

Social Implications of Drone Technology on Migrant Farm Workers

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On my honor as a University Student, I have neither given nor received unauthorized aid on this assignment as defined by the Honor Guidelines for Thesis-Related Assignments

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1. Introduction

Agriculture is experiencing a Digital Revolution, an era defined by the integration of digital electronics and automated technologies onto farms. This includes drones, technology used in agriculture to perform remote mapping, surveying, and spraying (Ku, 2021). As a reliable agricultural tool, it has the potential to displace migrant farm workers, people hired during peak seasons to perform farm manual labor. These workers come from ethnically and socioeconomically diverse backgrounds with most being of Mexican descent (Rural Poverty, 2019). The integration of farming drones could cause these workers to lose their jobs and increase the marginalization they experience.

I use a case study to analyze the social impact of drones on the migrant farm worker population in the United States. My argument is that drone integration will marginalize an historically vulnerable population in the United States by compromising their job security, and the improvement of government support programs is necessary to support this population once technological displacement becomes a reality. I bring in historical texts which detail the origins of the migrant farm workers system will describe the roots of their exploitation and marginalization in North America. I also analyze technological trends in agriculture to highlight the agricultural industry's motivation towards automation on farms. The sociotechnical imaginaries of farm workers in Rwanda will provide parallels to the opinions of farm workers in America. Then, current government programs like the National Farmworker Jobs Program (NFJP) will be evaluated based on their effectiveness. Through this study, I shed light on the concerns of these workers and suggest potential improvements to the NFJP and farm worker support programs in general to prevent future marginalization of this population.

2. Origins of Migrant Farm Worker Exploitation

In the early 1900's, there was an increased demand for temporary labor associated with the commercialization and growth of farms. Despite the economic growth of the agriculture sector, costs of machinery, buildings, land, and equipment continued to rise. At the same time, there was a shortage of farm labor due to the job's low wages and limited upward mobility. As a result, large farms had to rely on the exploitation of cheap labor to perform labor intensive farm operations. Workers were hired during short growing seasons, and technological constraints sustained a system of small-scale farming where a large number of pickers were needed for short periods of time. To meet these needs, farms relied on a system that employed large groups of temporary workers for low wages under poor working conditions.

The migrant farm worker system was first established by the Farm Labor Service (FLS), and it involved assigning crew leaders to recruit workers to perform particular jobs on the farm (Friedland, W.H., & Nelkin, D, 1972). The crew leader wore many hats as they played the role of contractor, camp manager, supervisor, policeman, and banker for their crews. Using the incredible amount of control they had, crew leaders assembled a compliant workforce that was heavily dependent on them.

One wonders how crew leaders were able to accomplish this for decades, and it's attributed to a couple factors. At the time, it was difficult for workers to assemble and fight for fair working conditions because the crew leaders cultivated a distrusting and hostile work environment. Due to the temporary nature of their work, workers were competing with each other for certain jobs on the farms. Crew workers assign farm workers to be "lieutenants" who were responsible for allocating jobs as a means of dispensing favors and creating social obligations that emulate modern office politics. Tensions were so high that workers often carried

knives and locked doors behind whenever possible. Additionally, workers were reluctant to accept position of leadership on the farm resulting in their lack of representation in more influential roles. This made unionizing unfathomable in the early days of this exploitative system (Friedland, W.H., & Nelkin, D, 1972).

Farms also took advantage of the migrant farm workers' status as immigrant. During this period, they lacked legislative coverage available to U.S. born workers like minimum wage, unemployment and disability insurance, and the right to self-organize (Friedland, W.H., & Nelkin, D, 1972). These barriers caused workers to develop an attitude of silent compliance and internalized grief that enabled ongoing exploitation. Workers lacked protection until 1960 when the Senate Subcommittee on Migratory Labor was established (Friedland, W.H., & Nelkin, D, 1972). This was due to the rise in organization among semi-skilled and unskilled factories in response to major catastrophes and public exposure of appalling work conditions. I argue that without public scrutiny, farms would've continued exploiting migrant farm workers as a cost saving measure. Once the cost of drone production, implementation, and maintenance becomes cheaper than it is to hire migrant farm workers, it's extremely likely that these workers would lose their jobs as evidenced by how they've been treated by farm companies in the past.

3. Marginalization and Racialization of Cheap Labor

The system of temporary farm labor is representative of the marginalization and racialization cheap, unskilled workers experience. They endure poor living conditions due to low wages, lack of insurance, and limited upward mobility due to lack of education. Immigrant workers are further disadvantaged by their lack of English-proficiency and status as minorities. As a result, these workers are pigeonholed into unskilled labor work. Agricultural corporations

take advantage of this and assemble an obedient, exploitable workforce. Additionally, these workers are disposable from the employer perspective as they are willing to displace workers once automated technologies become cheaper to produce. One of the most significant job displacements occurred in the 19th century during the Industrial Revolution, where agricultural technology eliminated millions of farm jobs. Technological displacement is a widespread problem across many industries, especially those reliant on manual labor. Creating additional job opportunities for farm workers alone isn't enough. Even if migrant farm workers find similar blue-collar jobs elsewhere, they will continue to compete against emerging technologies in order to make a living.

