



NUFFIELD
Farming Scholarships

Innovating AgTech Entrepreneurship

Written by:

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A NUFFIELD FARMING SCHOLARSHIPS REPORT

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NUFFIELD
Farming Scholarships

*“Leading positive change in
agriculture.*

Inspiring passion and potential in people.”

Date of report: Written 2022, Published 2025

Title	Innovating AgTech Entrepreneurship
Scholar	Hannah Senior
Sponsor	Elizabeth Creak Charitable Trust
Objectives of Study Tour	Investigate how to better align interests between the environment, farmers, entrepreneurs and investors. Learn how to create a more vibrant ecosystem for AgTech entrepreneurs in the UK.
Countries Visited	New Zealand, Australia, United States (plus a further 11 countries by zoom)
Messages	<p>A lot of emphasis is put on technology to address agriculture’s major challenges. Technology matters, but it’s equally crucial to address other issues, e.g. how we solve problems, invest capital and measure success.</p> <p>Many entities are involved in agriculture and agricultural innovation, including governments, the environment, farmers, entrepreneurs and investors. Naturally all these parties want to benefit, but currently imbalances in the relationships undermine long-term value creation.</p> <p>Important differences exist between AgTech and the Silicon Valley innovation template that often informs entrepreneurial ecosystems. To align interests and make a more vibrant AgTech ecosystem these differences need to be considered.</p> <p>Equipping the agricultural sector to understand the complicated relationships and unpredictable effects of change requires a new ‘tool set’ - more skill in Systems Thinking will help.</p> <p>Farmers, growers and their representative organisations must be more involved in entrepreneurial innovation as idea progresses from its conception, to commercialisation, to a change in farming practice. We must also diversify who invests in AgTech start-ups and how investments are made.</p> <p>All this requires a greater emphasis on collaboration, which involves finding methods to build trust, share risk, and equitably distribute value that’s created.</p>

EXECUTIVE SUMMARY

The potential for entrepreneurs to bring new technology to agriculture (“AgTech”) has created a recent focus for start-up activity (\$19Bn invested in “on-farm” innovations in 2021). Most AgTech innovations promise to tackle agriculture’s most pressing concerns: environmental impact, labour issues and farm profitability. This study set out to explore how to create a vibrant AgTech entrepreneurial community, and investigated questions such as what support around entrepreneurship is beneficial, and how interactions between start-ups farmers should operate.

However, it also asked much wider questions such as whether AgTech entrepreneurship can really influence farming, the environment and the food industry in the way founders and investors often hope. I questioned the appropriateness of modelling AgTech entrepreneurship ecosystems too closely on what worked well in Silicon Valley. Farming is a very different ‘problem space’ to computing or software. AgTech innovation influences the food system, ecosystem, and economic system, all of which are influenced by a complex set of interactions and feedback loops. This makes the impact of a new technology hard to predict – what is a good idea in one respect (e.g. artificial fertiliser) can bring unforeseen negative consequences (e.g. climate change impact, water pollution).

I began to recognise a pattern that I came to call a “Chain of Extraction” that happens, at a macro-level, between the environment, agriculture, entrepreneurs and investors.

- Agriculture extracts from the environment (e.g. biodiversity, carbon, water)
- Entrepreneurs extract from farmers (e.g. time, insight, risk)
- Investors extract from entrepreneurs (e.g. financial returns, mental health, lifetime earnings)
- Everyone is extracting from the public purse (e.g. tax breaks, subsidies, publicly funded research)

Despite both the two-way nature of the transactions and the many exceptions, overall benefits tend to accrue more in one direction than the other and this erodes one party’s ability to sustainably create value. The chain arises *despite* most people trying to do the right thing most of the time. It that emerges from the way social, economic and environmental systems operate.

Improving AgTech innovation requires greater awareness of this dynamic. It also needs creative approaches to align interests and address imbalances, paying attention to how risk, value creation and trust are created and shared. Examples include:

- Involving farmers earlier and more substantially in new technology development. Tennessee AgTech business accelerator AgLaunch does this well, working with farmers to select and trial entrepreneurs’ innovations while ensuring the farmers’ contributions are reflected when financial returns are distributed.
- Diversifying how early-stage investments are made. Novel ways to structure startup investment (“innovative finance”) exist but are not widely used although there is emerging evidence that investors can achieve strong financial returns even with agriculture-like characteristics (e.g.

longer adoption timeframes). Greater efforts to diversify who invests would also be beneficial.

- Equipping people in the AgTech ecosystem with “Systems Thinking” skills (e.g. being better equipped to identify how/where to make change in complex systems, and understand how influences can deflect us from our stated goals) alongside an openness to collaboration. New Zealand’s Te Hono movement aims to build a more holistic mindset among leaders of their Primary Industries, and build “collaborative advantage”

The study concluded that technology is only a partial answer to our problems. Changing less obvious things like how we solve problems, invest our capital and measure success will also be essential.

TABLE OF CONTENTS

Executive summary.....	ii
Chapter 1: Personal Introduction.....	1
2. Background to my Study Tour	2
3. Problems in Agriculture: Can Technology Help?.....	3
3.1 Labour.....	3
3.2 Agriculture’s impact on the environment.....	4
3.3 Farmer Profitability.....	4
3.4 Problems in Agriculture & Technology - Conclusions.....	5
4 Why do we need Entrepreneurship?.....	6
4.1 A Template: Silicon Valley	6
4.2 The Entrepreneurial Ecosystem.....	6
4.2.1 Existing Agribusiness: “Incumbents”	7
4.2.2 Government	7
4.2.3 Business Accelerators	8
4.2.4 The Entrepreneurship Industry	9
4.3 Conclusions	9
5 AgTech Entrepreneurship and Farmers.....	10
5.1 Including the Farmer Perspective.....	10
5.2 Trials	12
5.3 Adoption Challenges.....	13
5.3.1 Risk	13
5.3.2 Complexity.....	13
5.3.3 Hype, leading to cynicism	14
5.3.4 Investment	14
5.4 Conclusions.....	14
6 The Entrepreneur’s Experience.....	16
6.1 Entrepreneur Case Studies	16
6.2 Interaction with Farmers.....	17
6.3 Funding	17
6.4 Public Sector Support	18
6.5 Cost to the Entrepreneur	18
6.6 Conclusions.....	19

