Migrant Farmworkers' Experiences of Agricultural Technologies: Implications for Worker Sociality and Desired Change

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ABSTRACT

This mixed method study situated in Ontario, Canada, investigates how migrant farmworkers' experiences with agricultural technologies (agtech) affect their attitudes, conditions, and expectations of work, and how workers envision technologies serving as supportive interventions. Through a survey and interviews, we identify that surveillance and tracking agtech (chequeadoras) affect workers, imparting negative health and safety consequences. Workers' interactions with chequeadoras reveal three major impacts: performance expectations engender stress, surveillance causes fears of disciplinary action, and performance tracking heightens competition. These impacts demonstrate how chequeadoras erode workers' capacity to build sociality and solidarity. In response to these impacts and to support workers' desired workplace changes, which aim for safer environments with technical skill development opportunities, we examine tactics from HCI, critical design, and migrant justice movements. Our findings lead us to contemplate what qualifies as agtech and how we may support marginalised workers with divergent opinions regarding workplace technologies, and desired collective change.

CCS CONCEPTS

• **Applied computing** → **Agriculture**; • **Human-centered computing** → **Empirical studies in HCI**; *HCI theory, concepts and models.*

KEYWORDS

digital agriculture, agriculture, farming, agtech, migrant labor, surveillance, managed workforce, workplace technology, greenhouses, worker advocacy, sociality, labor organization, social justice, mixed methods

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1 INTRODUCTION

> *La tecnología nunca apoyará al trabajador. La tecnología apoyará al paltron, al propietario. Siempre.*
> Technology will never support the worker. Technology will support the employer, the owner. Always.

Miguel,[1] a Guatemalan migrant greenhouse farmworker of 13 years, shares his perspective on agricultural technologies (agtechs). We sit across from one another in Leamington, Ontario, at a park picnic table overlooking Lake Erie. Miguel wears a black baseball cap and a t-shirt with a red maple leaf centered across his chest. Occasionally massaging his right wrist bound in a splint, he tells me: *"I no longer go to work like when I was 20 years old. My body feels more and more tired. I'm not going to be able to do the same [work], I'm going to have to dedicate myself to other tasks"*. With carpal tunnel syndrome and a knee injury, Miguel estimates he has about 2 years left before having to retire at the age of 49. Before leaving Canada for good, Miguel thinks he may save up to buy a taxi cab back in Guatemala. The physical strain of agricultural work will not allow him to return to the *campesino* (peasant) farm work that got him his first job contract in Canada in the early 2000s. Miguel is one of about 10,000 migrant farmworkers who live in Essex County, Canada's southernmost region. In Essex, the muncipality of Leamington contains the highest concentration of greenhouses in North America [48]. Representing Canada's most technologically advanced agricultural industry, horticulture is a rapidly expanding business, increasingly supported via governmental and private investments [1, 45]. Agtechs are commonly recognised as technologies that apply techniques *"to control the growth and harvesting of animal and vegetable products"* [112]. More broadly, agtechs are seen as strategies to improve food security and mitigate climate change [2]. Given Essex's boom in horticulture and agtechs, and the county's reliance on migrant labour, it is critical to consider how these technological developments converge with workers' lives and experiences.

Migrant farmworkers occupy notoriously precarious positions in Canada [8, 122]. Although most arrive through state-run temporary programs [121], workers still face many risks related to their legal status, work conditions, access to health care, and so on [8, 19, 71, 86, 102]. In Ontario, the province where this study was conducted, migrant farmworkers are denied employment rights such as overtime pay, minimum wage, and the right to collectively

[1] Name anonymised

bargain [64]. Migrant support groups have expressed concerns about agtechs [91, 107], particularly the rise of surveillance and tracking technologies in agtechs [39]. With a handful of relevant literature available [39, 91, 92, 99, 107], none from HCI, there is currently a gap in public and academic scholarship regarding how migrant workers are impacted by agtech in Canada.

This embedded mixed methods study helps to bridge this gap by investigating: **RQ1**: How do migrant farmworkers' experiences with agtech, particularly those that surveil or track their labour, impact their attitudes, conditions and expectations regarding their work? and **RQ2**: If at all, how do migrant farmworkers envision agtech's role in the future and how may these technologies better support working conditions and well-being? To answer these questions, in the first phase, we collected exploratory quantitative survey data with 108 participants to determine which agtechs workers are most affected by and their corresponding attitudes. We relied on these data to design our second in-depth qualitative phase: through individual and group interviews with 22 workers, we investigated how workers describe their experiences with agtechs, and corresponding conditions and attitudes. We also asked workers what changes they desire regarding how technologies are used at work and how, if at all, technologies may be more supportive.

Our findings suggest that surveillance and tracking agtech affect workers by imparting negative health and safety consequences. Workers' interactions with these agtech reveal 3 major impacts: performance expectations engender stress and pressure; surveillance causes fear of discipline; and performance tracking heightens work competition. These impacts demonstrate how these agtechs can erode workers' capacity to build sociality, fragmenting opportunities for solidarity. We also learned that workers want safer, more ergonomic work environments with opportunities for technical skill development. Without external pressure, workers feel that the Canadian government and employers are unlikely to guarantee such changes. Workers' perceptions of agtech, collective action, and their desired changes seem to vary across social categorisations (e.g., nationality). From these findings we ask: what constitutes agtech and under what conditions? And how can the HCI community support marginalised worker groups with intersectional identities and opinions regarding the role of workplace technologies and collective action? Finally, we examine tactics from HCI, critical design, and migrant justice movements as a means of addressing the above questions, exploring possibilities and limitations of technology's capacity to serve as a positive intervention.

2 BACKGROUND

2.1 HCI and Agriculture

HCI projects addressing agriculture-related technological systems, and how to better understand relations and impacts between agtech, humans, and nature, is a growing area, with most literature published in the past 5 years [34]. This research is divided across multiple subdomains such as Information and Community Technology for Development (ICTD), Community Informatics, Sustainable HCI, and other computing areas like robotics [34]. HCI's widespread interest incites a fragmented and sometimes conflicting set of epistemological assumptions and commitments for how the field should address agriculture. This division is most prominently exemplified in the corpus' joint commitment to industrialised approaches to agriculture and alternative ones like organic farming. While industrialised agriculture prioritises optimisation and control to address food insecurity, climate change, and labour shortages, alternative approaches support small-scale agriculture communities, aiming to redefine our relationship to nature, and mitigate climate change. HCI scholars Bardzell et al. [6] and Biggs et al. [10] acknowledge this disciplinary division, advocating for HCI to shift from supporting industrialised agriculture and to instead re-envision how we design for technological engagements with nature. Liu and Sengers [66] also discuss HCI's attention to industrialised agriculture, but through a historicising lens that ties these developments to land displacement in the U.S., exploitation of racialised communities, and invisible work that many stakeholders must perform to prepare for the introduction of these agtechs.

HCI projects on agriculture commonly address 4 farm types: subsistence farming, organic farming, urban gardening, and commercial farming [34]. Across these types, HCI projects tend to emphasise the farmer as the primary actor, and focus on bridging knowledge gaps related to weather, crops, and pricing for subsistence farmers through the development of accessible ICTs [22, 24, 46, 78], aligning with organic farmers and urban gardeners' needs and values through creating design principles or tools [6, 10, 51, 65, 67, 79, 80, 110], designing prototypes to help farmers offset labour shortages, train workers, and improve crop production [30, 54, 69, 85], and developing more flexible and configurable systems and tools that are more attuned with farmers' technological capacities and lifestyles [63, 67, 100, 111].

Out of these farm types, Doggett et al. [34] note how subsistence farming papers appear to be the most prominent in the HCI corpus despite the lack of recent programmatic scholarship addressing this group's needs and perspectives. Doggett et al. [34] also argue that as many countries are dependent on temporary agricultural work forces, there is an opportunity for HCI scholarship to include and support migrant farmworkers, many of whom are subsistence farmers in their home countries. Attention to farmworkers in HCI is critical as agtech start-up companies typically frame data ownership and privacy in relation to farmers rather than farmworkers even though these companies sell labour system technologies designed to capture worker data [109]. Worker-specific agtech found in Steup et al.'s [109] discourse analysis demonstrates how these start-up agtechs simultaneously expose workers to the risks of automation and surveillance practices [109].

2.2 Tech-Mediated Labour Management Practices

The management of labour is a political process involving the maximisation of labour productivity. Keys to this endeavour are social technologies, e.g., the division of labour and the work incentives that shape worker motivation. The social division of labour, that is, the breaking down of work processes into discrete tasks to be performed more efficiently by workers, is a social process that humans have leveraged for centuries [36, 70]. The manufacturing division of labour [13], rooted within capitalist modes of production, takes the social division of labour a step further by not only segmenting tasks,

but also reassigning workers to specific tasks [108]. Braverman articulates the employer's advantage in this labour division process: "*the first step breaks up only the process, while the second dismembers the worker [...] In destroying the craft as a process under the control of the worker, he [the employer] reconstitutes it as a process under his own control*" [13]. This strategy increases efficiency and employer control of the workforce through intentional deskilling workers of their knowledge and abilities. Early principles of scientific management (e.g., Taylorism [115, 116]) which aimed at optimising labour efficiency through the systematic study of workflows and tasks, also rely upon a manufacturing division of labour. Although superseded by other forms of organisational models by the 1930s, they were foundational in shaping industrial practises and centralising power with employers by determining who had control over the organisation of work [13, 88].

Other historical systems of labour control include systems for managing productivity and facilitating surveillance. Many early examples of systems used to track productivity originate from agricultural labour, such as the physical ledgers used by Antebellum plantation owners to track individual slaves' physical and performance data [97]. Surveillance tools also represented a significant evolution in the politics of work [105] as the entry of digital technologies into workplaces extended the scope and granularity of labour monitoring. From a Foucauldian perspective [42, 43], these technologies were not just tools to increase efficiency, but also tools to heighten managerial control.

These systems of labour control individualise workers, diminishing the potential for solidarity and sociality, e.g., "*the tendency to live as part of a group with clear organisation of social interactions and the ability to cooperate with and adapt to the demands of the group*" [82]. Relatedly, these tactics impact organisational socialisation, which involves "*people learn[ing] about, adjusting to, and changing the knowledge, skills, attitudes, expectations, and behaviors needed for a new or changing organisational role*" [9]. These social processes play an important role in how workers respond to management control tactics, including shaping if workers resist, socialise or succeed in competitive work settings [72, 87].

Recent HCI scholarship has explored the interplay between digital technologies and labour management, focusing on how companies envision workers' role amidst technological shifts [23], and how workers interact and adapt to these systems. Studies have assessed how data tracking and performance monitoring have shaped existing work practices [4, 74, 89], and have raised tensions between privacy and surveillance [53]. Integration of AI systems into work has further precipitated HCI studies on algorithmic management and human-AI collaboration where researchers are investigating its effects on workers [58], and strategies to navigate these algorithms. These studies capture workers' experiences and expectations [84, 95], and how they choose to collaborate with [44, 123] or contest AI systems [52]. Design interventions in HCI highlight the necessity for providing workers with greater control over their work practices [119] and underscore the need for worker-centric designs and strategies to ensure fair work practices [14, 124]. These interventions attempt to counteract an ongoing era of "surveillance capitalism" [125] where data extracted from workers allows further centralising of power in the hands of those who control these technologies. Similarly, in the context of agtech, while tech-mediated labour management strategies promise increased efficiency and reduced waste [5], they also raise questions about data ownership [62, 99], worker autonomy [113], and the distribution of decision-making power [66]. In the face of data-driven and algorithmic management, scholars[14] argue that historical practices of collective action and data sharing between workers remain the most potent counter-strategy to help empower workers.

