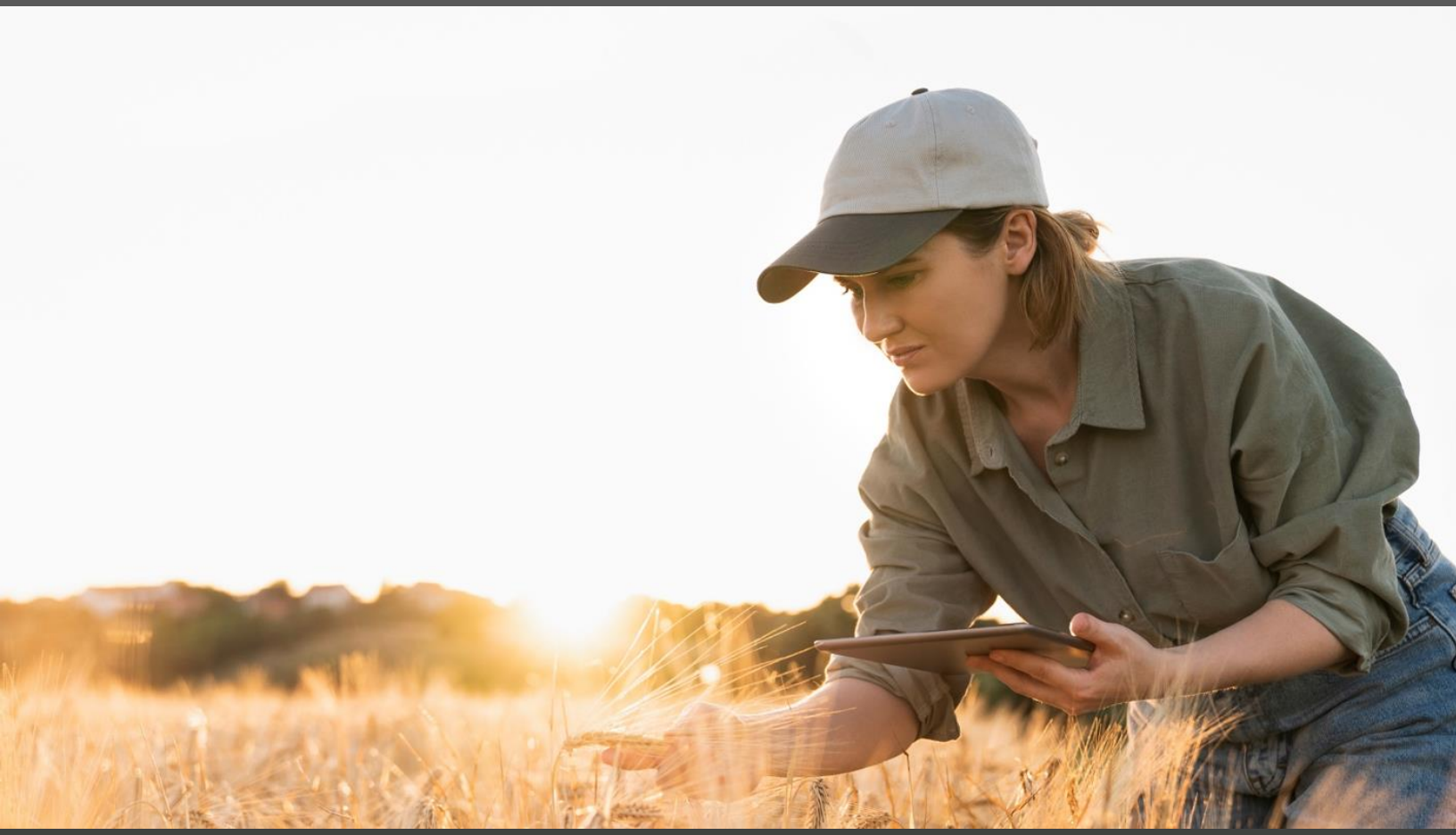

Case Study: Data Management Platforms

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A case study prepared for Remote controlled: The impacts of disruptive technologies in the Ontario agriculture sector

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About the Project

This case study is part of the *Remote controlled: The impacts of disruptive technologies in the Ontario agriculture sector,* which includes 48 key informant interviews with 52 key informants including agricultural industry experts, agricultural-related technology companies, and agricultural business experts to understand AgTech adoption in Ontario. For more information, please visit our project website.