7 Investment Models For AgTech.....	21
7.1 Venture Capital.....	21
7.1.1 VC and AgTech : An imperfect fit.....	22
7.2 Finding a model that works better.....	22
7.2.1 Private (Angel) Investing.....	23
7.2.2 Crowd Funding.....	23
7.2.3 Innovative Finance.....	24
7.2.3.1 Convertible Revenue Based Finance (C-RBF).....	24
7.2.3.2 Redeemable Equity.....	24
7.2.4 Tearing Up the Investment Rule Book.....	24
7.3 Conclusions.....	25
8 Systems Thinking, and the Chain of Extraction.....	1
9 Discussion: Doing things differently.....	3
9.1 Systems Thinking.....	3
9.2 The Economic System.....	3
9.3 Collaboration.....	4
9.4 Other World Views.....	5
9.5 Doing things differently - Conclusions.....	5
10 Innovating AgTech Entrepreneurship: Conclusions.....	6
10.1 Regenerative Agriculture – An Analogy.....	6
11 Recommendations.....	8
12 After My Study Tour: Postscript.....	9
Appendix 1: Contributors.....	10
Appendix 2: Verbatim quotes (where paraphrased).....	12
Section 3.1:.....	12
Section 4.....	12
Section 4.2.3:.....	12
Section 4.2.3.....	13
Section 5.1.....	13
Section 5.3.3.....	14
Section 4.3.4.....	14
Section 6.2:.....	14
Section 6.3.....	14
Section 6.5.....	15

Section 7.1.1.....	15
Section 7.1.1.....	15
Section 7.2.3.2.....	16
Section 9.....	16
Section 9.1.....	16
Section 8.1.....	17
Section 9.2.....	17
Appendix 3: Resources & Bibliography.....	18

DISCLAIMER

The opinions expressed in this report are my own and not necessarily those of the Nuffield Farming Scholarships Trust, or of my sponsor, or of any other sponsoring body.

Please note that the content of this report is up to date and believed to be correct as at the date shown on the front cover

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Nuffield Farming Scholars are available to speak to NFU Branches, agricultural discussion groups and similar organisations.

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CHAPTER 1: PERSONAL INTRODUCTION



Figure 1: Hannah Senior – a covid-era Scholarship experience!

My early career was working for and with large multinational corporations. Several years at Tesco and Tesco.com (when internet shopping was still novel, and orders could be faxed!) was followed by a stint as Strategy Consultant helping the like of banks and pharmaceutical companies with complex decision making. When I did an MBA at Stanford University it was a heady time - Facebook had just relocated to California, Google went public, and YouTube was bought for >\$1.5bn just 18 months after founding. Entrepreneurship was in the air and the social media revolution was kicking off.

This was all a long way from the small farming community and tiny village school where I started out. It was also the inflection point that brought me full circle back to agriculture. Despite the excitement of the technology world, I was drawn to more tangible and practical industries.

I returned to the UK and ended up acquiring some businesses, one of which makes products for plant breeders and seed producers. I found myself standing in plantations and agricultural research stations in remote parts of the world watching the threads of my career converge. I had a profound sense of 'coming home' to science and agriculture, while also noticing how much existing technology was *not* being used in the sector. I understood that that robotics, biological technologies, software etc could absolutely transform the sector but I also recognised the vast differences in culture, risk profile, economics and even vocabulary which stood in the way.

I became involved in supporting start-up businesses seeking to bring new technologies to agriculture. I wanted to use my Nuffield Scholarship to learn how other parts of the world were doing this. I started out intending to explore what the UK could learn from other parts of the world about creating a vibrant ecosystem for AgTech entrepreneurs. I rapidly realised that this was the wrong question to ask.



2. BACKGROUND TO MY STUDY TOUR

I became aware early in my research that the world of AgTech entrepreneurs couldn't be addressed in isolation. It sits within a network of other issues which kept drawing my attention to the bigger picture. Actors in the AgTech world are under the influence of food system, the economy, and both national and international cultures and history. This report takes an unashamedly macro view; big picture, global, and at times historical.



Figure 2: Countries visited (blue) plus interviews conducted (red) for this research.

My Nuffield year coincided with the Covid-19 pandemic, with many implications:

- It made this interconnectivity of issues even more apparent and raised big questions about matters previously taken for granted.
- My research spanned more than three years during a period of intense change within the AgTech ecosystem.
- Many of my best conversations happened by zoom, not in person. This gave me the advantage of being able to record & directly share their comments (with consent!).
- My innovative and far-sighted sponsor, The Elizabeth Creak Charitable Trust, supported me doing my research as a podcast documentary (available via all podcasting apps) called Innovating AgTech.

This report is designed to make it possible to dip into certain topics of interest, although collectively it describes the arc of my reasoning and the shift in my thinking. A list of contributors, especially those quoted, is found in the appendix.

A note about terminology

For simplicity and to avoid repetition, I acknowledge the following:

- I frequently refer to agriculture and farmers. These terms should more properly be broader e.g. "agriculture, horticulture and aquaculture" or "farmers and growers", even "primary producers", but using more comprehensive terms can be wordy and make the meaning hard to follow.
- I often use "innovators" and "entrepreneurs" interchangeably. One can, of course, innovate without an entrepreneurial venture.
- Some of the comments made by me or others need to come with a *#NotAll...* caveat which I haven't always included. There are many extraordinary examples of, for example, farms working in harmony with the environment which we can acknowledge, while also recognising the global-scale impact of agricultural activity. A similar point goes for labour relations or investor priorities etc etc. Where I feel a general point holds, I haven't belaboured this.



3. PROBLEMS IN AGRICULTURE: CAN TECHNOLOGY HELP?

Before discussing AgTech entrepreneurship, it's worth asking why we need more technology in agriculture. Typically, new technology in agriculture is used to address three major challenges affecting sustainability of agricultural businesses: labour availability, environmental impact, and farmer profitability.

3.1 Labour

Fewer people than ever before are required to produce food for the human population and labour saving has been the mainstay of agricultural innovation throughout history (Table 1).

Table 1: Agricultural labour force in relation to population

	10,000 BCE	1900	2022
Global human population ¹	4,300,000	1,500,000,000	8,000,000,000
% labour force in food production / collection	c.100%	c.70% ²	27% ³

Yet agricultural work still often relies on many pairs of hands doing repetitive, uncomfortable, and sometimes dangerous work, and finding staff remains a challenge. Working conditions and seasonality are important factors, pay is a concern (although some horticultural growers in the UK offered harvest workers £30/hr in 2021⁴ and were still unable to hire enough people), and agricultural work has a bad reputation for safety.

An enlightening conversation with US based author and journalist Sarah Mock illustrated this problem. She highlighted that farming traditionally relied on cheap or free labour, often supplied by family, serfdom or, notoriously, slavery. She then listed a long history of undesirable labour practices in agriculture, using forceful language to described how exploitative behaviour still unsettlingly common today⁴ (especially from a US perspective):

"Agriculture still enjoys essentially universal exemptions from labour law. We know that farm workers die at an exceptionally high rate on farms... Farmers or growers or processors use ... a myriad of ways to create deniability to create space to create cracks that ... vulnerable people can fall through".

COVID-19 travel restrictions exacerbated workforce shortages, as seasonal migrant labour collapsed. I spoke to Juliet Ansell, Head of Global Science Innovation at kiwi fruit giant Zespri International, a New Zealand based company which manages 30% of global kiwifruit volume and sells to about 60 countries around the world. She described the impact on their harvest and packing operations: *"In 2021, we had a shortfall of 4500 people. And we've predicted that that's going to be at least 6500-7000 [in 2022] ... we've estimated that's about NZ\$414 million of revenue that will have cost us"*.