3 RESEARCH CONTEXT

3.1 Essex County

We conducted our study in the municipality of Leamington and the town of Kingsville; two of Canada's southernmost regions located in Essex County, Ontario. Next to the Great Lakes and the U.S. border, Essex has one of Canada's most humid and hot climates, strategically positioning the county as a hub for a wide array of international agri-food production. In 1909, Heinz established a factory in Leamington, turning the municipality into Canada's "tomato capital" [21], and more broadly transforming the area into a horticultural hot spot. As of September 2023, Leamington has the largest concentration of greenhouses in North America; 135 businesses spread over 1,300 hectares [48]. This $3-billion-industry is expected to grow by an additional 50% over the next ten years [45, 48]. To support this industry, Essex receives the most migrant farmworkers (10,000) in Ontario, representing 16% of Canada' total annual agricultural workforce [45][2] . We focused on Essex because of its high concentration of migrant workers, and because horticulture represents Canada's most technologically advanced agricultural industry [2].

3.2 Temporary Farmwork in Canada and Racial Capitalism

As of 2020, there were 278,762 agricultural employees in Canada; more than half (51.7%) were migrant farmworkers who arrived through federal temporary labour programs the Seasonal Agricultural Workers Program (SAWP), and the Temporary Foreign Workers Program (TFWP) [15, 17]. The SAWP, established in 1966 when Canada reached the height of an agricultural labour crisis, is an 8-month long guest-worker program in partnership with Caribbean Commonwealth countries and Mexico [7, 104]. In 1973, the Canadian government established the TFWP as a way to extend labour contracts to two years and broaden the labour pool to other Global South countries [104]. As of 2021, a quarter (23%) of TFWP workers work in horticulture in Ontario [17]. About half of these workers come from Mexico (43.8%), followed by Guatemala (23.3%), and Jamaica (14.1%) [17]. An uncounted number of workers without legal status, such as those who enter Canada through tourist visas, also represent a notable portion of the workforce [122].

Workers in the SAWP or TFWP are typically bound to one Canadian employer who must provide workers with on-site housing [7, 11, 86]. On average, workers work 10 hours daily, 6.5 days weekly, and are paid hourly [18, 20]. Unlike Canadians, migrant farmworkers are exempted from basic employment entitlements like minimum wage and sick leave [122]. They also face high rates of injury and illness owing to repetitive strain, long working hours, chemical

[2]Ontario receives 24,000 workers, about 39% of the country's total

exposure, and inadequate equipment. They do not receive sufficient health support or worker's compensation [20, 37, 49, 102]. Owing to linguistic and cultural barriers, many experience discrimination and social isolation [7, 71, 103]. In Ontario, migrant farmworkers are restricted in their rights to collectively bargain [64] despite ongoing legal attempts by labour organisations such as United Food and Commercial Workers Union (UFCW) to have migrant workers included [38, 39].

Like many countries, Canada's temporary labour system is entwined in a global, neoliberal system of racialised capitalism, which *"structurally embeds the under-development and dependence of the 'periphery' or global south [...] through 'accumulation by dispossession'"* [50, 121]. In other words, for Canada to maintain its stable position of food system security and accumulation, it must rely on the devaluation of migrant farmworkers from the Global South, who accept legal, social, and employment conditions considered inhumane and illegal to most Canadians. Coupled with the precarious nature of migrant workers' legal and employment statuses in Canada, these transnational imbalances make workers highly replaceable or *"deportable"* [8, 120, 121]. Robinson [94] Gilmore [47], and Manjapara [68] trace the genealogy of racial capitalism back to agricultural methods of production rooted in such seemingly outmoded labour systems as the British West Indies slave trade, and American South plantations. When examining the contemporary structural, social, and corporeal exploitative conditions that migrant farmworkers experience in Canada, it is clear that the underlying mechanics of these historical slave systems have not dissipated; they have only modernised [25, 96, 121].

4 METHODS

4.1 Transformative Embedded Mixed Methods Study

To better understand how migrant farmworkers' experiences with agtech impact their attitudes, conditions and expectations at work as well as if and how workers envision technologies serving as more supportive workplace interventions, we conducted an embedded mixed methods study grounded in a transformative worldview. We leveraged Creswell and Clark's definition of embedded design, which is a "mixed methods design in which one data set provides a supportive, secondary role in a study based primarily on the other data type" [27]. We relied on an accompanying transformative worldview grounded in Merten's [73] transformative research and evaluation framework as our study is rooted in a political change agenda to confront oppression that migrant farmworkers face in Canada [28].

Merten's [73] transformative framework emphasises centering the experiences of impacted communities in the research process and linking inequities and power imbalances to socio-political actions. We align with this framework by working with migrant farmworkers and migrant justice organisations to design our research tools, objectives, and engagement strategies. For example, we responded to community organisations' need to better understand the impacts of agtechs on migrant farmworkers **(RQ1)**. We extended this focus through **RQ2**, which links workers' desires to potential supportive interventions that can help mitigate workplace inequities, particularly those regarding technologies. We co-designed and pilot tested our research instruments with workers and allies to ensure impactful, inclusive and safe processes for participant engagement and data collection wherever possible. In Sections 7 and 8, we connect workers' agtech experiences to their desired changes and ways that the HCI community can support these migrant groups.

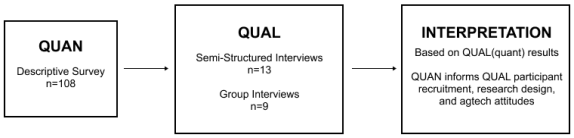

Figure 1: Embedded Mixed Methods Process

Our research design process (Fig. 1) began with a quantitative descriptive survey to better understand which agtechs workers across various demographics are the most impacted by at work, and workers' corresponding attitudes (**RQ1**). These quantitative results informed our qualitative research design of individual and group interviews, which more deeply explored **RQ1** and **RQ2**. This study received ethics approval from the first author's university research ethics board.

4.2 Descriptive Survey

Our descriptive survey[3] investigated which agtechs most impact workers, and workers' attitudes toward said technologies (**RQ1**). We worked closely with migrant justice organisations to create and test the study design before dissemination. We pilot-tested the survey with participants, and landed on a survey model of mostly closed-answer questions to increase accessibility. The survey consisted of 33 questions, addressing details related to worker demographics, workplaces, and tools and technologies. Participants were compensated with a $10 gift card from a national coffeehouse chain. Based on feedback from community organisations, we chose a gift card as the compensation method given the popularity and local availability of the coffeehouse chain amongst workers in Essex County. $10 was deemed an appropriate compensation allotment because the survey was estimated to take approximately 10 minutes for workers to complete. Participants received the gift card regardless of whether they completed the survey. To ensure anonymity, we did not collect identifying information such as names or contact information. We asked workers who were interested in future research to complete a separate contact form following the survey. We occasionally administered surveys orally to support workers with literacy barriers.

We collected surveys in-person in Leamington in 2022, using community events and snowball sampling for participant recruitment. Eligibility criteria included being a migrant farmworker aged 18 years or older who worked in Canada in the last 12 months on a farm that grows fruits, vegetables, mushrooms, maple products, herbs, and/or cannabis. Surveys were available in English

[3] See Appendix A.1 for survey protocol and questions

or Spanish. We attempted to make our recruitment process as inclusive possible (e.g., regarding agricultural subfield, gender, nationality, and so on.). However, the 108 surveys we collected were all in Spanish, and most (106/108) were completed by men, likely reflecting the dominant regional demographics for migrant farmworkers.[4] Our migrant justice organisation contacts were mostly Latino themselves, and more connected to their own communities. Following data collection, we digitally transcribed surveys onto a password-protected and secure data-management application available through the primary author's university. We exported these data to SPSS for quantitative analysis.

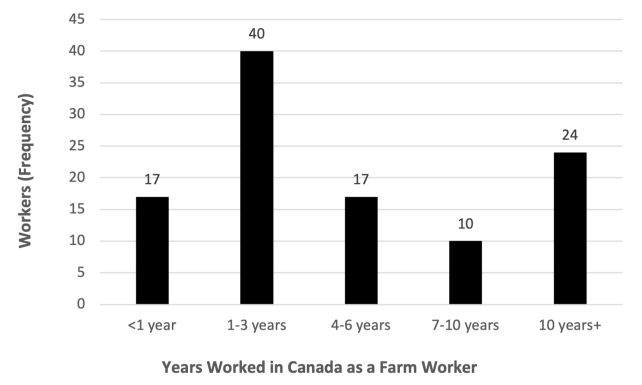

Figure 2: Frequency of Farm Workers and Years Worked in Canada (n=108)

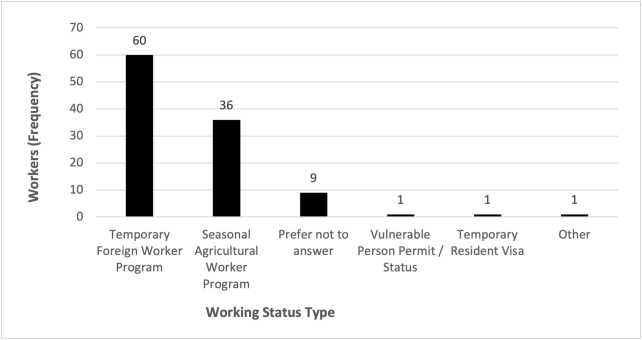

Figure 3: Frequency of Farm Workers and Working Status Type (n=108)

4.2.1 Participant Demographics. Workers who conducted the survey identified as primarily male (n=106) and Mexican (n=102). 90 participants were married or common-law and 18 were single. Most workers had at least one dependent child in their home countries, suggesting that most workers have a family back home. Most participants (n=62) were between the ages of 25-39. 47 workers completed junior high school, followed by 27 who completed high school, and 25, elementary school. Most workers (n=70) identified as *campesinos*

[4]Over two-thirds of TFWP workers in the region are Latino [15], and as of 2020, only 8% of TFWP workers across Canada were women [16]

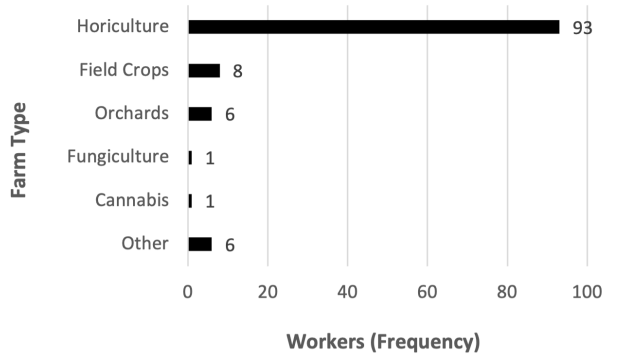

Figure 4: Frequency of Farm Workers across Farm Types (n=115)

(peasant farmers) followed by *albañils* (builders) (n=10). As shown in Fig. 2 and 3, more than half of participants (n=57) worked in Canada for less than 3 years, and 24 workers worked for 10 years or more. Most workers (n=96) reported working through the SAWP or the TFWP, and 9 workers preferred not to disclose their working status. [5] As represented in Fig. 4, most workers (n=93) reported working in horticulture, followed by field crops (n=8), and orchards (n=6).