One of the reasons why there isn't much research surrounding drones and their racial implications is due to the lack of conversation in the drone community. In 2018, a study was conducted involving focus groups who discussed issues surrounding drone use. They were divided into 2 groups which included "established users", who were exclusively white, masculine males, and "emerging users" who were more ethnically diverse. It was found that the established users largely avoided discussions of socially structural inequities such as immigration and racial profiling, in favor of topic like trespassing, personal property damage, and "Peeping Tom" actions (Olson, P., & Labuski, C., 2018). As topics irrelevant to them, it's unsurprising that topics like race and gender were not the focus compared to the "emerging users" group. With active drone users being primarily white, masculine men, there's evidence of how discussion amongst similar groups ignore and marginalize issues that arise for migrant farm workers once drones become actively adopted. The decreasing job opportunities for migrant workers and their lack of visibility in these discussions reflect a legacy of racism and ongoing

patterns of colonization. As engineers, it's important to obtain feedback from a diverse user base when studying the social impacts of farm drone technology.

4. Technology Social Trends in Agriculture

Unfortunately, technological displacement seems imminent as evidenced by the growth of agtech companies during the Digital Revolution. In 2017, agtech valuation reached \$1.5 billion, and venture capital investment has grown by 80 percent annually since 2012 (Rotz et al., 2019). These companies are developing labor saving technologies in areas such as transplanting, pesticide application, and grading. Emerging startups in these fields are quickly being acquired by agri-food and retail giants like John Deere, Walmart, and Nestle. These trends indicate that companies will prioritize investments in automation technologies over initiatives that improve migrant farm worker conditions and training.

Additionally, farming operations are integrating sensors, robots, and decision support systems that require support for programming software, hardware maintenance, and grant writing. Migrant farm workers don't meet this skill demand as their job responsibilities include seeding, watering, picking, and spraying, which may soon be automated by drones. It's been predicted that farm manual labor and pesticide applicator jobs will be most highly automated by 2030 (Rotz et al., 2019). Skilled labor job opportunities increase with the usage of automation technology while unskilled laborers are disproportionately affected. Many are forced to transition into service sector areas such as fast food and retail, but these fields are also threatened by automation. Blue collar workers in these fields are experiencing negative economic impacts as the adoption of robots in the labor market decreased employment-to-population ratio by 0.39 percent and average wages by 0.77 percent (Acemoglu & Restrepo, 2020). This demonstrates

that the integration of drones will endanger the employment opportunities for these workers and lower their earning potential. Automation essentially absolves farmers from public pressure to improve the opportunities and livelihoods of migrant farm workers. As engineers, it's important to understand the priorities of these agtech companies and to support programs that make these workers more competitive in the labor market once they lose their jobs to the technology we create.

5. Opinions of Migrant Farm Workers

When considering the direct impacts of drone technology on migrant farm workers, it's important to obtain the opinions of the affected population in question. While these studies are sparse in the United States, other foreign nations have conducted similar research that we can draw parallels to. In 2020, a study was published that analyzed the sociotechnical imaginaries of Rwandan farm workers regarding the integration of drone technology into their workplace. Interviews were conducted with workers directly impacted by the drone implementation initiative. Some participants initially expressed excitement for the technology as it could perform hazardous jobs like pesticide application in their stead. These workers experience a myriad of health issues including heat exhaustion, pesticide exposure, and various injuries due to the physically taxing nature of their work. Having drones shoulder some of the burden of their arduous work is welcomed by farm workers. Workers refer to Rwandan media coverage of delivery drones and similar technologies that automate labor in a similar manner (Hanrahan, B. V. et al., 2021).

On the other hand, there were many workers who expressed concern for their privacy, safety, and job security. Some workers were worried that drones would be used for surveillance

and evaluation of their work. Drones could induce mental stress on these workers due to their unnerving presence as a monitoring tool. Other workers expressed safety concerns towards the dangers of autonomous drones related to accidents. Loss of battery life during flight could be catastrophic and costly for farmers. However, one of the greatest concerns was for their job security. The threat of automation was most imminent to workers who performed manual tasks because they believed this technology would benefit the rich at the expense of a “poor person’s daily income” (Hanrahan, B. V. et al., 2021). Because their job role is slowly being becoming redundant in the presence of these drones, the only way these workers could keep their jobs is if their work revolved around maintaining and working with these drones. Since these workers lack a technological and educational background, these fears were slowly becoming a reality.

To appease these concerns, farm workers express a desire to engage in labor up-skilling, mentorship, and cooperative labor pooling as well as collectivized automation (Hanrahan, B. V. et al., 2021). These workers are open to learning how work with drone technology with the hope that this technology aids them rather than replacing them. The sociotechnical imaginaries of Rwandan workers are also comparable to those of migrant farm workers in the United States as they are also experiencing a similar Digital Revolution. The implementation of labor up-skilling programs is necessary to enable workers to find other jobs. Drone technology developers should also consider how drone technology could collaborate with farm workers. Facilitating a symbiotic relationship between drones and farm workers who have the means of obtaining the knowledge to operate these robots could also prevent job displacement.