Technology can certainly help here, either by making manual work a little less gruelling, or moving to greater/full automation. Juliet Ansell described the first step as making manual

¹ <https://ourworldindata.org/world-population-growth>

² <https://www.maxroser.com/roser/notebook/Agricultural%20Employment/>

³ <https://data.worldbank.org/indicator/SL.AGR.EMPL.ZS>

⁴ <https://www.examinerlive.co.uk/news/food-firm-offering-workers-30-21677777>



labour easier and faster without sacrificing quality, while transitioning to a more automated robotics-driven future (see Appendix 2.).

3.2 Agriculture’s impact on the environment

The human population has ballooned from 2bn to 8bn in about 100 years. This is a huge success story because fewer people dying. It also causes monumental impact on the planet.

Brent Loken, Sweden-based Global Food Lead Scientist at WWF explained *“It [the food system] is probably the single largest driver of environmental degradation on our planet. We’re starting to realize that we cannot address the environmental crisis that we’re facing without fixing our food system”*.

Take greenhouse gas (GHG) emissions, one third of which comes from the food system. Francesco Tubiello, Senior Statistician at the United Nations FAO broke this down into three roughly equal categories (Table 2).

Table 2: The climate change impact of food and agriculture

Approx % world GHG emissions	Cause
10% comprised of 5% 5%	Within farm-gate emissions - Methane (primarily from ruminants, but also rice paddies) - Nitrous oxide (especially from synthetic fertiliser use).
10%	Food after it leaves the farm, - e.g. transportation, processing & waste
10%	“LULUCF”: Land Use, Land Use Change & Forestry. - Converting wild land into agricultural land e.g. draining peatlands, cutting down rainforests or grazing scrub

The potential for technology to help here is mixed. There is room for improvement, but technology can be a sticking plaster which delays or is easier than making more fundamental changes.

Brent Loken (WWF) was vocal about this, saying technology might help create more with less, or reduce waste, but the temptation to rely on it is misplaced (see Appendix 2.ii). Waiting for a technological innovation to “save us” can delay addressing the real, underlying issues. He went on to stress that much of the environmental challenge is not technological, it’s about human coordination. We have many of the answers already, but inertia or commercial cost issues prevent them being adopted in the way that’s needed.

3.3 Farmer Profitability

Taken as a whole, agriculture is not a very profitable industry to be in⁵. This is a problem for the economic sustainability of agriculture even before asking for better working conditions or more environmentally friendly practices with a price tag that many farmers find hard to pay.

⁵ eg <https://www.gov.uk/government/statistics/agriculture-in-the-united-kingdom-2021/chapter-3-farming-income#distribution-of-farm-incomes-and-performance>



One way to understand profitability issues in agriculture draws on the famous business analysis model “ Porter's Five Forces” ⁷ . This highlights that farmers are relatively small companies forming the middle layer of a sandwich. They are squeezed between the greater bargaining power of huge, highly consolidated suppliers who influence the cost of production (e.g. seed, feed and equipment companies) and large, highly consolidated customers who largely set selling prices (e.g. supermarkets and grain companies). It's perfect recipe for poor margins for those in-between.

On top of that as Sarah Mock, the American food journalist and author, reminded me that much of agriculture produces for commodity markets. Commoditisation means aggregating produce from thousands of farms to sell as one single product. The system has benefits: customers can buy what they need without dealing with lots of different farmers, and consumers see low prices. But it is hard on farmers who frequently sell into the commodity market close to or below the cost of production.

Technology is unlikely to solve problems of **farmer profitability**. It *can* influence the balance of power in an industry, but this is rare. Technology might help farmers to command higher margins sometimes - e.g. when better traceability demonstrates the use of practices that consumers value such as exemplary environmental stewardship. Similarly, robotics could increase profits through better quality and less wastage.

Overall though, the history of technology adoption in agriculture shows these benefits are often short-lived. The entrenched and powerful dynamics in the food system pass the financial benefits of technology on to others in the food system, and this is very hard to change.

3.4 Problems in Agriculture & Technology - Conclusions

Although improved agricultural productivity is a human success story, there is a compelling need for change how we do things. Stopping agricultural activity is impossible - humanity would starve - so we must find ways to feed ourselves that rely less on human labour, allow farmers to make a decent living, and don't inadvertently ruin our planet. Technology is an important tool, but not the sole answer. Other, more complex issues about how we organise ourselves as humanity are also important.

Table 3: Can technology help solve major on-farm challenges?

	Can technology help?	Why?
Labour	Probably	<ul style="list-style-type: none"> Technology can make tasks less difficult, faster, or remove human involvement entirely
Environment	Maybe	<ul style="list-style-type: none"> Innovations could help ... But could also be a distraction preventing tackling more fundamental issues
Profitability	Probably not	<ul style="list-style-type: none"> The dynamics of the industry are stronger drivers of farm profitability

Technology generally increases the efficiency of how our society and economy *already* works rather than address underlying systemic issues. What's more, technology may inadvertently create new, unintended problems. It can give us incredibly valuable ways to help make food and fibre production more sustainable ... but it isn't a magic cure.



4 WHY DO WE NEED ENTREPRENEURSHIP?

Agriculture is primarily a commercial activity, and entrepreneurs are one important ingredient to bring much-needed novel approaches to market. Turning a bright idea into farming practice needs people who find innovative solutions to challenges, perhaps coming at them from a different direction or challenging received wisdom. Change may also require new business models and a willingness to take risk, which not everyone can embrace.

I spoke to Rasmus Hartman, Associate Professor at the Copenhagen Business School several times by zoom. His original and refreshing views (especially on the Entrepreneurship Industry – Section 4.2.4) were influential in shaping my thinking. He said about entrepreneurs:

“We know with quite high levels of certainty that a dynamic economy needs entrepreneurs... We know that there are types of innovation, that established companies just don't introduce, only new companies introduce. And we need those innovations developed. And we need entrepreneurs to do that.” (see Appendix 2.ii)

4.1 A Template: Silicon Valley

Silicon Valley, in California, has been the global epicentre of entrepreneurship for decades. It arose thanks to cold-war era government investment in defence research, leading to technological breakthroughs and an influx of people relevant engineering skills. Spinout companies developed, and many founders became very wealthy. These founders reinvested in future entrepreneurial innovation, supported by a new method of high-risk / high-return investing: venture capital (VC – see Section 7.1). A technological gold rush was sparked.

The wealth creation, innovation and change created by Silicon Valley has created huge interest among people wanting to know how similar success could be recreated elsewhere. As Rasmus Hartman pointed out, this is akin to how Manchester may have been researched to understand the ideology and methods underpinning the Industrial Revolution (*“What is this factory thing?”*).

