germany, but this may change in the future. In other instances, however, there have been reports of wage theft being made easier by the use of digital technologies. In Canada, for example, it has been reported that computer timesheets have been used to incorrectly calculate salaries. But farmers who employ seasonal workers believe that digital technologies may actually have the opposite effect: by digitalizing the measurement of work time and workers' output, employers will no longer be able to cheat, because everything is now automatically and digitally reported, rather than the other way around (Pasupuleti, 2015c).

Although workers' concerns are focused on the specific issue of increased employer control over workers through surveillance, they also speak to the broader issue of how digital technologies contribute to the opaqueness of certain aspects of the labor process as a result of information being concentrated at the level of farm management. However, while digitalization of agriculture is generally hailed as a tool to increase transparency along supply chains, this is not always the case from the standpoint of labor, particularly for seasonal workers, who may lose access to critical information such as physical records of work time or harvested products. Moreover, for permanent employees who work with digital machinery, it may not be able to determine what information is actually being recorded about them and their job by their employer, nor to determine how farm management intends to use this information.

Agricultural Skills and Working-Class Fragmentation

My interview results contradicted claims made in the LPT literature that digital technologies de-skill workers, and similar claims made in the digital agriculture literature that these technologies may erode farmers' agricultural and ecological knowledge. Farmers who used seasonal labor and digital tools said they still needed qualified personnel and trained their seasonal staff extensively (Adusumalli & Pasupuleti, 2017). A professional staff is especially crucial for harvesting fresh fruits and vegetables, which must meet the strict quality criteria of large consumers like supermarket chains and wholesalers.

Permanent employees and farmer-operators did not perceive a loss of abilities, but rather gained new skills through the use of digital technology, such as operating complex machinery and software. One farmer said that he and his father had expanded their family farm company to include digital mapping services using drones.

The farmers' impression of acquiring skills and knowledge rather than losing them may be linked to the digital tools they choose to use. Others argue that digital decision support tools for farming may endanger farmers' experiential expertise. My responders did not use these technologies. However, farmers in the Global North have long used external information and data. In German agriculture, decision-making involves farmers, farm advisers, chambers of agriculture, regulators, supply chain actors, and other farmers. Similarly, using data on weather, seed kinds, or weeds was routine practice before the advent of digital platforms, digital support systems, and agricultural applications.

Digital Technologies and Labor Dependency

It is suggested that robotics and other technology, such as optical sorting machines, will replace manual and low-skilled labor in agriculture. In line with this logic, German farmers consider digital technologies as a long-term instrument to lower farm costs, including labor costs in the horticultural sector. High labor expenses, due to the 2015 minimum wage hike, and difficulty obtaining trained workers are driving factors for farmers to engage in robots and automation. Germany has yet to adopt robotics. According to a Bitcoin and German Farmers Federation study, about a third of respondents expected to invest in robotics in the near future. Rather than a rupture or revolution, digital agriculture appears to be a continuation of long-standing agricultural attempts to produce labor-saving machinery and devices. Robotics or automated sorting devices have allowed farmers to replace some of their manual workforce. But none of them could totally replace manual labor. While robotics and automated sorting methods cannot yet completely replace manual labor, they may help stabilize and reduce the cost of labor in agriculture by making certain workers redundant.

As a result, less manual labor is required, and workers can no longer simply switch jobs. Nonetheless, the German agriculture sector is currently experiencing seasonal and permanent workforce shortages. Workers from Poland, Germany's closest neighbor, used to be the majority (Pant and Odame, 2017). However, seasonal workers from Romania, Ukraine, and even Georgia have increased in recent years. This is partly due to the narrowing of the German-Polish wealth gap and the consequent drop in Polish seasonal employment in German agriculture.