4.3 In-Depth Individual and Group Interviews

We designed our semi-structured interviews based on an early analysis of survey findings and discussions with community allies, which revealed that workers were most impacted by agtech that track or surveil their labour. These data informed the focus of our interview design, which was to better understand how workers' experiences with surveillance and tracking agtechs impact their attitudes, conditions and perceptions of work (**RQ1**) and if and how workers envision technologies better supporting their working conditions and well-being (**RQ2**).

For participant recruitment, we relied on snowball sampling, and reached out to interested workers who had completed the survey. We conducted interviews from August 2022 to May 2023. In-person interviews were conducted in Essex in a safe setting of the workers' choosing. Individual interviews were approximately an hour, and group interviews ranged between 1-2 hours. Interviews were conducted in Spanish by the first author and an accompanying Latino community member. To protect workers' confidentiality, we did not ask for workers nor employers' names. Workers were compensated $35[6] in cash for individual interviews, $20 for group interviews. Participants received their compensation before commencing the interviews, and were informed that they could stop the interview at any time and still receive full compensation. Community allies advised us to provide participants with monetary compensation at the aforementioned amounts, which was often double workers

[5]Conversations with workers and community advocates suggest that the reported number of workers arriving through state-run programs may be inflated as many workers arrive in Canada on tourist visas and are reluctant to disclose this employment pathway as it is illegal.
[6]Canadian dollars

average hourly wages. We followed these compensatory guidelines to account for how workers were spending valuable and limited time off to engage in an interview with us.

Following the interviews, we transcribed the data into Spanish, and then de-identified and translated them into English. To protect participant data, the primary author locally stored transcriptions in password-protected files. We relied on a professional Mexican translator and community representatives to support an accurate and culturally specific translation process. Following translation, we thematically analysed the data[12]. We shared initial themes, desired changes and possible recommendations from this study with migrant workers, migrant justice organisations, government officials and academics who support migrant workers through disciplines like occupational health and law. Stakeholder feedback informed the focus of our discussion (Section 8), where we address the impacts of surveillance and tracking agtechs on farmworker sociality and solidarity, and explore strategies for mitigating these impacts.

4.3.1 Participants. We conducted 13 individual interviews with workers in-person or remotely, and 2 in-person group interviews with 9 workers. We collected demographic data from individual interviews (Table 1), but did not collect any from more informal group interviews. Most workers were Mexican, identified as male, and were married with children. Six workers were employed through the SAWP or TFWP, and 5 held informal contracts as they arrived in Canada as tourists or asylum seekers. Those arriving through state programs were more likely to come from a *campesino* background. Most worked in greenhouses growing, harvesting, and packaging tomatoes, cucumbers, and peppers. Those in state programs tended to work for one horticultural employer while those working through more informal contracts usually worked for many employers across multiple farming settings including greenhouses, fields, and orchards. Most TFWP and SAWP workers had been employed in Canada for about 4 years while those on informal contracts had worked in Canada for less than a year.

4.4 Researcher Positionality

The first author who conducted most of this study's research design, fieldwork, and analysis is a female, white settler, native English speaker and second-language Spanish speaker from Canada with an academic background in HCI and information systems design and 12 years of experience in community outreach with migrant communities. As a non-Latina, the first author was dedicated to recognizing her own position, limitations and standpoints [57] throughout the research process. With the aim of helping migrant farmworkers come closer to desirable socio-political action, the first author worked closely with migrant justice organisations to design a study that aligned with workers' values, needs, and lifestyles. Cognisant of the inevitable power differentials in place between herself and workers, the first author conducted most research activities alongside trusted Latino community organisations and allies.

5 WORKER REPORTED IMPACTS OF AGRICULTURAL TECHNOLOGIES

Our descriptive survey indicated that 72% of horticultural workers reported surveillance and tracking technologies as the agtech with the most impact on their jobs (Fig. 5) followed by 40% of non-horticultural workers.[7] 17% of all workers (horticultural and non-horticultural) reported not interacting with any agtechs, 5% identified sensor agtechs, and 6% pesticide spraying agtechs as most affecting their jobs. 11% of workers (Fig. 6) reported having to meet a daily performance quota, which is a specific production expectation imposed by employers.

Fig.7 represents all workers who reported that they are the most impacted by surveillance and tracking agtech (n=68). About 51% of workers either disagree or strongly disagree with the 5 attitudinal prompts with 55% reporting a negative sentiment toward the desire to continue working with surveillance and tracking agtechs, 39% with the prompt that these agtechs increases work speed, 48% disagreeing that they increase quality of work, 63% disagreeing that they improve health and safety conditions and 50% with that they help workers learn new skills. About 27% of workers report strong agreement or agreement that surveillance and tracking agtechs increase work speed (35%), improve quality of work (31%), and help workers to learn new skills (30%). About 22% of workers reported neutral sentiments with the highest neutrality toward increases in work speed (26%), and desire to continue working with surveillance agtechs (23%). We drew from these attitudinal results to better understand workers' sentiments toward surveillance and tracking agtechs, and to inform our qualitative research design.

6 *CHEQUEADORA* SYSTEM AND ITS IMPACTS

Surveillance and tracking agtechs are commonly recognised in agtech start-up spaces as labour system technologies [93]. In conversations with workers, we learnt that they refer to these technologies as *chequeadoras* or *ponchadoras*. The Spanish verb *chequear* (to check) is also used as a noun to describe a person, "*chequeador/a*," who is someone responsible for monitoring people or products in a company [29]. The verb *ponchar* translates to "punch." Loosely, these words translate to the "Controller" or "Supervisor" and the "Puncher." We learnt that while some workers use *chequeadora* and *ponchadora* interchangably, many refer to *ponchadora* as a time-punch machine used for entry and exit, and *chequeadora* as a technology for productivity tracking. To align with workers' perspectives, we will use the term *"chequeadora"* from now on to refer to labour system technologies.

Chequeadoras track work and production data, usually adding these data to a larger workforce tracking system. As shown in Fig. 8, *chequeadoras* are usually comprised of a terminal network and a corresponding device such as a watch, which is equipped with a RFID tag. Fig. 9 represents an interaction process that most greenhouse worker interviewees (P4, P6, P8, P11, P12) reporting experiencing. First, workers check into a production terminal (*chequeadora)* after completing one row of activity such as harvesting plants or weeding. *Chequeadoras* are fixed across the greenhouse, approximately 50 metres apart. Once a worker finishes a row, they go to the *chequeadora* to input the relevant information. Second, workers tap their watch or enter their employee ID number. Third, workers indicate which activity they completed. If workers were harvesting, they move to the fourth step, which is entering the number of boxes

[7] Those working in field crops or orchards

Table 1: Overview of Interview Participants

ID	Age	Origin Country	Married or Not	Past Employment	Years in Canada	Working Status	Farm Type
P1	39	Mexico	Y	Unemployed	4 years	Refugee Claimant	Mixed
P2	65	Mexico	Y	Unemployed	2 months	Tourist	Mixed
P3	21	Mexico	Y	Student	6 months	Tourist	Horticulture
P4	36	Honduras	Y	Farmer/Builder	2 years	TFWP[a]	Horticulture
P5	36	Mexico	Y	Farmer/Builder	4 years	SAWP[a]	Field Crops
P6	37	Mexico	N	Farmer/Builder	2 years	TFWP	Horticulture
P7	27	Mexico	Y	Industrial Engineer	5 months	Tourist	Mixed
P8	47	Guatemala	Y	Farmer	13 years	TFWP	Horticulture
P9	23	Mexico	Y	Student/Farmer	6 months	Tourist	Horticulture
P10	N/A	Mexico	Y	Legal Assistant	5 years	TFWP	Fungiculture
P11	26	Mexico	N	Civil Engineer	5 years	TFWP	Horticulture
P12	59	Mexico	Y	Farmer	16 years	TFWP	Horticulture
P13	34	Mexico	N	Farmer	4 years	TFWP	Horticulture

[a]TFWP is the Temporary Foreign Worker Program
[b]SAWP is the Seasonal Agricultural Worker Program

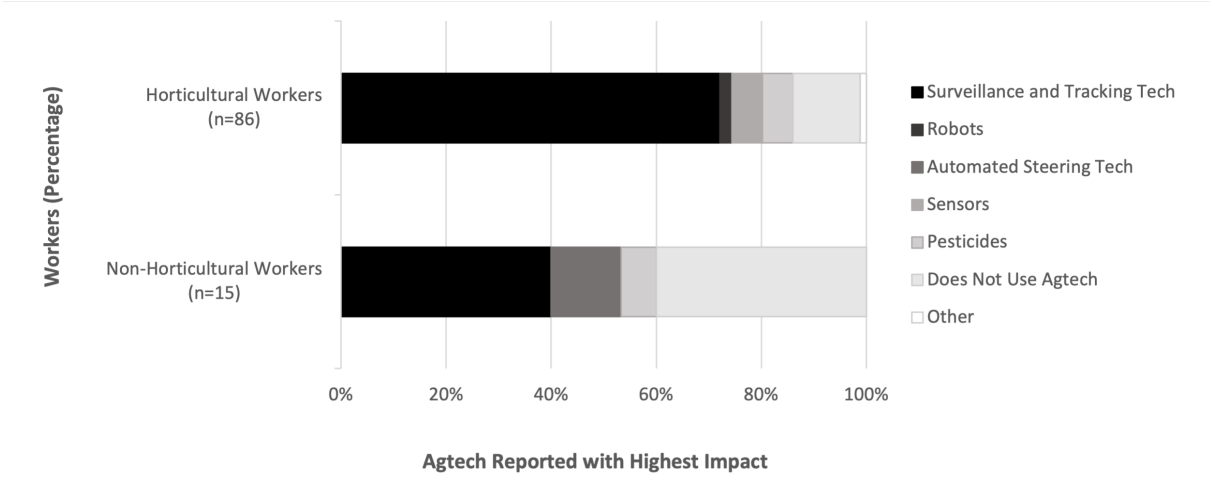

Figure 5: Percentage of Farm Workers across Agtech Reported with Highest Impact (n=101)

they completed in the row. Workers continue this cycle until they have completed the work in their designated zones.