Sarah Nolet, of VC firm Tenacious Ventures, grew up in Silicon Valley *“I lived the experience of entrepreneurs who would get an idea...create it, and then get funding and be successful. And then once they left the company they founded, they could become that next wave of investors backing the new crop of entrepreneurs...That is such a critical factor in an ecosystem, because you need people, you need capital, and you need the ideas and technologies. That's all absolutely critical for agriculture”*

However, while the Silicon Valley formula for success worked brilliantly in California, in computing, it hasn't proven easy to “cut and paste” this formula to other geographies, cultures and industries. Rasmus Hartmann sounded a highly relevant note of caution saying that borrowing too heavily from the same playbook might be *“bad reasoning on whole range of counts”*.

4.2 The Entrepreneurial Ecosystem

To be a successful entrepreneur involves navigating networks of other relevant organisations known as the **Entrepreneurial Ecosystem**. The term “ecosystem” is used because, like a biological ecosystem, it is made up of parties which interact and interdepend in multiple ways.



Table 4: Examples of participants in the Entrepreneurial Ecosystem

Publicly Funded	Industry Specific	“Entrepreneurship Industry”
<ul style="list-style-type: none"> • Government - local and national • Research centres and universities 	<ul style="list-style-type: none"> • Farmer co-operatives • Existing agribusinesses • Other start-ups 	<ul style="list-style-type: none"> • Business Accelerators • Start-up Advisors • Investors & financiers

The dynamics of the entrepreneurial ecosystems I observed varied widely by country. The American ecosystem is heavily influenced by investors and existing large agribusinesses, whereas in New Zealand and Ireland government were influential in setting priorities. In contrast, farmer-owned cooperatives play an important role in Denmark. Despite variation, all the ecosystems I researched looked extensively to Silicon Valley for inspiration (Section 4.1).

4.2.1 Existing Agribusiness: “Incumbents”

Adrian Percy is an agribusiness veteran turned Director of the North Carolina State University Plant Sciences Initiative. We discussed how new companies fit in among agriculture’s incumbents and he pointed out that despite all the noise around certain AgTech startups, on the scale of global agriculture their impact has been relatively small.

He thinks that will change as big agribusinesses are now starting to engage with startups far more: *“In the past, I would say most of their [Multinationals’] activity was centered on their own R&D ... but was limited to only a few technologies that they really felt they could bring to market. I think now, what has changed is that ... they’ve adopted a more, what I would call an “open innovation” model ... in the hope that they will kind of unveil the next transformative technology.”*

Partnerships between startups and incumbents can work to the advantage of everyone involved (see Section 4). Big companies can help startups with costly and time-consuming product development, regulation and marketing challenges, while big corporations can benefit from smaller companies’ unique research focus and specific expertise.

Inevitably though, it won’t work for all ventures. If entrepreneurs want to disrupt the position that existing companies have in the market, or focus on very different priorities to traditional agribusinesses, e.g. indoor agriculture and alternative protein production, other alliances may be needed.

4.2.2 Government

Another feature of all entrepreneurial ecosystems is the role of Government.

For Sarah Nolet, the Australian government is especially keen on AgTech. She explained *“Australia is thinking a lot about technology to improve productivity and increase the amount of food and fibre output, but also potentially as an exporter in its own right, selling products and services to the rest of the world. And that’s led to government support around early stage innovation, like incentives for venture capital funds or incentives to do trials, or rebates for farmers to access a new technology... So there’s a whole range of ways [from grassroots to government] that have been really critical in catalysing a lot of this work.”*

In New Zealand, Juliet Ansell, of Zespri International also sees government support as important to build connections and carry out global scanning to find new innovations. *“That’s something that happens really well here in New Zealand [there are] lots of people [in government] looking on behalf of industry, researchers and companies.”*



4.2.3 Business Accelerators

Business Accelerators are organisations designed specifically to help new ventures flourish. They aim to help young companies build momentum, growing or launching products faster by offering a mixture of connections (e.g. investors, lawyers, trial partners) and services (e.g. lab space, business training). They also act as integration points for the entrepreneurial ecosystem as a whole.

While important, business accelerators are not very profitable. Startups, typically, have no money to pay for services. For this reason accelerators are often started by parties who have incentive to cultivate or get close to innovative companies e.g. investors, large agribusinesses or governments. To understand these dynamics better I met with three business accelerators relevant to AgTech (Table 5).

Table 5: Overview of Selected AgriFood Business Accelerators

<p>Sprout Hamilton, New Zealand</p>	<p>Sprout acts as a AgTech hub, building on New Zealand’s strength in Primary Industries by bringing together government, agricultural companies and startups.</p> <p>Funding came from the New Zealand government, and more recently the VC fund, Finisterre. Representatives from major New Zealand agricultural companies such as Zespri, Frontier and LIC take part as “Industry Partners”. Involvement gives these partners access to new ideas and allows them to share insights with other industry partners. (see Appendix 2.iv, Juliet Ansell of Zespri’s explanation)</p> <p>Participating startups benefit from these industry partners and VC connections. They get pitching experience, feedback, industry insight and advice. Sometimes industry partners may buy a start-up’s innovation for use in their own business or ask for help with a problem the entrepreneur’s expertise could help with.</p>
<p>Food System 6: San Francisco, USA</p>	<p><u>Food System 6</u>, is an educational non-profit organisation, set up by US engineer-turned-investor Peter Herz (his VC firm is 1st Course Capital, ICC). He wanted to create an “engine for change” across the food system, believing that both for-profit and non-profit innovation is needed to impact the environment, health and social justice. He said “<i>We believe supporting innovation across both [for-profit and non-profit]... is a key way to have the larger <u>systems</u> impact we’re trying to have</i>”.</p> <p>This approach recognises that sometimes, creating change means backing ventures that have the potential to cause greatest impact, even if they aren’t necessarily the most lucrative (e.g. an educational or not-for-profit company)</p>
<p>AgLaunch: Memphis USA</p>	<p><u>AgLaunch</u> is a proudly farmer focused non-profit organisation, developed by Tennessee based Pete Nelson to select and trial agricultural innovations.</p> <p>Pete is keen to help agriculture move away from the current unsustainable, commodity-based system. He described that funders support the organisation to help farmers position</p>



	<p>themselves to capitalise on future opportunities, diversify the crops produced and have more incentive to increase environmental sustainability, all while breaking away from the US' "corporate driven models" of innovation.</p> <p>Pete described how a core differentiator is that "Our incubator... is a network of farms. And the way we scale is creating feedback loops across multiple soil types, crop types, to help grow and commercialise the companies... That's work that a startup company would not be able to fund for themselves". (see Appendix 2.v)</p>
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4.2.4 The Entrepreneurship Industry

The entrepreneurship industry is a term used to describe not the entrepreneurs themselves but the array of businesses selling products and services to them. Examples might include hot-desk space, conferences or training.