Discussion and Conclusions

As part of a preliminary investigation, this exploratory study looked into how digital technologies are influencing labor processes in the German horticulture and arable farming sectors. It demonstrates how digital technologies are being utilized to increase monitoring and control over both the permanent and seasonal labor force, as well as to intensify the labor process.... The study also demonstrates that while digitalization is being hailed as a critical tool for increasing transparency in agricultural production and the food system, this is not always the case when looking at it from the perspective of laborers (Littler et al., 1982). Workers may find it difficult to comprehend, track, and exert control over the data that is being gathered and reviewed about them and their work performance, as well as how this data is utilized to compute their work time and wages, among other things. Such findings are not exclusive to Germany, as they have been recorded in a variety of other contexts. Workers in Canadian greenhouse farming, for example, are required to wear smartwatches to monitor their performance, while robots and harvest machines are employed to regulate the speed at which workers work. As a result, digital Taylorism has made its way to the farms and fields (Pasupuleti, 2015b). The fact that what has happened is not entirely surprising. For the most part, Taylorist methods have been researched and critiqued in relation to the industrial sector, and more recently, in relation to the digital economy.

While this exploratory study identifies some significant shifts in labor control techniques as a result of digital technology, further systematic research is required to understand how these new control methods affect agrarian workers' agency and worker organization in the agricultural sector. Agrarian employees, particularly seasonal laborers, may find themselves under constant monitoring, which may have a severe impact on their ability to organize. In sectors that are underrepresented by labor unions, such as the agricultural industry in Europe, everyday interactions between workers during work breaks can be critical for organizing among themselves and for promoting contacts with labor organizations during field visits by labor organizations (interview with organizations supporting agrarian workers, 6 November 2020). Contacts during working hours may become increasingly difficult due to the use of constant surveillance measures, as well as an intensification of work processes, which reduces the likelihood of interactions during working hours.

The loss of agricultural skills and knowledge gained via hands-on experience, which has been proposed as a consequence of the digitalization of agriculture, did not appear to be a significant issue in my interview data. Farmers in particular, but also permanently employed individuals, stated that they were obtaining new skills and improving their knowledge about soil quality as a result of the usage of digital technologies, such as those used to monitor soil quality. Although it is possible that gaining such new skills will be more difficult for an older generation of farmers and workers than for a younger generation who is technologically adept, this could result in working-class split along generational lines (Pasupuleti, 2015a).

Finally, my research lends weight to the hypothesis that robotics and automatic sorting equipment may one day replace manual labor, which is currently primarily performed by seasonal migrant laborers in the United States. However, given the current state of digitalization in agriculture, obtaining a competent seasonal workforce in Germany, as well as in other OECD nations, remains a significant difficulty for farmers. Even while farming robots are currently available, they are not yet commonly used in German agriculture, and even the most advanced of these machines cannot totally replace manual workers performing the same tasks. Also to be determined is how well robots and autonomous machines will be able to deal with the more diversified and frequently small-scale agricultural structure that is still prevalent in many parts of Western Europe.

As this article has demonstrated, digital technologies in agriculture are also contributing to a rearrangement of the agricultural labor process, which is a positive development. To successfully build and implement digital technologies that can successfully encourage a sustainable agrarian system in Europe, sustainability must be viewed not just in ecological but also in social terms (see for more information on sustainability). This might be accomplished, for example, by incorporating elements of the 'just transition' paradigm into the agriculture sector. Since the 1970s, labor unions have advocated for a 'just transition' to a post-carbon future that includes social demands for fair and equitable work, employment, and working conditions, among other things. Likewise, this is a call that is pertinent for today's agriculture sector, which includes both farmers and agrarian employees.

The social sustainability of agricultural policies, on the other hand, must be aggressively promoted. Labor is expensive, and farmers are subjected to intense pricing and quality pressures from supermarkets and wholesalers, making it difficult to ensure fair and equitable working conditions for their employees. Consequently, in order to give an alternative to merely replacing manual labor with robotics and automation, new legislative measures that allow for "good employment" in agricultural production are required. For sustainable farming enterprises, high labor costs must be made affordable. One way to do this is through a distinct system of European CAP subsidies that are allocated on a per employee basis rather than on a per hectare basis. More labor-intensive sustainable agricultural production strategies that contribute to reducing agriculture's impact on the environment while simultaneously creating new employment opportunities in rural communities may be favored in this scenario.

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