6. Analysis of National Farm Workers Job Program

The National Farmworker Jobs Program (NFJP) is a nationally-administered program that provides grants to community-based organizations and public agencies that support migrant farmworkers and their dependents. They offer a range of services including Career Services, Training Services, Youth Services, Related Assistance Services, and Housing Services. Fortunately, this program aims to provide farm workers with the necessary skills to advance in their agricultural jobs or obtain stable employment in other industries. Career Services offer career planning resources, job search assistance, and financial literacy courses. Training Services provide occupational skills and job trainings to help these workers transition into in-demand industries. Youth Services provide tutoring solutions to increase graduation rates and enable them to further their education. This program addresses the needs of many farm workers with regards to economic stability, and there has been a significant amount of grants awarded. In 2021, the Department of Labor awarded NFJP Career Services and Training grants valued at around \$86,946,000 in the United States and Puerto Rico (National Farmworker Jobs Program).

This program, however, is not a perfect solution to the ongoing concerns of technological displacement. While there are 3 million migrant farm workers in the United States, a report published in 2013 stated that the program served only 19,700 participants with its \$78 million funding (Clary et al., 2013). It's especially important for more migrant farm workers to participate in this program, so increased funding is necessary.

Many farm workers also experienced little wage increases as a result of agricultural skill up-leveling. Programs in the Training Services organizations offered certifications in tractor licensing, pruning, and farm management, but these certifications did not always result in wage increases. As farming technology continues to evolve, positions operating farming machines will

need more high-skilled individuals, and special training will be required in order to operate this machinery. Large farms utilize precision machinery that requires more than a quick training program to operate, which is beyond what the program can fund for (Clary et al., 2013). Without additional funding, this program can't train these workers in the technical skills needed to remain a valuable resource on farms that utilize agtech.

Another barrier this program struggles to address is the migrant farm worker's socioeconomic status. These workers don't have the luxury to attend specialized training programs because they have to support the financial needs of their families. While stipends are available for fixed periods of time, from several weeks to over a year, program participants said that the lack of income was still a burden on them (Clary et al., 2013). These organizations need to come up with strategies to provide financial support to program participants such that they are able to improve their skills without worry.

Migrant farm workers also state that despite the presence of retail jobs in their areas, these positions were not a great fit for farmworkers who lacked remedial education and/or English-language skills (Clary et al., 2013). NFJP funding can be used to further the education of these workers, but these must come in the form of scholarships to address their financial hardships. Many services providing organization cite a need for collaborations with educational institutes to provide ESL classes for these workers. They should consider working with nearby community colleges to create programs that combine occupational skills and ESL training, but organizations are unsure about how to initiate the process (Clary et al., 2013). Additional government intervention and funding is needed to mitigate the educational barriers migrant farm workers experience.

While program providers emphasize improved employment outcomes for migrant farm workers upon implementation of this program, they are unsure of what factors contributed most to positive economic outcomes. This could include factors like age, educational level, motivation, and available training programs in their area. Increased research on the association between these factors and employment outcomes would help the NFJP allocate resources to services that provide the most benefit to migrant farm workers. Organizations will also have to follow up with participants more frequently and simplify the reporting process. Program providers have difficulty staying in contact with program participants and tracking their career and educational programs resulting in more biased data. By improving research initiatives, we can obtain more valuable data that can be used to further improve this program.

6. Conclusion

Through an analysis of the history of migrant farm worker exploitation, marginalization of cheap labor, technological trends, and government support programs, I found that drones pose great social concerns for these workers as it endangers their job security and livelihood. There already exists a program, NFJP, to address these concerns, but there is room for improvement. As technology continues to evolve, so does the training that is required to operate it. Technological displacement pervades many industries that rely on manual labor, so it's necessary to give migrant farm workers the opportunity to up-level their technical skills while also giving them the financial means to support their families. In order to enact these improvements to the NFJP, additional government funding is needed. Additionally, there should be more collaboration between the government and facilities like community colleges, worker associations, and similar programs to obtain more resources for paid, upskilling programs. While

this program does find a correlation between participation in this program and better employment outcomes, additional research is needed to better understand this phenomenon, which also requires additional funding. If there is enough investment made in the training, education, and skill development of migrant farm workers, it could open the door to more opportunities for them while addressing their technological displacement concerns. With these resources, they will be able to improve their skills, find more stable jobs, and provide for their families in the process of participating in this program. As engineers and constituents, it's important to advocate for programs that support those who are marginalized by the technology we create. Drones and similar robotic technologies will continue to revolutionize the labor industry with potential adverse impacts on those unfamiliar with the technology. By providing farm workers alternative means of employment as these drones displace them, we can limit the marginalization of their issues and give them more opportunities to pursue economic freedom.

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