Much is made of Silicon Valley success stories, such as portrayed as billionaires made almost overnight, or college drop-outs developing world-changing software from their garage. But knowing there is money to be made from entrepreneurs' aspirations should make us a little cautious about this. Rasmus Hartmann of Copenhagen Business School believes "in Silicon Valley, there's a high level of self-consciousness around this [the entrepreneurial dream]" because it's an important selling tool for the Entrepreneurship Industry.

The less positive sides of entrepreneurship are less widely discussed. For instance, failure rates are high among start-ups, but the impact of this is minimised by the entrepreneurship industry who re-frame failure a normal test of entrepreneurial grit, encouraging founders to keep persevering in their ambitions so they continue as "customers". As we'll see in section 5.6, this can be at considerable disadvantage to the individual entrepreneur.

4.3 Conclusions

Entrepreneurs have an important part to play in bringing new technologies to market, especially in the context of a food system that needs change to work better for the planet, for humanity and those that work in agriculture.

Success is more likely if there's an ecosystem buzzing with information, trials, exchanges of ideas and access to risk capital. While everyone in the ecosystem is pursuing their own goals, identifying and aligning with people who share interests is critical. This enriches everyone, not just entrepreneurs but also farmers, industry incumbents, governments and investors. While traditionally investors and entrepreneurs feel most 'ownership' for the entrepreneurial ecosystem the important role of the government and the wider agricultural industry can't be overstated.

Nonetheless, for individual entrepreneurs the decision to work in a start-up is risky and may be especially so in the world of AgTech (see Section 4). If we want entrepreneurial innovation in agriculture, it's important to question how the model of entrepreneurship that succeeded in Silicon Valley will map across to other settings. Attitudes that work well in software ("move fast and break things") may not map onto an industry like Agriculture which impacts the environment and human health. Equally, expectations about product development cycles developed in Silicon Valley may not accommodate farming's growing cycles and seasons.



5 AGTECH ENTREPRENEURSHIP AND FARMERS

In my research and discussions about AgTech, I found that the voice of farmers was often missing. The views of investors, entrepreneurs and large agribusinesses are plentiful, but the people who will use this technology, whose industry is under transformation, were often not well represented. The main place farmers showed up was for on-farm trials, a necessary precursor to bringing a new approach to market.

I wondered, does the farming sector see any impact for the billions of dollars invested? Do they agree the right problems are being prioritised? When is the right time to go from the workshop to the farm, and how should this be done?

5.1 Including the Farmer Perspective

What do farmers actually want? New Zealand farmer Craige MacKenzie believes many innovators develop technology without really understanding what farmers need. Craige founded Vantage New Zealand in 2010 to help supply precision agricultural systems and training to farmers. This brought him into contact with many AgTech entrepreneurs and he described a common failing: that entrepreneurs miss valuable insights by not talking to farmers enough in the early stages of defining a problem.

“So often they are poles apart, what they’ve [entrepreneurs] designed and what farmers actually need... There’s a massive disconnect in that space...[and] some of them don’t actually want to hear the bad bits, they just believe it works.”

A complaint I often heard from farmers is that many AgTech entrepreneurs devise a technology, then look for a problem they can fix with it, rather than starting with a problem and exploring how technology can solve it.

For Ethan Cleary at the Irish Farmers Association, data collection is an example of this, describing how data collected without a clear purpose in mind has no value to a farmer. He suggests data is only helpful if farmers can make practical business decisions as a result, like planning crop rotations or fertiliser use. In his view, when data is collected supposedly for farmers’ use it’s often presented badly or fails to provide the insights needed. This makes farmers reluctant to get more closely involved in the tech development process.



Figure 2: Sarah Nolet discusses the AgTech Ecosystem

Sarah Nolet believes connections between would-be AgTech entrepreneurs and farmers are becoming more formalised, saying



“There are pathways and programs where you can get that feedback ... where you can learn about how the other side’s thinking and be in that environment that fosters collaboration, and creativity, and trials, and all the things we need to develop new technologies.”

This is important because it’s often true that technology developed in the course of a PhD programme, for example, can be used in a commercial setting. For this reason communication structures and programmes that encourage regular feedback between farmers and innovators are essential.

Case Study 1: AgLaunch

Doing on farm trials well and putting the needs and interests of farmers at the centre of the innovation process, are the reasons Tennessee-based business accelerator AgLaunch was created (see 4.2.3). Their model offers interesting ideas about how to configure the entrepreneurial process allowing greater benefit for everyone involved.

Pete Nelson started it after becoming interested in the economics and value chain opportunities for both farmers and consumers, and how these could be changed. He envisaged helping farmers move away from commodity production by diversifying their income, measuring and adding value to sustainability and wildlife, and creating a traceable value-added production base.

AgLaunch connects entrepreneurs with farmers early in their development, helping them test and scale an idea. It facilitates the startup’s growth by creating *“path to market that is more efficient, effective than the current offerings.”* (see Appendix 2.vi). It also provides access to entrepreneurial ecosystem elements like a business accelerator program and investor partners.

Pete developed a network of farmers prepared to trial innovations. These farmer participants are recruited to represent a wide range of production systems and scales, providing valuable diversity in the feedback startups receive. AgLaunch also actively seeks innovations to solve the problems farmers themselves want solving, such as herbicide spray drift.

Pete says, *“the farmers are engaged at every step of identifying what we’re targeting, screening the technologies and the deals, giving feedback. The things that we choose to invest in and grow are because our farmer partners have recommended those.”*



Figure 3: AgLaunch Partner Farm, Greenleaf Learning Farm, Memphis TN

The AgLaunch approach creates benefits for everyone. Entrepreneurs get stronger agricultural connections for trials and development, farmers gain by having better risk management, more engagement and better solutions, while investors can invest in more effectively “de-risked” ideas.



Figure 4: AgLaunch Partner Farmers James and Scott Fullen, from the large-scale row-crop focused Fullen Farms, Ripley TN. Pete Nelson, centre.

5.2 Trials

No technology can go from idea to product without a period of trialling, ideally in many different farm settings. Done well this improves the utility of the solution, identifies areas to improve and clarifies the benefit to the customer. Trialling is best achieved in conjunction with real farmer-users but the process takes time, energy, and expense. It also involves building trust, a shared interest in success, and ensuring everyone delivers on promises.

Even with the best of intentions, unfortunately, things do not always go according to plan, as the experience of arable farmer, Andrew Todd, shows .

Case Study 2: Andrew Todd, Seed Terminator

Arable farmer Andrew Todd grows wheat, barley and oilseed rape on his 4200ha family farm in Western Australia. Concerned about herbicide resistance in weeds, he was excited to come across a start-up called Seed Terminator. The company had developed a machine that controls weeds by destroying their seeds as the crop is harvested, preventing them from returning to the seed bank and germinating the following year.

Andrew knew there would be an element of risk working with a startup, but he applied to take part in the trial, investing AUD\$70,000 in hardware and AUD\$20,000 in a 1% share in the company.