Data Management Platforms

Advances in digitalization and the use of data are transforming agriculture and food systems. Data management platforms include big data and software technologies that store, analyze, and share the data collected from different sources throughout agriculture operations. Based on information collected about soil, crops, weather, or animal health, data management platforms promise to help producers enhance decision-making and improve processes on the farm or even across the agricultural value chain, from the field to consumer.[i]

Data management platforms function as the central data and intelligence hub within a larger set of precision agriculture technologies that may include GPS, sensors, Internet of Things (IoT), artificial Intelligence (AI), application programming interfaces (APIs), broadband connectivity, and high-tech farming equipment.[ii] To connect data from these diverse sources, data management platforms are designed with features and data processing capabilities to facilitate and enhance data integration, data analysis, and the communication of insights.[iii] For example, platforms may support data integration through data connectors, data accessibility and security features, data models, and other tools for data interoperability, that combine different datasets into a single, secure data repository. The insights derived from data analysis are often communicated or displayed in user-oriented formats, such as dashboards or websites, which are often accessed via mobile devices and are designed to help farmers and food producers prioritize actions or enhance decision-making.[iv]

Focus on Ontario

Ontario farmers and food producers of all sizes are increasingly adopting data management platforms.[v] Such data management platforms form part of a growing market of farm management technology.[vi] Although solutions offered by global companies such as Climate Fieldview (USA), John Deere Ops Centre (USA), Trimble Ag Software (USA), and Syngenta AgriEdge (Switzerland) are in use across Canada, several Canadian solutions have gained traction among farmers in Ontario. **Table 1** provides examples of Canadian data management platforms firms actively involved in the agricultural sector.

Table 1: Examples of Data Management Platform Companies Headquartered in Canada

Company	Founding Year	HQ Location	Solutions
AgExpert Field	2002	Regina, SK	AgExpert is farm management software for farmers across agriculture and food sectors. Field management solutions enable tracking of field inventory, crop rotations, and cost of production.
CropTracker	2006	Kingston, ON	CropTracker is a farm management software system for fruit and vegetables growers. Solutions include record-keeping, scheduling, work crew communications and activity tracking, analytics and reports, and traceability.
FarmersEdge	2005	Winnipeg, MB	FarmersEdge solutions collect real-time field data, monitor crop progress, optimize inputs, improve yield, manage carbon credits and provide complete lifecycle traceability of crops. FarmCommand enables data, team, and task management from anywhere.
Semios	2010	Vancouver, BC	Semios is an all-in-one crop management platform for tree fruit, nuts, and vines. Configurable solutions include climate monitoring, insect pest management, diseases management, frost management, water management, scouting tool, reporting tools and plant stress monitoring.
TELUS Agriculture	2004	Calgary, AB	TELUS agriculture solutions include platforms for precision agronomy, sustainability, analytics, compliance, field management, livestock management, equipment and inventory management, crop planning, cost and revenue tracking, and other capabilities.
Ukko Agro	2017	Toronto, ON	Ukko Agro uses digital data gathering and input technology, proprietary algorithms, and modeling, to mitigate risk and help farmers get the highest possible returns from their input investments.

Source: Created by authors based on company websites.

Impacts for Rural Work & Development

Significant drivers for the adoption of data management platforms include optimizing farm operations and improving environmental sustainability performance. Such platforms allow farmers to implement, monitor, and report on their activities. For example, data-driven farming approaches may lead to reductions in farm inputs like chemicals and water.[vii,viii] Based on insights derived from the data centralized and analyzed within data management platforms, farmers and food producers may also be able to optimize operations, increase production and yields, improve resource efficiency, and enhance sustainability.[ix] Farmers, scientists, and policymakers are also interested in using digital agriculture data to address social questions related to farming and food systems, including traceability, animal health and welfare[x], and the environmental impacts of different farming practices.[xi] Some interviewees further explained how data management platforms offered both farm optimization and environmental sustainability benefits:

> *[…] we're using the data in a more integrated fashion in farms, but also in some cases the willingness to share beyond the individual farm itself. It allows better management, allows better farming, better utilization, better application of water, better application of pesticides, herbicides, all that sort of thing* (Ag Industry Expert 7).