While some workers do not know where the data they enter into the *chequeadora* terminals go, two workers (P4 and P8) reported that their employers have television screens mounted in their offices tracking workers' progress. Fig. 10, a photo taken from a United Food and Commercial Workers (UFCW) report [39], is an example of one such screen, which displays each worker's real-time productivity. The workers on the left side (red bars) have not reached the expected quota while the workers on the right side (blue bars) have [39]. This *chequeadora* system corresponds with our interviewees' experiences: 7 workers reported how their employers actively track their performance daily, and use these data to make production decisions. P8 describes his experience of this cycle of performance tracking:

> *"For example, say I can't do it in 3 days: I go home [to the guesthouse] and don't earn a penny. I am suspended, I earn nothing. And this person who did it in 3 days is going to come and they're going to do my job, the one I couldn't do. They're going to do it on Thursday and Friday. Then I come back [...] the following week. And I have to do it in 3 days. If the same thing happens again, I am sent back home."*

P8's experience exemplifies how in a weekly work cycle, all workers may work Monday, Tuesday and Wednesday. Supervisors then use these data to determine who should work for the rest of the week: the highest performers conduct the remaining work for the week while the lowest performers are asked to "go home" and take unpaid leave until the following Monday. Through this *chequeadora* system, high-performing workers are expected to work harder for the same

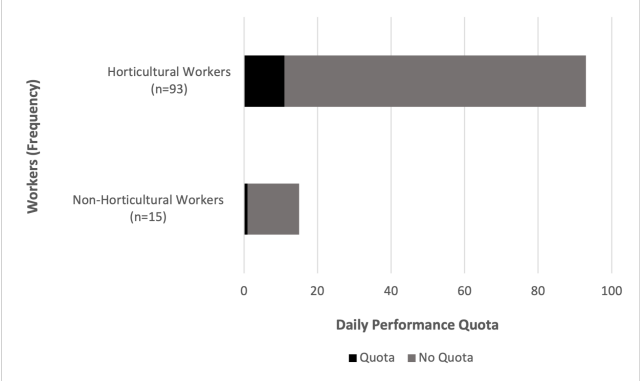

Figure 6: Farm Workers with Daily Performance Quota vs. Those Without (n=108)

pay; low-performing workers do not get paid, and employers save labour costs by reducing employee overhead.

For workers, *chequeadora* systems are primarily driven by punitive rather than compensatory measures. Workers report that the consequences of low performance include 2-3 days of unpaid leave, while the rewards for high performance, as reported by 2 workers (P4 and P8), is a bonus of $10-15 [8] per fortnight. Given that workers reported earning approximately $12 an hour, and working an average of 10 hours a day, the average punitive cost for workers could amount to losing $375 of expected salary in a week, which far exceeds the positive incentive of a $10-15 two-week bonus. Given that workers are often paid hourly rather than by piece-rate, *chequeadoras* do not align with their work incentives. Workers report that instead *chequeadoras* correspond to how supervisors are compensated, which accounts for production amount and associated labour costs. P6 describes the impacts of his supervisor's compensation model on his own work: *"To him [the supervisor], he wants one [the workers] to get the job done much faster because on Saturday he doesn't want to work. He only wants to work Monday through Friday or even Monday through Thursday"* (P6). In a group interview, another worker shared how the *chequeadora* benefits the employer and not the worker: *"It is better for the employer because we work faster [...] The more we do for the employer, the better it is for him because [...] the less time worked, the less pay he has to give."* This worker indicates that he feels that employers leverage *chequeadoras* to maximize their productivity and profitability at workers' financial and physical expense.

Through survey and interview data, we determined that *chequeadoras* impact workers in 3 major ways: work rhythm expectations cause stress, surveillance leads to fear of discipline, and performance tracking heightens competition.

6.1 Impact 1: Work Rhythm Expectations Engender Stress and Pressure

In the survey, we asked workers to identify the agtechs that most impacted them at their jobs, and their corresponding attitudes.[9] Most workers (66/101) (Fig 5) reported that *chequeadoras* had the highest impact on their work. In Section 5, we outlined workers' attitudes toward *chequeadoras* for all participants (n=68) that reported feeling most impacted by them (Fig. 5), and learnt that these many workers believe these agtech impart negative consequences on health and well-being. In Table 2, we further investigate *chequeadoras'* effect on workers by using Mann Whitney U tests to compare attitudinal results across categorical independent groups that we identified as corresponding with strong signals of *chequeadora* usage. These groups include horticultural workers vs. non-horticultural workers (Fig. 5) and workers with a quota vs. without (Fig. 6). From this analysis, we identified 4 findings that correspond with 3 of the 5 attitudinal prompts, outlined in Fig 5 and the survey guide: a) this technology enables me to learn new skills; b) this technology improves the health and safety conditions at my work, and c) this technology improves the quality of my work. We measured attitudes with a sentiment ranking of 1 for strong agreement and 5 for strong disagreement.

As shown in Table 2, we observed a statistically significant difference in the attitudes of horticultural workers vs. non-horticultural workers regarding agtech's role in skill acquisition (U=177, p=<0.1). Horticultural workers displayed more negative attitudes, with a mean rank of 40.43 compared to 26.63 for non-horticultural workers. We also observed a statistically significant difference in horticultural vs. non-horticultural workers' attitudes and workers with a quota vs. those without for the second prompt regarding agtech improving healthy and safety conditions (U=128.5, p=<0.05 for horticultural vs. non-horticultural workers and U=197, p=<0.1 for workers with quota vs. those without). Horticultural workers exhibited more negative attitudes, with a mean rank of 40.66 compared to 22.36 for non-horticultural workers. Meanwhile, workers with a quota reported more negative attitudes with a mean rank of 51.11 compared to 37.4 for those without. We also observed a statistically significant difference in attitudes of workers who are the most impacted by *chequeadoras* vs. those who are not regarding the prompt addressing agtech improving quality of work (U=291, p=<0.1). Workers who are impacted by *chequeadoras* held more negative attitudes, with a mean rank of 40.38 compared to 29.38 for workers who did not *chequeadoras*. All 4 results suggest that most workers who likely use *chequeadoras* disagree that these agtechs enable skill development, improvements in health and safety as well as quality of work.

Workers' negative attitudes toward *chequeadoras*, particularly those relating to healthy and safety conditions and quality of work, were verified and contextualised through our interviews. Labour tracking and production expectations pressure workers to maintain consistent performance rhythms. As work shifts are approximately 10 hours daily, these expectations cause physical, mental, and emotional stress for workers. For instance, employers' demand for consistent work performance is unforgiving toward the care labour that workers often give for their families from afar. As one worker reports: *"workers have families, emotional and psychological concerns and problems with what's happening back in Mexico. They don't always sleep well"* (Group Interview 1). This lack of employer consideration extends to how workers are not given adequate time to rest. P8 describes how *"there is no conscientiousness to some workers who do not have any days off. If they don't come in, they will get*

[8] Canadian dollars
[9] See Appendix A.1 for full survey guide. Question 26 includes all attitudinal prompts related to the agtech that workers' reported being most impacted by.

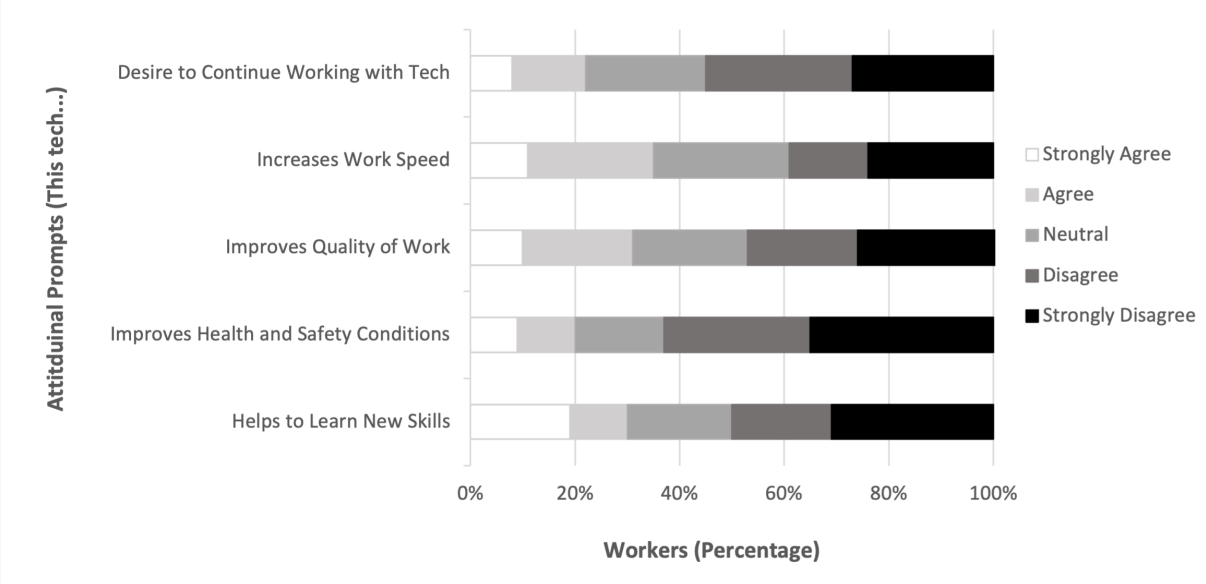

Figure 7: Farm Worker Attitudes Toward Surveillance and Tracking Agtech (n=68)

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(a) Productive Terminal Network

(b) RFID Watch Connected to Network

Figure 8: Productive Terminal Network (*Chequeadora*) Technology

suspended" (P8). P8 and others at his greenhouse have no choice but to continue working or risk being punished. Environmental factors such as temperature can also affect workers' performance. P11 shares how: *"Greenhouses are very hot, which makes it hard to maintain the same pace of work"* (P11).

The long-term health consequences of long hours, performance expectations, and repetitive tasks for workers can be severe. P8 shares that he will have to retire in the next couple of years because of physical injuries sustained on the job. He sees the *chequeadora* as a technology that his employer uses to unhealthily optimise worker performance: *"The body is human and will not tolerate moving at a single speed for a long time [...] The supervisor wants the worker to become a working machine"* (P8). P8's observation that employers expect workers to operate at a mechanic rather than human pace is reminiscent of Taylorist modes of scientific management [115, 116] where task components are broken down and studied to determine optimal completion time, and maximise efficiency. Bound to one

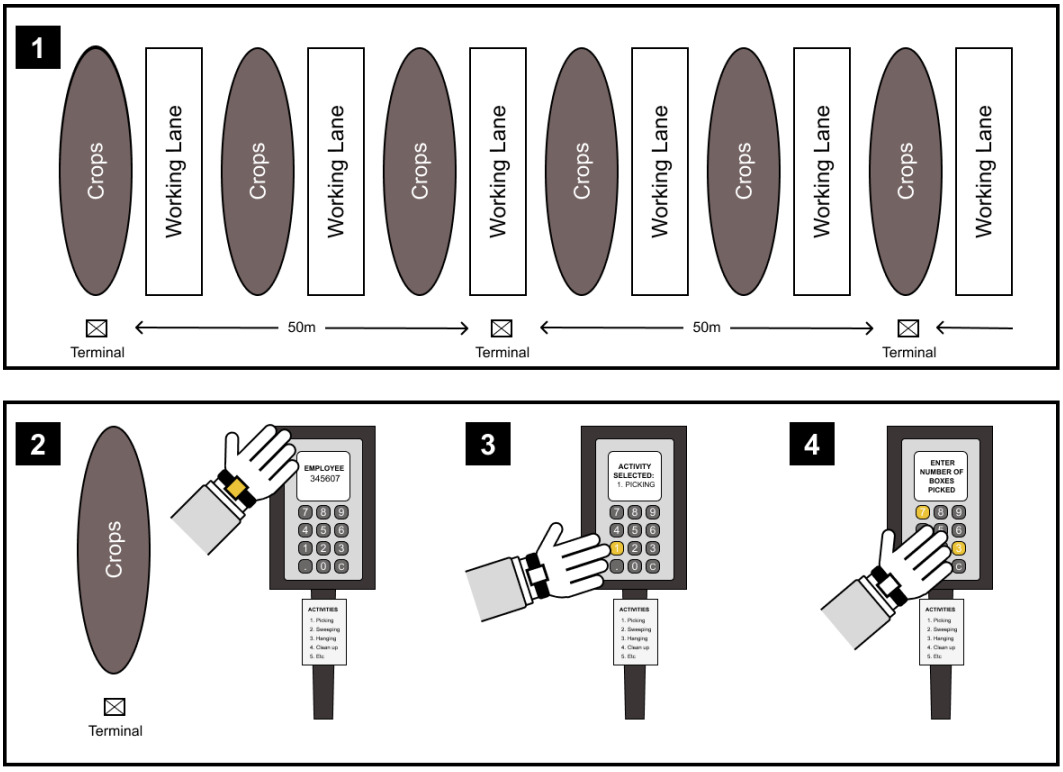

Figure 9: Diagram of Migrant Farmworkers' Interactions with Chequeadora in Greenhouse