"It was a way to get some skin in the game... to be on board to help make it work in those final stages of R&D... But it was also to incentivise us. There'd be more in it for us in the future to reward us for the risks we were taking at the time."



Figure 5: Andrew Todd with the Seed Terminator

Unfortunately, the trial didn't work out as expected. The prototype device couldn't cope with the workload, and the company's engineers weren't able to offer the technical support needed. Harvest productivity dropped from 80-100ha/day without the Seed Terminator, to just 650ha over 21 days with the kit, costing Andrew as much as AUD\$400,000 in oilseed rape losses.

"It was a hard lesson," he said. "We needed the support, we needed boots on the ground, hands on the spanners, eyes on the problem, not a phone in my hand in a paddock with a dodgy reception ... They didn't have the resources."

The trial cost Todd dearly, but the story does have a happy conclusion. The following year he was given a new machine at no cost, and the mechanical issues he'd initially experienced were largely solved. Now, not only has the technology become part of Todd's operation, the company has since sold hundreds of units to farmers around the world.

5.3 Adoption Challenges

Once a technology has been proven to work, the next step is adoption. This is typically slower in agriculture than other sectors. At least four factors are at play.

5.3.1 Risk

Many of the people I met explained that for farmers one of the biggest, but often overlooked, barriers to adoption is risk. Beyond financial resources, trialling an innovation also requires investing time and energy that can't be spent elsewhere. As Andrew Todd's story shows, the risk that technology won't work, yields will be impacted, or the effort to implement it will outweigh the benefits, are all concerns.

Ethan Cleary of the Irish Farmers Association was adamant on the need to demonstrate economic impact. *"It has to show a clear return on investment for a farmer,"* going on *"If I adopt this technology, I have maybe one chance this year to grow a crop. This technology [must] show that it's going to make a difference, it will make me more productive, or make me more profitable."*

5.3.2 Complexity

Another challenge to adoption is the level of complexity and diversity in agriculture. Agriculture deals with complex biological systems, variation across soil types, different climate types and genetics. Technology that claims to have solutions for all contexts and farming systems, or that overlooks the skills and knowledge of farmers gained over generations, can miss complex but important differences. For Vantage New Zealand's Craig MacKenzie, neglecting farmers' instinct and their understanding of the crop is dangerous:



“When we’re in the field, and we’re living in a biological system, you can stand in a crop and go ‘something doesn’t feel right;’” he says. “There’s not too much science behind that... but it’s taking the instinct [and making] appropriate decisions... based on history, based on experience, and... what’s happening around you ...I don’t think we ever want to lose those skills from the farmerswe need to enhance the skills.”

5.3.3 Hype, leading to cynicism

Pete Nelson also worries that the tendency to put too much emphasis on AgTech innovation can be corrosive for trust. Hype can result in expectations being raised too high, or oversimplification causing a search for single solutions. Pete said: *“There’s still a prevailing attitude, even 10 years into this modern boom of venture capital and interest in agriculture... that there’s some big silver bulletThere’s not going to be any silver bullet, but there’s going to be a portfolio of solutions that are constantly adapting.”* (see Appendix 2.vii).

Similarly, Craige describes technology as ‘silver shotgun’, not a silver bullet. *“There are multiple things that come into play here,”* he explains. *“The more layers you get, the more complex it gets. But actually, the better the outcome becomes, it gets better and better every time you put another layer of detail across it.”*

5.3.4 Investment

The fourth challenge to adoption is simply making new technologies economic within the farm budget. Sarah Nolet described a trend towards focusing business models on meeting the needs of other organisations in the food system besides farmers, who are able and willing to pay for innovation.

For instance, a consumer-facing brand like PepsiCo or McDonalds may want to ensure its suppliers meet certain standards to fulfil the brand’s promises. Brands are often so powerful they can *insist* that producers use a method or technology as a price of entry for being a supplier, substantially accelerating adoption.

Sarah said, *“What we’re seeing now is unlocking the big incentives in the supply chain”* (see Appendix 2.viii) If the farmer’s customer, who she/he’s already selling to will now pay a premium for the technology, the economics of innovation are changed dramatically.

5.4 Conclusions

In general, was clear to me that the farmer her/himself is not sufficiently at the heart of AgTech innovation and although the benefits of getting involved are significant, so are the risks.

Without sufficient farmer engagement, an entrepreneur risks wasting time, money and energy on ideas that don’t work properly or will never be economically viable. Equally, farmers may find considerations they believe are important get overlooked.

For farmers to get involved in development and trialling of innovative technologies involves investing time and money – an ‘opportunity cost’ - and can significantly impact the wider business. As a result, finding ways to more equitably share risks, costs and the benefits of success across farmers, investors and entrepreneurs are important.

Powerful brand-owners are major customers for agricultural goods, and they could use this to financially support the trial and adoption of innovation in order to benefit from the ‘halo effect’ in the eyes of the consumer. Brand owners’ scale could give them huge power to drive beneficial change (e.g. lower carbon footprint production). However, while this might reduce



the risks for farmers of trialling and adoption, they might still find themselves financially squeezed by ever greater technology requirements. Another example of how it's hard to find solutions that benefit everyone!



6 THE ENTREPRENEUR'S EXPERIENCE

6.1 Entrepreneur Case Studies

Just as every farm has its own unique context, so each AgTech entrepreneur has their own motivation, challenges and aspirations. I met many entrepreneurs with ventures at different stages, but have selected case studies, shown in Table 4, where ventures have reached revenue generation and roll out stage. By definition, therefore, all the case studies are proving successful and have matured simultaneously with a surge in interest in AgTech. All of them discussed developing their technology (notably this almost always took 5-8 years), building a team, and raising investment, but the startup phase still felt current even as they transitioned to a more mature phase of commercialising and scaling.

