



Summary of Questions and Answers During Outreach with Members of Agricultural Associations in Eastern Ontario

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Research focus and scope

1. Why was the study focused on the use of digital agriculture on small farms when the size of farms is going in the opposite direction?
 - This was our focus because the bulk of the academic research on adoption of digital technologies has been on larger scale commodity farms – like grain farming. We were curious about the kinds of technology engagement on the smaller-scale farms and assumed that this would reveal interesting differences in adoption rates but also the types of technologies being used on these farms (e.g. smartphones versus the expensive variable rate equipment and “decision support platforms” sold by companies like John Deere and Bayer).

2. Does the study include any comparative analysis for what is going on in other jurisdictions, such as the United States?
 - No, the analysis is not currently being compared with the US; but we are comparing responses and results between participants in Ontario and Quebec. The survey that has been running as part of the project is currently being released in Germany and also South Africa for a future comparative analysis.



Survey participant representation

3. Is there information on the educational backgrounds of participants?
 - No, we didn't ask about education level or background.

4. Any interest to look at the first language of the farmers and their main differences or detailed demographics?
 - We hadn't thought of sorting the data this way but that is an interesting thought though I am not sure our sample size is large enough to uncover any patterns in the data related to language.

5. What is digital agriculture as per survey responses?
 - Question in survey: How do you define 'digital ag'?
 - Many participants referred to **specific technologies**: GPS, infra-red surveying, digital communication and sales, automated technologies
 - Responses with **positive connotations** far outweighed the responses with **negative connotations**.
 - The theme of **efficiency** was clear in some responses: "Agricultural technology that utilizes and enables digital information gathering, potentially leading to increased efficiencies or helping to identify/solve problems"
 - Several respondents explained that they saw it as only for larger farms: "My feeling is that this term only really applies to large-scale operations who can afford expensive tech and the sundry equipment required to run it."

6. Criteria for farm size in survey
 - Small - <10 acres; Medium – 10-100 acres; Large - >100 acres

7. What is livestock farmer representation in survey? Tech adoption with small scale farmers a challenge. E.g., RFID readers purchase for 100 head not feasible. But might 1 reader be useful/applicable to group of 5 farmers; can they read for 5 subsets of livestock data? Split cost. Biosecurity not a concern because do not touch the animal.
 - Mostly we interviewed mixed vegetable growers based upon who responded to our call for participants.
 - Many survey respondents have mixed vegetables, but also some chickens, or pigs, or sheep. So, classifying the respondents as either crop or livestock farmers in this context doesn't really work.



8. What is the definition/criteria for the farm practice?

- The survey participants can self-define their practice within the five choices (conventional, organic, regenerative, agro-ecological, market gardening). Participants who aren't using organic methods would likely identify as using conventional practices. Participants could choose which farm practice is most applicable to their farm (and choose more than one). Regarding 'agro-ecology' (as asked by one audience member), this is generally the application of ecological concepts and principles to the design and management of sustainable agricultural ecosystems.

Digital agriculture adoption relationships/correlations

9. Are there any characteristics that make operators more likely to be early adopters?

- Our sample size isn't really large enough for us to see statistically significant or relevant patterns around adoption.
- However, our farm visits alongside the survey data show something worth exploring in future research which is that the market gardeners by and large do not adopt the commercially available tools and it has to do with factors which have been reported in the peer-reviewed literature like: cost; no return on investment for farmers of this size; unsuitability of the precision agriculture equipment for small-scale and biodiverse farms whose crop types are not really covered by the decision support platforms and for whom the tractors do not make sense both biophysically and in terms of capital investment.
- The surprising finding was of a difference in technology adoption among farmers in Quebec and Ontario which was striking (not necessarily the precision equipment but other digital tools and infrastructure). This contrast was resulting from different provincial level government support for farmers where in Quebec there appears to be more support (or at least more awareness and ease of access to support among farmers).

10. Wondering if educational background is related to willingness or barrier to adopt; is this also correlated with age in addition to farm type/size?

- Certainly in the adoption literature more broadly there is often found an inverse correlation between age and willingness to adoption of precision agriculture (and there is a lot, I could follow up with some studies if people or organizations are really interested).
- Most people make sense of this as a "digital divide" issue – as farmers get older they find it more difficult to learn the new tools (digital tools involve a novel computer



based skillset) or they have become more comfortable with their proven way of doing business.

- Our study of course shows this relationship (with our limited sample size) YET a curiosity is greater adoption among young and established farmers. This likely has to do with access to capital where those “in the middle” so to speak are at most disadvantage.

11. Did the survey ask farmers if they felt limited in their ability to use digital technology? perhaps because internet is limited or the cost of using various platforms is high?