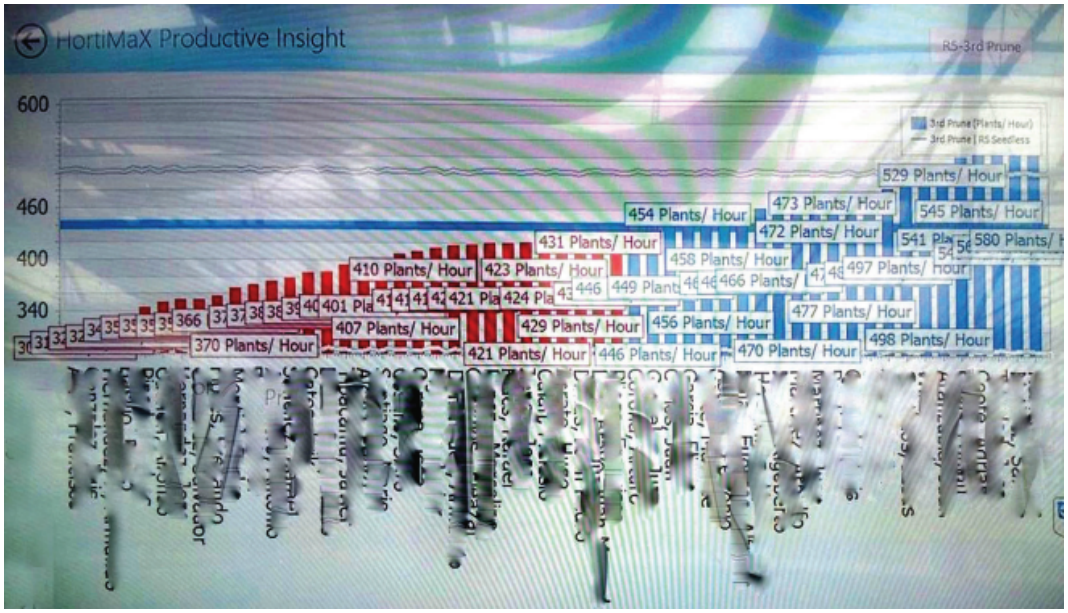

Figure 10: Example of *Chequeadora* Screen, Photograph by UFCW Canada [Public Domain], reported in https://ml.globenewswire.com/Resource/Download/709696c3-7d67-4d2d-bf71-e600701a2c8c

task such as harvesting, workers' performance rhythms are measured and compared to determine who is working optimally and who is not. These heavily managed and standardised employer expectations cause stress, pressure, and physical strain.

Table 2: Mann-Whitney U Test Results: Comparing Attitudes Toward Agtech with Highest Impact on Work Across Various Worker Classifications. The table presents mean ranks for each group with U values indicating statistical significance (*p < 0.1, **p < 0.05).

Attitudinal Prompts (This technology...)	Horticultural (n=93)	Non-Horticultural (n=15)	Quota (n=12)	No Quota (n=96)	Chequeadora (n=68)	No Chequeadora (n=33)
Enables me to learn new skills	40.43	26.63	36.4	39.39	40.33	32.46
	U=177*		U=309		U=331	
Improves work health & safety conditions	40.66	22.36	51.11	37.4	40.59	31.15
	U=128.5**		U=197*		U=314	
Improve the quality of my work	39.49	28.79	42	38.03	40.38	29.38
	U=173.5		U=270		U=291*	

6.2 Impact 2: Surveillance and Tracking Precipitate Fear of Discipline and Control

The second common impact that we identified workers experiencing is a fear of discipline and control owing to the tracking and surveillance nature of the *chequeadora*. One greenhouse worker describes how he works with a smartphone version of a *chequeadora*, which he uses to track his work activities. His supervisor also uses his data to track his location and movements. If the supervisor notices that he is not moving fast enough, the worker states that the supervisor will come and ask *"What happened? Why did you stay still for so long?"* (Group Interview 1). P6, who uses a RFID-tagged watch, describes a similar experience: *"They are measuring your time [...] If you get one line in 20 minutes and the other line you don't get in 20 minutes, they start to control you and say 'Hey, you're taking too long [...] Move it, move it! Let's go!'"* (P6). These experiences illustrate how supervisors leverage workers' data to closely monitor worker movements and temporal rhythms. Given that workers do not see where their data are going, they never know when they will be disciplined. One worker shares how this blind surveillance impacts his mood and performance: *"Imagine feeling watched at all times. You literally feel that you have a supervisor in front of you watching you at all times [...] Your work rhythm changes and sometimes even your mood changes, and you feel sadder because of this same pressure"* (Group Interview 1).

This experience of feeling perpetually watched is reminiscent of the effects of Foucault's Panopticon, which induces *"a state of conscious and permanent visibility that assures the automatic functioning of power. So as to arrange things that the surveillance is permanent in its effects, even if it is discontinuous in its action; that the perfection of power should tend to render its actual exercise unnecessary"* [42]. While Foucault sees the Panopticon as a surveillance apparatus in a prison for inmates, the *chequeadora* used in greenhouses for workers creates a similar effect. Workers input their performance data, and may have their movements tracked involuntarily. These data are sent to a larger workforce tracking system, which is invisible and unverifiable to workers. The act of inputting performance data, and the unverifiable nature of how these data are used, contributes to worker feelings' of constant surveillance and increased pressure. As P6 shares: *they control your time form the moment you enter until the end of your work"* (P6). While supervisors do discipline workers, these acts become less necessary as workers feel constantly surveilled, becoming *"caught up in a power situation of which they are themselves the bearers"* [42] of self and intra-worker surveillance and competition.

6.3 Impact 3: Performance Tracking and Quotas Heighten Worker Competition

The final impact we identified is that *chequeadoras*, which are used to measure worker performance to make production decisions often at a punitive cost to workers, impose a competitive environment, exacerberating workplace toxicity and stress. The *chequeadora* worsens an existing intra-social dynamic where SAWP and TFWP workers not only work together, but also live together in guesthouses [86]. This fusion of co-living and working blurs the boundaries of workers' relationships, occasionally resulting in power struggles [86, 87]. The intra-sociality of these shared settings highlights the impacts that punitive performance measures such as being *"sent home"* can have on workers: home is still where the farm is, and everyone is conscious of who is performing "well" and who is not. P4 describes this competitive awareness and accompanying stress: *"the chequeadora is stressful because you're in constant competition with other people. It's stressful knowing that there's always other people who can do it in less time"* (P4).

P4's stress can be understood as an organisational socialisation process, which is how people adapt to a new organisational role or environment [9]. In the context of migrant farmwork in Canada, Perry [86, 87] and McLaughlin [72] note that this organisational socialisation process often occurs inter-generationally where more senior workers attempt to socialise junior workers to life in Canada. McLaughlin [72] refers to this assimilation process as the "performance of subordination," which is when workers learn to succeed in highly competitive environments. Perry [87] notes that a common part of this process is for new workers to be hostile toward rituals and expectations that they view as eroding worker solidarity while senior workers attempt to change these newcomer attitudes, such as complaining about workplace conditions, as they believe these actions could lead to collective harm.

We heard these socialisation processes described by junior and senior workers. Junior workers were more likely to speak negatively about the *chequeadora*, and complain about the competitive

conditions that it perpetuates. More senior workers, P11 and P12 - 2 Mexicans who have worked in Canadian greenhouses for 5 and 16 years - reinforce how the *chequeadora* is particularly stressful for new workers who are training and who may be slower: *"It is stressful for new workers because the chequeadora keeps track of who is on track and who is left behind. If the workers don't get fast and learn within 15-20 days, the supervisors may send them back"* (P12). In P12's experience, the *chequeadora* creates enormous pressure on new workers who only have a 2-3 week probationary period. As a remedy for new workers' stress, P11 recommends that supervisors inform workers more about how their data are used: *"It's a mistake that they don't explain to you what you're punching for. Because people don't explain to you, workers think that the one who is punching more is going to get a better job or maybe they are going to get bonuses or things like that"* (P11). The lack of performance data provided by the employer perpetuates stress and competition, particularly for new workers.

P8 and P11 also frame *chequeadoras'* effects on working conditions and employee retention before *chequeadoras* were introduced versus afterwards. P8 shares: *"In the beginning, they started with a tolerant work rhythm, a normal work rhythm, but later on when they introduced the chequeadora, they made that work rhythm [...] faster, faster, faster, faster, to the point that they need you to be a machine to work"* (P8). New workers faced these performance expectations upon arrival, and discovered that the *chequeadora* managerial system did not align with their hourly incentive model. P11 describes how these factors impact employee retention: *"people don't want to use it anymore because they think they are working by the hour, not by what they do in the day" (P8).* Worker retention has worsened since P8 first started working in Canada: *"In the first season, about 5 or 6 [workers] of them left. In the following 2-year season [...] more than half of them left [...] And now those who are arriving are also leaving too quickly. 2, 3 months, [and then] they are retiring"* (P8).These results show how the *chequeadora* has likely worsened workplace competition to the point that new workers often do not stay long enough to adjust.

Unlike new workers, P11 and P12 do not feel as mentally impacted by the *chequeadora* because they see themselves as high performers. In an interview with P12 and his wife, P12 describes how he felt okay working with the *chequeadora* because *"all the time, I am dominating"* (P12). His wife adds that *"over the years, he hasn't had a single complaint."* This exchange reveals how P12 has adjusted to the competitive greenhouse environment. This assimilation may be a point of pride that softens P12's opinion about the *chequeadora*, and deters him from pursuing better working conditions. P8, a TFWP worker of 13 years, provides a counter-perspective to P11 and P12's more neutral attitudes. Unlike most other participants, P8 is Guatemalan, a national minority compared to the Mexican worker majority in Essex, and has sustained repetitive strain injuries that will likely force him into early retirement. As previously highlighted, P8 feels the *chequeadora* forces the body to work in unsustainable ways, and sees agtech as serving only the employer. P8's position clearly relates to his experiences as an injured worker. P8's nationality as a Guatemalan may also have an impact on how he adapts to inter-generational socialisation processes, which are likely defined and managed by majority Mexican senior workers. P4, a worker from Honduras, reported similarly negative feelings of competition and pressure, stating that the *chequeadora* contributes to a toxic work environment.