Below we highlight specific impacts concerning changes to farm work and shifts in employment and skills.

Changes in Farm & Food Production Work

Digital agriculture data plays a key role in crop management, farm operations management, and livestock management.[xiixiii] Because data management platforms can help identify new insights for farm and food production management, such solutions may compel shifts in the arrangements of work processes, farm activities and tasks, and roles. In many cases, these changes may ultimately help to improve productivity or efficiency increases at the farm level or across the food system. However, changes in the nature and organization of farm work may decrease the amount of time farmers spend out on the land (or in the barn).[xiv] According to one interviewee, data management platforms might be "*shifting farmers away from being traditional producers of food to data managers in some respect and actually much more focused on sort of analytical numbers"* (Ag Industry Expert 6). At the same time, some interviewees noted that farmers are also not utilizing data collected to its full potential. As Ag Industry Expert 2 explained: *"There's a lot of data collected in these processes that we don't necessarily see farmers make great use of.*

Shifts in Employment & Skills

The introduction of new technologies such as data management platforms on farm also has the potential to create jobs with different data analysis and technology skill requirements. As a result, some farm work has evolved into a career requiring business management, agricultural

sciences, and technology expertise.[xv] While these job opportunities may be readily accessible to technology savvy workers, questions remain about how accessible they would be to existing farm workers, who might have different skills.[xvi]

As Ontario's (and Canada's) agriculture and food operations continue to face labour shortages, the use of data management platforms may enable farms to increase productivity and efficiency. For example, a report by the Canadian Agricultural Human Resource Council (CAHRC) noted that 16,500 jobs in agriculture could not be filled in 2017, costing the sector $2.9 billion in sales, despite a high proportion of foreign workers.[xvii] In addition, in 2022, there was a reported loss of $3.5 billion in the agri-food sector as Canada's agricultural labour supply shortage intensified.[xviiixix] An aging population, declining numbers of young people entering the agriculture workforce, worker retention difficulties, and sector specific skill deficiencies are among the many factors contributing to this widening labour gap.[xx] Concurrently, Canada's agricultural sector is also experiencing growing demand for workers.[xxi] However, a number of the ag-related technology companies involved in our research discussed how adopting technologies is providing new opportunities for careers in agriculture and is more attractive to a younger workforce. The also emphasized the need for skills related to data analytics, as Ag-Related Tech Company 3 noted that with the adoption of more indoor farming technologies:

> *there's so much data that needs to be collected and just having the idea on how to interpret data, collect data and use this to make informed decisions on how these facilities should be run is a really big skill gap that's missing. And that's where these growers are recruiting these tech companies to come. Bring in that data expertise.*

Future Considerations

A number of interviewees discussed how technology adoption would increase in the future, especially in relation to big data analysis and farm monitoring and management systems. There is also a growing interest in AI, machine learning and predictive analysis. As these technologies evolve and develop, the industry will need to address concerns over centralizing agricultural data, compatibility, ownership, privacy, and security issues.[xxii] Often, data generated by farms is privately owned, but ownership of specific datasets may be complicated by property rights, alongside regional regulations, leading to questions about security and privacy:[xxiii, xxiv] As Ag Industry Expert 6 explained:

> *Canada's had a very pretty lackluster regulatory environment around protection of data and around interoperability in particular, like I think that is a major issue for a lot of the precision agricultural technologies […] you're often buying into an ecosystem of services that are under one company, like John Deere, for example. And I think that there's questions around governance of data that comes out of that, but also just fundamentally, if you really want to maximize the value of the data you're generating through all these sensors, having access to more of an open source set of options for where you can use that data and what you can get out of it.*

It is worth noting that a number of our interviewees discussed interoperability challenges. Interoperability was also recently highlighted in the media, including the associated costs with having to buy all products from the same company.[xxv] Finally, interviewees highlighted concerns related to cybersecurity, noting the growing complexity of these challenges. As Ag Industry Expert 4 explained:

> *I think one of the biggest issues that's going to come out is going to be cybersecurity. You are going to have a lot of problems. You have Internet of Things. You have all this automation. If another country decides that they want to impact our trade and they can go use bad actors to try to impact some of our bigger farms or some of this equipment, they could really do a lot of damage if everything is automated. They could take a system hostage. I've heard of one place that that happened to already.*

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