- We didn't phrase the question that way. We did ask if they saw advantages to the digital technologies. Some participants said no because they don't have good broadband access.
- We also asked them about problems they experience on the farm – some said slow internet or lack of internet access.
- On the other hand, one memorable response (when asked what they would tell a technology developer to build) was the following: “Our farm doesn't have internet or cell-phone reception. And I'm happy with that and don't want either on the farm. So, I would ideally like a tool that doesn't need to be connected to operate. Maybe a tool to gauge carbon currently stored in the soil and rate of carbon sequestration.”

12. Lack of better internet in rural Ontario like eastern ON must be a barrier. Restricted ability to access; can't use cloud based technological applications

- This is a known barrier, and we didn't dig deep here because it is so well documented and is being addressed. Indeed, there are multi-million dollar programs to bring better broadband access to rural Ontario in place. See <https://www.r2b2project.ca>

13. Is there any disclosure of the direct economic impact of respondents by sector? For instance, direct marketing of fruit and vegetables by small scale market gardens is a growing sector, with a strong interest in digital -- understanding how this sector is growing relative to other sectors would be of interest. Similarly, the greenhouse sector and large-scale row crop agriculture have also embraced digital to a greater proportion than some other sectors. Understanding this issue with respect accelerating the growth and competitiveness of faster growing sectors. Maybe this is a chicken and egg question. Has the study looked at this research in terms of where the adoption of digital tech may be linked to growth?



- Our study does not compare adoption across sectors and our sample size is too limited for doing that comparison after the fact with the data collected (especially we didn't seek representativeness from two or more sectors).
- There is a study being run out of Guelph University that was running adoption surveys across the country and sectors. The lead there is Dr. Evan Fraser. I am not sure if they have data yet from their surveys but I am sure you are right that adoption depends on sector. Well-known in the literature is that the commodity grain sector was the earliest and is still the strongest region in terms of adoption of digital agriculture, though even then adoption results are mixed (see the AAFC surveys done by Dan Steele which are available online here: <https://cdnsiencepub.com/doi/10.1139/cjps-2020-0234>). This is largely because of access to capital but also because the precision ag machines and decision support tools are designed for these farmers.
- Our survey's interesting finding is that the smaller-scale and market gardeners are adopting digital tools but not precision agriculture – more classic information and communication technologies for connecting their markets.

14. Wondering if the oncoming fuel crisis has been taken into account? Would digital technology help or hinder coping with more expensive fuel and/or less available fuel?

- I guess theoretically precision agriculture would help by allowing for reduced fuel consumption because of more precise data-driven farming. At the same time, there isn't great evidence showing such a solid ROI that might justify the investment in the equipment.

15. Concerns for data ownership for what farmers are doing, the soil types, etc. Might data be sold by equipment manufacturers?

- We suspected we would see this concern around data privacy and ownership and potential corporate misuses of data. For the most part, however, what we saw was a kind of indifference toward what the large companies are doing with big data and in part because there was an indifference toward the data collecting equipment and decision support tools – i.e., these farmers are just opting to operate outside of what is going on, say, in commodity grain production in mid-western Canada. So the farmers were not concerned or resistant but rather mostly just did not care to engage.
- There are some interesting (mostly voluntary) data regulation initiatives summarized in this report: <https://usaskstudies.coop/documents/big-data-in-canadian-agriculture-report-fultonetal.pdf>



16. Organic certification needs documentation/traceability/reporting. Record keeping is a huge impediment. Is software available? There is a cost benefit for this application.

- Yes, definitely – some respondents said that they have trouble with the bureaucracy of organic certification processes, and they would love a type of app or software where they could store all the information they would need to certify as organic. Some respondents said that that would be difficult with the level of crop and livestock diversity they have on their farm.

Policy options

17. I was interested in your point around women being overrepresented in market garden sector. Were their policy suggestions as part of the research findings? Did the respondents suggest any areas?

- This was not a finding but rather comes out of the most recent agriculture census data. The gender “bias” is one reason we focused in on this area and this production strategy so we had gender in mind all along.
- We haven’t explored the relationship between gender and technology yet in our analysis in part because even though we let this statistical relationship guide our participant recruitment we still had data from both survey and farm visit skewed toward participants identifying as male.
- I suspect – and it’s an inference based on prior studies of mine in Saskatchewan - we interviewed more women than we would have if we had sampled in Alberta or Saskatchewan.

Next steps

18. I find it interesting that you left the definition of digital ag open ended. Will there be a follow-up survey about this perspective and see if mindsets change?

- We hadn’t thought to do this but it’s a neat idea. Presumably your hypothesis is that the definition might change over time as more people adopt (if they do)?

19. What are the opportunities for policy input that will result from participation in the survey research?

- The findings from this study are being shared directly and through various web channels (OMAFRA, agricultural associations and a “community of practice” or working group within AAFC) with policy makers in the form of a “project brief.” (also attached as part of the follow up to all presentations).