7 WORKERS' DESIRED TECHNOLOGICAL CHANGES AND PERCEIVED CHALLENGES

For this study, we adopted a transformative worldview with the hopes that this project will help to link migrant workers' desires to potential supportive interventions that can mitigate workplace inequities, particularly regarding technologies (**RQ2)**. We developed a list (Table 3) of workers' desired changes, fears, and perceived barriers, which we outline below.

7.1 Desired Changes, Fears, and Specific Cases

Workers' desired changes fell into 4 broad categories: a physically safer work environment; a more ergonomic workplace; a psychologically safer workplace, and more technologically-related skill and job opportunities. For a safer work environment, P8 describes how better harnesses are required for workers on electric carts: "*I was in a greenhouse where it was really scary to get on an electric cart [...] Even I, who has been coming here for so long, I felt insecure working high up. I couldn't ask a harness because the harnesses they have for us immobilize you"*. Other workers (P6, group interviews) call for better masks and protective gear when using pesticide spraying technologies. These desires are tied to workers' fears of experiencing further poor health conditions resulting from inadequate safety equipment.

For a more ergonomic workplace, workers shared ideas for agtech that would reduce physical strain like a system that automatically stacks crates (P9), and a robot that moves heavy tomato boxes for female packers (P2). P2 and P9 were fearful, however, of the success of these ideas as they believed that once work became easier, they would lose their jobs. P2 describes his perception of the future effects of automation and surveillance agtech: *"the worker will be impacted by unemployment. [These technologies] benefit the employer"* (P2). This skepticism arises from workers' awareness of the precarious nature of their jobs and that job security is contingent on Canadians' lack of interest in farm work as a vocation.

For a psychologically safer workplace, P4 advocates for stricter regulations from governmental officials to protect workers: *"The government should supervise people so that the supervisors aren't on top of people pressuring them so that one can do the job more in a more relaxed way"* (P4). At the employer-level, P11 thinks that new workers should be informed of how their performance data are used as this information could help to alleviate worker stress: *It would be better for the workers because they're literally in the dark. They don't know what the information is used for"* (P11).

Regarding skill development and role opportunities, some workers want to adopt more technical training and roles. For example, P7 and P11 are trained engineers, but are not allowed to help with mechanical tasks at work. P4, P6, and P9 want more technical training because they believe that it will help them feel safer and will allow them to develop new skills that are useful back home. These desires are rooted in a fear of being unable to learn and apply knowledge from Canadian workplaces as well as an ongoing fear of injury related to inadequate technical training.

Table 3: Desired Technology-Related Changes for Workers

Desired Changes	Underlying Fears	Specific Cases for Change	Barriers to Change
A Physically Safer Work Environment	Injury	Protective harnesses for electronic carts	Safety equipment is costly for workers
	Sickness	Protective gear for pesticide spraying	Low confidence in employer intervention
A More Ergonomic Work Environment	Automation will cause job displacement	System that can automate crate stacking	Employer resistance
		Robot that can more heavy packing boxes	High cost of tech implementation
A Psychologically Safer Work Environment	Stress, pressure, toxic worker relations	Stricter governmental regulation of *chequeadoras*	Low confidence in governmental intervention
		Employer disclosure of *chequeadora* data usage	Low confidence in employer intervention
More Skill Development and Role Opportunities	Lack of job development	Desire for technical roles	Employer resistance
	Injury	Desire for technical training	

7.2 Barriers to Change

Each desired change that workers identified corresponds to a barrier that workers perceived as preventing the actualisation of these transformations. Most barriers related to employer and governmental behaviors and expectations. For example, some workers (P4, P8, group interviews) were skeptical about successfully introducing new protective equipment as many workers presently must pay for equipment like protective gloves out of their personal salaries. In a group interview, a worker shares an example of the consequences of having to pay for equipment: *"Raoul* [10] *went to the hospital emergency room because he was poisoned or I don't know, got an infection because of the chemicals. And why is that? Because Raoul didn't have the $10 to buy the box of [safety] gloves."* Workers also reported that employers said they would provide better equipment, like medical masks during the COVID-19 pandemic (P6, P10), but these promises were often unmet. P10 describes how during the pandemic, the company's offices *"locked themselves in, but there were no measures for us. They gave us a mask for two weeks. No social distancing, no protection."*

Regarding more ergonomic technologies, workers stated that their employers were not interested in investing in new technologies because they were too expensive (P5), and because employers do not listen to workers' ideas for improvement. P9 describes how *"there are new talents, there are fresh minds, there are new ideas [...] But [employers] trust so much what they already know so they say 'No, this has to been done this way because it works for us.' They do not dare to take the risk of saying we are trying this other way"* (P9). Owing to workers' past experiences with agtechs, many expressed skepticism or conflicting views regarding technology's ability to support better work environments. For example, P8 states that he believes that technologies will always benefit owners: *"Technology will never support the worker. Technology will support the employer, the owner. Always"* (P8). This sentiment was shared by other workers who had only experienced agtechs that cause physical strain, financial loss, psychological stress, and pressure. These negative associations contributed to workers' low confidence in their bosses' willingness to intervene in how *chequeadoras* are managed. Other workers saw the potential benefit that other agtechs such as robotic electric carts and conveyor belts offered, but were concerned how these agtechs have reduced job opportunities, and feared that this trend will continue. P3 shares his pros and cons about agtech: *"It is positive because it helps you... Yes, but it may be in the future that it will no longer be necessary to be there in the field because the machines will do the job"* (P3). Workers' desire for more ergonomic

[10] Name anonymised

work is conflicted with their fear that these advancements will lead to job displacement.

Workers were also skeptical toward agtechs because they believed that automation would make work easy enough for Canadians to want to do. P11 elaborates: *"the jobs that are difficult, that Canadians don't want to do, are done by migrant workers. These types of work are where the labour force is used, not technology"* (P11). P11's belief is shared by others who expressed a desire for more technological roles and training, but were skeptical regarding those events actually occurring. Uncertainty also arose owing to past experiences with unmet requests for training, and gate-keeping from technical roles and training opportunities. For example, in response to the question "do you think you can apply your professional knowledge and skills to your work in Canada," P9 replies: *"No, because supervisors don't allow you to do that. In other words, there is a protocol and you have to respect it"* (P9). The "protocol" that P9 refers to is a labour system where workers, particularly newer ones, are confined to a finite set of tasks without development opportunities. P11, a civil engineer considers how racial difference may decrease training opportunities: *"There are Mexicans who are trained for this kind of thing, but they are not going to have that kind of job"* (P11). P13, a trained mechanic from Mexico, expresses how his lack of technical opportunities relates to his supervisor feeling threatened: *"sometimes when the boss isn't there, and the supervisors are only there, they say 'Oh no, you're not going to know more than I do'"* (P13). These experiences show how employer resistance toward workers' vocational development desires result from rigid managerial roles and supervisory gate-keeping.

Desired changes proposed at the governmental level were mentioned to a lesser extent. P4 simultaneously advocated for enhanced regulations enforced by the Canadian government over *chequeadoras'* implementation and usage while expressing little expectation in the government's ability to implement this change.

8 DISCUSSION

8.1 What is Agtech?

Chequeadoras or labour system technologies are the most common technology by which migrant farmworkers (68/108) reported being affected by at work. This finding was not surprising to us nor the farmworkers and community representatives we consulted with, as these groups have already begun to recognise *chequeadoras* as an ongoing threat to worker safety and well-being [39, 91]. The predominance of *chequeadoras*, however, still raises critical questions about what constitutes agtech. With the exception of a few definitions [61, 109], these technologies fall outside of a common public understanding of what agtechs are. For example, Encyclopaedia Britannica defines agricultural technologies as the *"application of techniques to control the growth and harvesting of animal and vegetable products"* [112]. The U.S. Department of Agriculture describes the benefits of agtech adoption: higher crop productivity, decreased water and chemical usage, and better monitoring of natural resources [81]. Both examples emphasise data collection, monitoring, and decision-making of natural resources and food products to promote climate mitigation, food security, and nature conservation. Often excluded from these descriptions are agtechs designed to monitor and control *human data*. This inattention reflects a disconnection from historical examples of agricultural technologies such as physical ledgers used on U.S. plantations to track workers' physical and performance data [97] and currently available commercial agtechs such as systems that capture worker data, posing the double risk of automation and surveillance to farmworkers [109].

The *absence* of labour system technologies in broader, public understandings of agtech and the *presence and availability* of these systems in historical accounts of farm labour management and through current commercial agtech start-ups point to a semiotic flexibility of what agtechs are depending on the audience and context. Based on these disparate definitions, we ask the HCI community: what constitutes agtech and under what circumstances? What risks and opportunities arise from the flexibility of agtech's definition and categorisation? Working counter to industrialised agriculture, several HCI scholars have begun to address the question of what an agtech is and for whom, showing how most agtechs inherit values associated with commercial, scientifically-managed agricultural production [6, 10, 51, 66, 67, 79, 110]. Scholars are working to shift this industrialised narrative by focusing on the perspectives of small-scale farmers, and designing tools like information systems to manage permaculture-related data [79, 90]. Other projects have not led to new technologies, but have aimed to support existing farmer-nature relations and to transcend HCI's commitments to agriculture beyond human-computer interactions [6, 67]. This work is critical to redefine HCI's understanding of agtech and our broader responsibility to agriculture and the environment. Disapproval of industrialised agriculture should not mean that we ignore the workers, technologies, and human-nature relations that are still embedded in these systems. There is an opportunity for HCI to attend to the work being done by the semiotic flexibility of agtech. By doing so, we can better situate and acknowledge the historical, ongoing, and multidimensional harms that industrial agricultural production contributes to while supporting marginalised worker groups bound up in these systems.

Support from the HCI community can begin with accounting for the historical and present power disparities that farmworkers face in their jobs alongside the needs and desires that they identify [66]. As shown in Table 3, workers' desired changes do not always align with technological solutions, and if they do, refer to ergonomic systems that help protect workers' *bodies* rather than to monitor plants. Furthermore, workers' perceived barriers to change concern how migrant work is governmentally regulated and implemented by employers, indicating the potential need for technologies that enable workers to easily share information to help to self-organise and shape more equitable regulations at legal and political policy levels. These interventions - ergonomic technologies designed to support workers' well-being and information systems aimed at improving worker rights and collaboration - fall beyond the scope of common agtech definitions, further raising the question of who gets to define agtech and under what conditions?

International organisations such as the United Nations (U.N.) increasingly promote agtechs as critical tools to reduce carbon emissions and stabilise food security [75, 76]. What is commonly excluded from these priorities, however, is how to design and implement these technologies in ways that enact a just transition,

that is, providing equity for those who are affected by green transitions [55, 77, 83]. Given the apparent flexibility of what agtechs are, there is an opportunity for the HCI community to help broaden public, commercial, and academic understandings of agtech to include desired worker interventions that support equitable and safe labour practices and employment pathways. These contributions would align with the promises of the U.N. and 46 nations including Canada, the U.S., and the E.U., that have committed to executing just transition strategies [83].