Table 6: Case study AgTech companies

Entrepreneur & Company	Proposition	Support, Investment Type
<p>Bethany Deshpande SomaDetect Founded Canada 2016</p> <p>Bethany holds PhD in Biology & climate science but had no prior on-farm experience</p>	<p>Cow-by-cow management information about milk quality & animal health:</p> <ul style="list-style-type: none"> • Optical sensor detects somatic cell count & fat content in milk • Helps farmers maximise profitability & milk value (e.g. cull /don't breed unproductive cows) • Reduces vet bills & antibiotic use (anticipate & prevent mastitis) 	<ul style="list-style-type: none"> • CAN \$10m equity investment at time of interview • Strong farmer engagement: on-farm interviews & prototype development with >150 dairy farms • Backed by Strategic investors (dairy companies) and VC • Government grants and incentives especially climate-related. • Participated in several business accelerators: generic, agriculture specific and climate-oriented
<p>Ashwin Madgavkar Ceres Imaging Founded California, USA, 2014</p> <p>Ashwin had a business career prior to founding, which included working with sugarcane clients in Latin America</p>	<p>Aerial imaging data as management information for orchards and field-crops</p> <ul style="list-style-type: none"> • Initially used to identify irrigation inefficiencies. • Expanded into geolocated disease & plant nutrition issues. • Precision intervention increases yield and reduces costs 	<ul style="list-style-type: none"> • Founded during a severe drought, when farmers had strong incentive to address water use issues. • US\$ 60m equity investment raised at time of meeting • Investors include VCs, farming families, farming businesses. • Government grants c. \$1m plus extensive collaboration with academic institutions to connect imaging to on-the-ground plant health.
<p>Stefan Pedersen FieldSense Founded Denmark, 2015</p> <p>Stefan is a computer science expert with no farming experience: his co-founder's extended family were farmers</p>	<p>Management information for arable farmers</p> <ul style="list-style-type: none"> • Hyper-localised weather information to help plan work e.g. timing of spraying • Disease prediction tools. 	<ul style="list-style-type: none"> • Personal relationships forged key links e.g. farmer 'Experience Exchange Group' shaped the company's mission. • Initial investment from Angel investors & Danish Agro (cooperative farmer-owned buying / agribusiness group) who became distribution partners. • Later rounds from strategic investors
<p>David Smith, Ceres Tag Founded Australia, 2016</p> <p>David grew up on cattle stations, but his prior career was in engineering</p>	<p>Low cost, easy to use monitoring to geolocate cattle.</p> <ul style="list-style-type: none"> • Supports better pasture management • Identifies cattle needing welfare interventions • Enables easier mustering & rapid alerts to cattle theft. 	<ul style="list-style-type: none"> • Developed by building a coalition of partners including CSIRO, Meat & Livestock Australia (MLA) • All investors are either high net worth individuals or strategic investors (e.g. livestock or technology). • "Supportive government ecosystem": match-funding 50% of private investment



6.2 Interaction with Farmers

Many of the entrepreneurs had little prior experience of farming – and this should be embraced, enriching agriculture with new skills and perspectives. One benefit is that fresh eyes challenge conventions, as Ashwin Madgavkar described:

“I saw how some of these large farms made decisions around chemical or fertiliser applications to their crops, and I was struck by how little data was collected or used in order to guide those decisions.... [They] weren't able to get the granular data to customise how much they put on” (see Appendix 2.ix)

However, lack of experience of agriculture also creates risks, such as those in Section 5.1. All the case-study entrepreneurs engaged extensively with farmers to validate needs, something potentially made easier by timing. Being founded between 2014-2016, farmers may have experienced less hype and felt less cynical. At the same time, these entrepreneurs couldn't take advantage of the many farmer engagement programmes that exist today.

Bethany and her SomaDetect team spent time with more than 150 dairy farmers around their New Brunswick base discussing ideas and sharing prototypes. Recognizing the demand on farmers' time her team mucked in, both to learn and as a form of reciprocity:

“Farmers do not need another chore. I think everybody knows that there is an endless list of things that need doing ... we were just incredibly respectful of their time... if they spent two hours with us, we were happy to ... shovel things or whatever it was [that] helped to give back some of some of the time that they've given us. And that was a huge way we learned as well.”

The entrepreneurs also described shaping their ventures based on insights learnt along the way. As Stefan Pederson described:

“Contextual enquiry is a favourite tool. We learnt that farmers have enmity to [government and EU imposed] governance and regulation and wanted to be sure that data was not going to be shared and affect CAP payments. We decided we wanted to be on farmers' side, help them navigate the bureaucracy”.

6.3 Funding

The entrepreneurs I spoke to thought hard about their approach to raising investment; both how to raise the level of investment they needed and the kind of skills and input that would be attached to that capital (“smart money”).

David Smith described how Ceres Tag was developed from the start with close relationships with Meat and Livestock Australia (MLA) and the research organisation CSIRO, so they already had a lot of “domain expertise” available to the company. They build on this with “strategic investment” to support other aspects of the company: *“One [investor] is related to the satellite, another to communications, and one's our manufacturer... people who shared the vision, and where they wanted to see this a success”.* (see Appendix 2.x)

SomaDetect had to work harder to achieve domain expertise, and did this by finding strategic investors who knew the dairy industry alongside VCs who provided the depth of capital and technology expertise. As Bethany puts it:

“It helps [the business that] VCs or folks that don't necessarily understand dairy or agriculture to that same level of detail, nonetheless have confidence in the technology you're creating”... while for industry investors “It's an incredible opportunity, they get early insight into new



developments and really innovative stuff...[because they are] seeking to be innovative to be at the cutting edge and to stay up to date “. (see Appendix 2.xi)

This sense of win/win was also demonstrated in one of Field Sense’s early investors, Danish Agro. As a major cooperatively owned and well trusted incumbent, Danish Agro gained from understanding the technology and became sufficiently convinced to become a Field Sense distributor, while Field Sense gained from association with Danish Agro’s reach and deep expertise in the needs of farmers.

Timing is everything in entrepreneurship, and especially when investors often follow pronounced trends in the technologies and sectors with potential. For instance Ashwin Madgavkar of Ceres Imaging found that his initial fund-raising tapped into a “craze for drones’ among investors. Plus, he also sought out investors that will help in developing the company for future growth.

“Part of our ambition is to broaden our data sets so that it's not useful to only the farm, but it can also be used in an insurance claim or for a market or a trader for certain commodity,” he says. “And so that individual is helpful in thinking through some of the strategic implications of productising it for different use cases, different agriculture, ecosystem stakeholders, outside of the farmer, too.”

6.4 Public Sector Support

All the companies in these case studies are privately owned. Yet all benefitted from public support in one way or another. This includes collaborating with or using technologies developed in public universities and tapping into government incentives and grants.

Ashwin Madgavkar described one of Ceres Imaging’s collaborations, developing data exchanges with plant scientists at UC Davis. Early funding also included grants and cooperation with state-funded agencies. *“The government could be a really great partner for us to help expand the technology,”* he said.

David Smith talked with enthusiasm about the support received from the Queensland government, which helped to incentivise private investors and make their money go further

“I can't tell you how important that was... we have a very supportive government ecosystem, particularly, agriculture is one of the five pillars in which they see the economy booming”. He went on to describe receiving “a lot of grants, in fact, it's probably funded 30% of our company So that means every time any investor puts \$1 in, they're getting \$2 worth of value and the government is, you know, they're “pro that” because it keeps the economy ticking.

6.5 Cost to the Entrepreneur

All the case-study companies above were successful to date, having raised investment and brought their products to market. Nonetheless building a company is hard and entrepreneurship is risky. We hear primarily about the success stories yet we know that the failure rate for new companies is high.

Rasmus Hartmann, Associate Professor at Copenhagen Business School, highlighted this imbalance, called “survivor bias”. He laid out an unflinching view of the less rosy side of the entrepreneur’s story. He used a sports analogy to highlight the incredible rarity of the out-sized successes that journalists write about and VCs seek, vs the reality for most entrepreneurs:



"I think most people who go into professional sports, they have a sense that it's very few people who get to the NBA [The USA's National Basketball Association] ... People will tell them as they go through their career, "you're really talented, but this is a high risk choice". So [similarly] I think we should tell people: "make that choice about entrepreneurship with your eyes wide open"."