8.2 Repercussions of the *Chequeadora* for Worker Sociality and Collective Action

For over 30 years, migrant farmworkers and supporting labour groups have fought to improve farmworkers' working and living conditions in Canada. Labour organisations like UFCW Canada have helped to establish collective bargaining agreements for farmworkers across multiple provinces,[11] and are currently advocating for workers' right to open work permits, permanent resident opportunities, and safety training programs [39, 118]. Grassroots organisations like Migrant Workers Alliance for Change (MWAC) [40] and Justice for Migrant Workers (J4MW) [41] have also supported thousands of migrant farmworkers through solidarity acts like wildcat strikes, sickouts, and legal aid. Supported by these groups, migrant farmworkers have led and participated in collective actions to improve their working conditions despite facing significant risks of deportation. Ongoing courage and collaboration are critical for workers to continue to fight for better conditions in Canada.

Given this need for worker sociality to enact collective change, our study findings - that *chequeadoras* impacted workers by facilitating highly structured worker rhythms, enabling intensive supervisory surveillance and discipline, and heightening competition and workplace toxicity - are critical to address as these effects contribute to individualising workers and eroding opportunities for solidarity. These consequences are particularly essential to evaluate given how farmworkers face many layers of vulnerability [7, 20, 37, 49, 71, 102, 104, 122] and are bound in a global system of racial capitalism [121], causing workers to be highly replaceable or *"deportable"* [8, 120, 121]. While many workers engage in solidarity acts, others have accepted exploitative conditions, not voicing concerns for fear of losing their jobs. Others are more positive about their work conditions, especially compared to the job opportunities in their home countries [8].

Workers' feeling of *"deportability"* may explain why some do not participate in solidarity acts or are disinterested in collective organisation. Perry's [87] research on intergenerational organizational socialization among migrant farmworkers in Canada reveals the necessity for workers to develop intra-social strategies to thrive in competitive farm environments. Perry notes how many senior Mexican workers whom he interviewed feel like they have to put on a mask in Canada, as expectations for adaptation demand *"an outward performance of a public image that is accepting of difficult conditions, regardless of how this performance may contradict [one's] inner sense of self and dignity"* [87]. For some senior workers, this process of *"putting on the mask"* and pressuring and teaching new workers to follow suit is the best way forward for the collective good, that is, for workers to defend against *"deportability"* in work programs that are precarious by design. While these internal tactics are deemed necessary for survival, they encourage self-preservation and suppress collective organisation. Individualised performance tracking and surveillance enabled by *chequeadoras* would likely reinforce the need for such tactics.

In Section 6.3 on performance tracking, we observed how workers reported differing attitudes toward *chequeadoras*. Similar to Perry [87], we found that senior Mexican workers often reported feeling better adjusted than newer or non-Mexican workers. Given the prominence of Mexican workers in horticulture in Ontario, [12] workers' reliance on intergenerationally taught strategies for adapting to work life raises the question of how those who fall outside of these dominant social categorisations (e.g., male, Mexican, heterosexual) are left to adjust to life in Canada. We observed that TFWP workers from Central America (P4, P8), and newer TFWP workers (Group Interview 1) particularly felt the physical and mental toll of competitive greenhouse environments, and were most concerned about how *chequeadora* data could be used against them. Owing to this intra-social exclusion, these workers may be less successful at the *"performance of subordination"* [71] assimilation process. These workers may require more support from community organisations, and may also be more interested in collective organisation to improve living and working conditions.

Workers' divergent perspectives and interests in establishing intra-worker sociality and organising collective change point to the complexity of how we can support workers with differing intersectional identities respond to similar inequitable working and living conditions. While *chequeadoras* likely exacerbate workplace competition and toxicity and erode opportunities for collaboration, it does not mean that workers respond to these harms in the same ways: some may rely on the internally managed self-preservation tactics mentioned above while others may choose to speak to community organisations requesting support. Transnational inequities embedded in Canada's migrant farmworker programs are also relevant here, as the power of racial capitalism lies in marginalised communities' acceptance of comparatively improved vocational opportunities. Canadian community organisations and the authors of this paper may consider punitively measured performance quotas a greater injustice than migrant farmworkers from the Global South who view work in Canada as essential to their livelihoods and better than what is available back home. We encourage the HCI community to reflect upon how to support marginalised worker groups with divergent intersectional identities and opinions regarding collective action. We also urge scholars to consider how to define and respond to uneven perceptions of injustices in the context of transnational labour systems dependent upon racial capitalism.

[11] In 1994, UFCW Canada successfully lobbied for the Agricultural Labour Relations Act, which allowed collective bargaining rights to farmworkers in Ontario. In 2001, the Ontario government's responded to this Supreme Court ruling by forming the Agricultural Employees Protection Act, which granted farmworkers the freedom to "associate" but denied them collective bargaining rights, which are available to workers under the Labour Relations Act. Farmworkers are still denied the right to collectively bargain in Ontario [39].

[12] 43.8% of all workers as of 2023 [17]

8.3 Learnings for HCI

In Section 7, we learned that workers want to protect their bodies and minds at work, and to develop new skills that prepare them for viable future employment pathways (Table 3). These desires are grounded in experiences of workplace sickness, job displacement, and stress. Workers articulated structural barriers at employer and government levels that eroded their confidence in transformative action. Without third-party pressures, workers felt that employers are unlikely to guarantee such changes as job security in the event of new agtech adoption and worker access to performance data. Despite differences in attitudes and strategies regarding how to enact desired changes, it is clear that *chequeadoras* still negatively impact many workers' well-being. It is also evident that all interviewees have visions for how to improve their existing conditions, skill-sets, and employment pathways, and these visions are often shared across a diversity of workers. Given these findings, we ask: how may HCI begin to repair the damage of *chequeadoras*, support desired work changes, and help build sociality and solidarity amongst a precarious worker group with divergent viewpoints?

Multiple HCI and design scholars offer productive starting points to these questions. For example, DiSalvo's adversarial design [33], rooted in the agonistic belief that contestation is critical to democracy, is a form of design intended to elicit and respond to political issues. DiSalvo introduces 3 key design tactics: revealing hegemonic orders; assessing and reconfiguring whose needs and agendas are addressed; and offering a participatory space that can help challenge dominant structures and offer alternatives [33]. These tactics are useful for evaluating how to expose historical and ongoing usage of human labour tracking technologies like *chequeadoras*, and how to support collectives that offer space for shared desirable changes and also differences. DiSalvo's tactics are similar to HCI scholars Asad [3] and Keyes et al. [59]'s concept of counter-structures, which are grounded in relationships within and between impacted communities, and which aim *"for the community to be autonomous and have more control over issues that impact them"* [3]. These strategies resonate with Robinson's [94] guidance that collective resistance to racial capitalism must take the form of *"(re)constituting collectives,"* or reshaping and creating new forms of sociality. Robinson's advice points to the dynamic, constructed nature of collective social movements, and how they can be built and rebuilt to enact change [31].

Following HCI scholars dedicated to social justice [26, 35, 59, 98], we should also consider how to support historical and ongoing migrant justice campaigns to help enact workers' desired changes. These community organisations offer examples of collectives or counter-structures that aim to improve workers' well-being and autonomy in lieu of a lack of justice and support from the Canadian government, employers, and so on [3]. Drawing from Khovanskaya et al.'s [60] research on how to support platform gig workers in Tayloristic labour environments, one way forward for supporting labour organisations is through improved informal approaches to self-reporting, which could facilitate user-controlled data. Organisations such as UFCW, J4MW, and MWAC already offer confidential, multi-lingual, informal communication channels across Canada as ways for farmworkers to reach out for help and report instances of abuse. Future opportunities for worker-generated data could advise on reform recommendations, design campaigns, and directly help workers in need. These data could also inform workers about ongoing challenges that other workers face, enabling them to make more informed decisions, improve their agency, and potentially to foster worker collaboration and solidarity.

Two present examples of informal collective technological interventions that support self-reporting of marginalised worker communities are Turkopticon, a secure online resource tool for Amazon Mechanical Turk workers to share information about bad requesters, payment issues and so on [56], and The Bad Client and Aggressor List, an online information system that allows sex workers based in Montreal to anonymously report abusive clients [114]. Both self-reporting tools expose workplace abuse, challenging broader *"structures of violence"* [106, 117], and build worker sociality through enabling community communication. Similar to sex workers in Canada, whose labour is criminalised, migrant farmworkers' precarious status places them outside of traditional systems of civic justice, and makes them dependent upon community counter-structures for protection and mobilisation. From these examples, we can begin to think of how community-run collective self-reporting can build migrant farmworkers' capacity to support and shape their own forms of sociality and collectives, report abuse, and perhaps also reinscribe data rights from systems such as the *chequeadora* to become more worker-controlled. We may also do well to consider that to repair the damage that *chequeadoras* have reinforced as a disciplinary agricultural technology, *unmaking* [101] rather than revising or re-appropriating labour tracking and surveillance agtech may be the most desirable way forward for workers.

9 CHALLENGES AND FUTURE WORK

Despite our intentions, our study encountered limitations in participant diversity. Specifically, our recruitment network did not provide adequate access to diverse groups such as women, LGBTQ2S+, and non-Latino workers. We recognise that more expansive research is required to gain an inclusive understanding of other migrant farmworkers' experiences and perceptions of agtechs in Canada. We also acknowledge that while we believe that we have carefully centered and engaged with migrant workers and allies in this study's design and implementation, it is challenging to represent various stakeholder perspectives, which we have found are not always aligned on diagnosing problems or resolutions associated with exploitative migrant farm labour conditions in Canada. To conduct a study of this nature also requires knowledge mobilisation across multiple audiences such as labour organisations, government bodies, academia, the general public and amongst migrant workers themselves. The resources and expertise needed to conduct this knowledge work have been significant. In future, we hope to investigate intersectional factors that impact worker sociality and solidarity as well as existing internal tactics for resisting or navigating agtech such as *chequeadoras*. We also hope to explore any existing informal information systems that workers use for collaboration and how to further support these modes of communication and sociality.

10 CONCLUSION

We started this paper with a statement from Miguel, a Guatemalan migrant farmworker, who believes that technology will never support the worker, only ever the employer. Miguel's bleak perspective regarding the role of technologies in the workplace is not surprising: for many, *chequeadoras* are the only agtech workers have interacted with, and based on our findings, these agtechs affect workers by perpetuating negative health and safety consequences. Furthermore, workers' interactions with *chequeadoras* revealed 3 major impacts: performance expectations engender stress; supervisory surveillance cause workers to be fearful of discipline; and performance tracking heightens competition. These impacts demonstrate how *chequeadoras* reduce workers' sociality, instead individualising workers and fragmenting opportunities for solidarity. Given that workers identified that infrastructural changes are needed to guarantee the success of their desired workplace transformations, which relate to safer, more ergonomic environments with opportunities for technical skill development, it is critical for workers to rebuild and create new forms of sociality and collective resistance. To support these efforts, we recommend that the HCI community engage with and learn from ongoing examples of labour movements' solidarity strategies, and build upon HCI's growing collection of political design tactics and informational strategies for worker-controlled data gathering and reporting.

We end by highlighting the importance of how the most widely reported agtech, the *chequeadora*, falls outside of broader public and academic understandings of what an agricultural technology is. From this study, we hope to bring attention to what technologies are included in our definition of agtech, and under what conditions. If HCI scholars want to shift agtechs and systems from the missions and priorities of industrialisation, we should follow the guidance of labour movements [38, 40, 41, 92] and social justice advocates in HCI and other fields like STS [3, 26, 32, 35, 106]. These influences can help us to expose omissions like *chequeadoras* in our common conception of agtech, and help workers redefine what agtechs are through the reconceptualisation and design of systems that support collaboration.

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A APPENDIX

A.1 Quantitative Descriptive Survey

A.1.1 Introduction. Thank you very much for your interest in this survey. The goal of the survey is to learn more about the experiences

[12]Participants had the option of completing the survey in English or Spanish, but all participants ended up completing it in Spanish. Despite how the survey was exclusively conducted in Spanish, we provide the English version of the survey in this appendix given that it reflects the dominant language of the journal audience.

of agricultural workers in Canada, with a particular focus on their experiences with agricultural technology. The survey will take approximately 15 minutes and is completely anonymous, meaning we do not collect your name, your employer's name, your location, or your contact information. By completing the survey, you will have the option to receive a $10 Tim Hortons gift card.

A.1.2 Selection Process. Before completing the survey, please make sure you meet the following criteria. If you answer "No" to any of the following questions, you are not eligible for this survey.

(1) Are you 18 years or older?
   - Yes
   - No
(2) Do you currently work as a farm worker in Canada or have you worked as a farm worker in the last 12 months?
   - Yes
   - No
(3) Do you work on a farm or greenhouse that grows: fruits, vegetables, mushrooms, maple products, tobacco, herbs and/or cannabis?
   - Yes
   - No
(4) Can you speak, and/or write and read in English and/or Spanish?
   - Yes
   - No

A.1.3 Privacy and Confidentiality. How your confidentiality and privacy are protected in this survey:

(1) This survey is anonymous. We will not collect your name, your employer's name, your address, your employer's address, or your contact information.
(2) If you would like to participate in future research, we will provide you with a separate questionnaire at the end of the survey to share your contact information (email address or Whatsapp). Your contact information will not be linked to your survey responses.
(3) All survey data and contact information will be password protected and will not be shared with anyone outside of the core research team.

If you have any pending claims in court that may impact your stay in Canada, we recommend that you do not share personal information that may negatively impact these claims.

A.1.4 Consent. If you accept these terms and conditions, select "Yes" and continue with the survey. If you do not agree to the terms and conditions, please let the person helping you know that you no longer want to participate.

- Yes
- No

A.1.5 Survey Questions.

(1) Gender
   (a) Male
   (b) Female
   (c) Non-binary
   (d) Other
(2) Age
   (a) 18-19
   (b) 20-24
   (c) 25-29
   (d) 30-34
   (e) 35-39
   (f) 40-44
   (g) 45-49
   (h) 50-54
   (i) 55-59
   (j) 60-64
   (k) 65-69
   (l) 7-74
   (m) 75-79
   (n) 80+
(3) Highest level of completed education
   (a) Elementary school
   (b) Junior high school
   (c) High school
   (d) College or university
(4) What country did you live in prior to coming to Canada? (Open-ended response)
(5) What is your country of origin? (Open-ended response)
(6) Are you married or in a commonlaw relationship?
   (a) Yes
   (b) No
   (c) If yes, in what country is your partner located? (Open-ended response)
(7) How many children do you have?
   (a) 0
   (b) 1
   (c) 2
   (d) 3
   (e) 4
   (f) 5+
   (g) If answered 1 or more, in what country is your child/children located? (Open-ended response)
(8) What province are you located in?
   (a) Alberta
   (b) British Columbia
   (c) Ontario
   (d) Manitoba
   (e) New Brunswick
   (f) Newfoundland and Labrador
   (g) Northwest Territories
   (h) Nova Scotia
   (i) Nunavut
   (j) Prince Edward Island
   (k) Quebec
   (l) Saskatchewan
   (m) Yukon
(9) Where is your place of residence?
   (a) On the farm site
   (b) Within 2km distance of the farm site
   (c) Farther than 2km from the farm site
(10) What is your legal status for working in Canada?
   (a) Temporary Foreign Worker Program (TFWP)
   (b) Seasonal Agricultural Worker Program (SAWP)

(c) Temporary Resident Visa (TRV) or Temporary Resident Permit (TRP)
(d) Vulnerable Worker Open Work Permit (VWOWP) or Refugee claimant
(e) Permanent resident or Canadian citizen
(f) Other
(g) I don't know
(h) Prefer not to answer

(11) How long have you been working as a farm worker in Canada?
(a) Less than a year
(b) 1-3 years
(c) 4-6 years
(d) 7-10 years
(e) More than 10 years

(12) Before coming to Canada, what did you do for work? Select all boxes that apply to you.
(a) Farmer/Peasant
(b) Builder
(c) Student
(d) Teacher
(e) Vendor
(f) Driver
(g) Electrician
(h) Fisherman
(i) Unemployed
(j) Other

(13) How many times have you visited your permanent place of residence since you started working as a farm worker in Canada?
(a) 0
(b) 1
(c) 2
(d) 3
(e) 4
(f) 5+

(14) What type of farm do you work on? Select all boxes that apply to you.
(a) Horticulture (Greenhouse) - for example: tomatoes, cucumbers, peppers
(b) Crops (Fields) - for example: broccoli, cabbage, potatoes, strawberries
(c) Crops (Orchards) - for example: apples, pears, peaches, grapes
(d) Fungiculture (Mushrooms)
(e) Cannabis cultivation
(f) Other (please describe)

(15) How big is your farm?
(a) Less than the size of 1 soccer field
(b) About 1-4 soccer fields
(c) About 4-7 soccer fields
(d) About 7-10 soccer fields
(e) More than 10 soccer fields

(16) What kind of work do you do on the farm? Select all boxes that apply to you.
(a) General labourer
(b) Greenhouse worker
(c) Harvester/Picker
(d) Wrapper
(e) Packer
(f) Cutter
(g) Other

(17) Based on your farming roles, what tools do you use to do your job? Select all boxes that apply to you.
(a) Sharp tools such as harvesting or paring knife
(b) Pruning tools such as scissors or clippers
(c) Trolleys, platforms, scissor lifts or ladders
(d) Forklift, Hand jack or Power jack
(e) Picking trays, hooks or baskets
(f) Safety belt including gloves, respiratory face mask and bump cap
(g) Pesticide sprayer and tank
(h) Power washer, hose or squeegee
(i) Planting tools such as a shovel or trowel
(j) Bucket and scoop
(k) Pen and paper
(l) Other

(18) Check all months that you most commonly work in a year.
(a) January
(b) February
(c) March
(d) April
(e) May
(f) June
(g) July
(h) August
(i) September
(j) October
(k) November
(l) December
(m) I work all months

(19) How many days do you typically work in a week?
(a) Less than 3 days
(b) 3-4 days
(c) 5 days
(d) 6+ days
(e) My schedule changes a lot and I do not have a typical weekly schedule.

(20) How many hours do you typically work in a week?
(a) Less than 20 hours
(b) 20-29 hours
(c) 30-30 hours
(d) 41-49 hours
(e) 50+ hours
(f) My hours change a lot and I do not have a typical daily average.

(21) Do you have a quota (expectation for how much work you are supposed to complete in a day)?
(a) Yes
(b) No
(c) If yes, does your employer track if you reach your quota?
(i) Yes
(ii) No
(d) If yes, do you receive a bonus if you reach your quota?

i Yes
ii No
(e) If yes, what happens if you don't reach your daily quota?
i I am not allowed to work for 1-3 days
ii Nothing happens to me
iii Other

(22) What technologies do you use at least a couple of times a week for personal use?
(a) Cellphone
(b) Tablet
(c) Laptop
(d) Other
(e) I don't use personal technologies

(23) How do you typically use this personal technology? Check all boxes that apply to you.
(a) Communicate via Whatsapp
(b) Communicate via Facebook
(c) Send money to friends and family
(d) Organise transport
(e) Check the weather
(f) Look up information
(g) Play games
(h) Other

(24) How do you access the Internet while in Canada?
(a) My employer provides access to the Internet
(b) I pay for my own data
(c) I use public Wifi
(d) Other

(25) Please select the digital technology that most affects what you do at work.
(a) Technologies that track your movement and/or productivity while working
(b) Robots that move stuff at the farm or help to plant or harvest
(c) Automatic technologies such as tractors that steer for you
(d) Sensors to water plants or give them more light
(e) Biometric technologies that keep track of your fingerprints or other personal information
(f) Technologies that spray pesticides or fertilizers
(g) Drones or satellites other
(h) I don't interact with any kind of technology

(26) You chose [technology] as the technology that most affects your work. Thinking of [technology], rate how much you agree with the following statements. Scale: 1-5 - [1 = strongly disagree and 5 = strongly agree]
(a) This digital technology improves my health and safety conditions at work.
i 1 (Strongly disagree)
ii 2 (Disagree)
iii 3 (Neutral)
iv 4 (Agree)
v 5 (Strongly Agree)
(b) This digital technology speeds up how quickly I work.
i 1 (Strongly disagree)
ii 2 (Disagree)
iii 3 (Neutral)
iv 4 (Agree)
v 5 (Strongly Agree)
(c) This digital technology improves the quality of my work.
i 1 (Strongly disagree)
ii 2 (Disagree)
iii 3 (Neutral)
iv 4 (Agree)
v 5 (Strongly Agree)
(d) This digital technology helps me to learn new skills at work.
i 1 (Strongly disagree)
ii 2 (Disagree)
iii 3 (Neutral)
iv 4 (Agree)
v 5 (Strongly Agree)
(e) I want to continue to work with this digital technology.
i 1 (Strongly disagree)
ii 2 (Disagree)
iii 3 (Neutral)
iv 4 (Agree)
v 5 (Strongly Agree)

(27) Are there any other digital technologies that impact what you do at work? Select all boxes that apply to you.
(a) Technologies that track your movement and/or productivity while working
(b) Robots that move stuff at the farm or help to plant or harvest
(c) Automatic technologies such as tractors that steer for you
(d) Sensors to water plants or give them more light
(e) Biometric technologies that keep track of your fingerprints or other personal information
(f) Technologies that spray pesticides or fertilizers
(g) Drones or satellites
(h) Other
(i) I don't interact with any kind of technology

(28) If you answered that you are impacted by technologies that track your movement and/or productivity while working, please answer the following questions:
(a) Has your employer informed you how and under what conditions they are monitoring your activities and movements with this digital technology technology?
i Yes
ii No
(b) Has your employer explained to you what information is collected through this digital technology?
i Yes
ii No
(c) Has your employer explained to you how it uses the information it collected about you through this digital technology?
i Yes
ii No

(29) Is there anything you would like to share with us today? (Open-ended response)

(30) Are you interested in any of the following? If so, please ask the person helping you with the survey for a separate contact form.

(a) We are planning for paid follow-up interviews for some participants of this survey ($35 for 60 minutes). Would you be interested in possibly participating in a follow-up interview?

(b) Would you like to be contacted with any research reports or resources that are created from this research?