Investors lose out financially if a venture is unsuccessful but, the entrepreneur pays a higher price than the investor. This somewhat echoes the asymmetry of risk seen in Section 3.2 between farmers and entrepreneurs.

There are several reasons for this. The investor typically has a portfolio of investments, whereas the entrepreneur can only put their efforts into one venture at a time. Second, the VC professionals themselves have much lower financial exposure to failure, receiving management fees whether or not good investments are made. Third, when entrepreneurs experience bad practice among investors, especially the VC community, they are encouraged to keep quiet about it. As the entrepreneur Mark Johnson wrote about his experience with the AgTech data company, Descartes Labs, speaking out is a guaranteed way to ensure *"you'll never raise money from The Valley again"*⁶.

Finally, as Rasmus Hartmann spelt out, the average cost of entrepreneurship is much higher than generally understood. Entrepreneurship is stressful, demanding and uncertain and takes a toll both financially and psychologically:

"Entrepreneurs make less money, on average, over the course of their life [than non entrepreneurs]. The figures vary, but some come to like 20%, less over the course of a life. Right? That's a non-trivial amount of money. They should know that it's super stressful, and very high demand... With that actually also comes a whole range of psychological issues. We know that entrepreneurs are more depressed, they're more anxious, and have higher rates of psychological illness" (see Appendix 2.xii).

6.6 Conclusions

Being an entrepreneur has become quite fashionable pursuit, but developing a new technology, bringing it to market and growing a company is a seriously hard, all-consuming slog that goes on for many years, while success can be very vulnerable. On some level, the fact that anyone embarks on this path at all is remarkable!

Many entrepreneurs are attracted to AgTech with a strong sense of mission, including those from outside the industry. This is welcome if we want to find novel solutions to agriculture's challenges and bring new talent into the industry, although newcomers with backgrounds in other sectors must find ways to interact early and effectively with potential users of their innovations. Careful engagement of "smart money" is also a critical ingredient of success. The right investors bringing insight, connections and expertise to the company which proves invaluable in their development.

Nonetheless, although entrepreneurship is primarily the domain of private industry, it affects the economy and society (and in agriculture's case, the environment) as a whole. This means there is clearly an important role for the public sector. Well-designed incentives, grants and initiatives to support innovation and collaboration have a significant impact.

If we believe entrepreneurship is important and we want the best and the brightest to commercialise their ideas to bring innovation into agriculture, we need to recognise the full

⁶ <https://philosophygeek.medium.com/meditations-a-requiem-for-descartes-labs-8b913b5e898>



cost to them. We should acknowledge the financial and personal costs associated with this career path and seek to support entrepreneurs to manage the downsides better.



7 INVESTMENT MODELS FOR AGTECH

Finding the money to develop an idea and grow a business is one of the biggest challenges young companies face. Some can become self-funding quickly and grow with their own resources, others need years of expensive lab research and prototype development to even trial an idea, let alone generate revenue.

How much capital needs to be raised and where it comes from has a major impact on how an entrepreneurial venture develops. A startup's priorities are often driven by the need to win investment and comply with obligations associated with that finance.

7.1 Venture Capital

In terms of profile and awareness, Venture Capital (VC) dominates the landscape of startups and entrepreneurship. In 2019, 58% of investment raised by UK startup AgTech companies⁷ came from VC firms or Corporate VC (e.g. agribusiness-run VC divisions).

VCs are professional investors, finance experts paid to find promising startups and return a profit from backing them. The capital is provided by "Limited Partners" e.g. endowments, pension funds & wealthy individuals. Since VCs are mostly gambling on unproven technologies and young entrepreneurs, and because they take equity (shares) in exchange for investment, it is very risky. However, the rewards can be huge if a company is successful.

Most of the young companies VC invests in will fail. A 2019 report by Correlation Ventures, a data-driven VC fund, estimated that 64% of all VC-backed companies return a loss. To offset the losses exceptional financial returns are expected from the remaining ventures.

This means to make their business model work, VCs have very specific needs in the companies they back. They seek startups which could:

- become very large and very valuable,
- grow quickly,
- be "exited" (e.g. sold) within 5-10 years from investment
- and do so with relatively limited capital requirements.

This model results in a "shoot for the stars" mentality, sometimes summarised as "go big or go home". It is why the word Unicorn entered business vocabulary. A Unicorn is a very rare startup that grows to be worth \$1bn or more. The UK has seen 16 venture-backed young companies achieve Unicorn status in the past ten years, a staggeringly small 0.0002% of all businesses founded⁸.

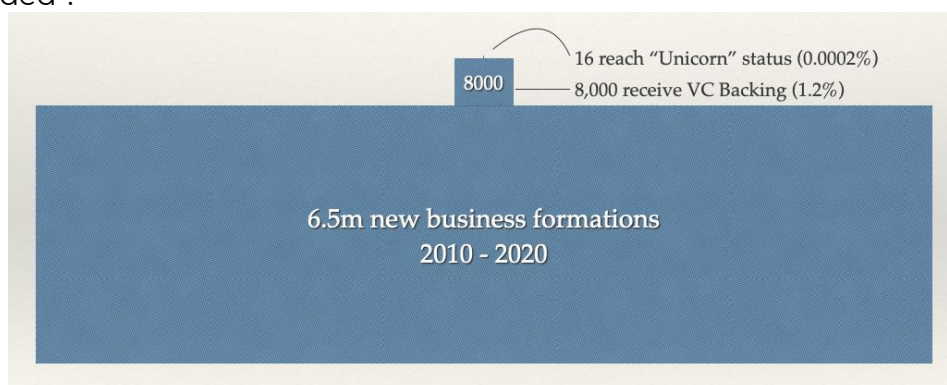


Figure 6: The rarity of Unicorn companies (UK 2010-2020)

⁷ Source - Hannah Senior 2019 analysis of UK KTN research

⁸ Source: Companies house registrations, Beauhurst



7.1.1 VC and AgTech : An imperfect fit.

Very few companies in any sector are a good fit with the VC model and this is especially true in agriculture. VC success stories in AgTech do exist, such as when Climate Corp was bought by Monsanto in 2013 for nearly \$1bn, but these are rare.

As Sarah Nolet, co-founder of Tenacious Ventures puts it: *“We see a lot of businesses that look amazing... It's a great business, it's a great team, it's a great area, they've got customers, but it's not a fit for venture capital,”*

There are at least four reasons that AgTech companies are particularly likely to be a bad fit for the VC business model:

1. The **complexity** of agriculture (climates, species, soil types, farming systems) makes it hard for one product or service to be a good fit for a huge market. This limits the maximum potential valuation for a company.
2. Agriculture involves **physical goods**, which often means infrastructure or capital-hungry inventory. As Peter Herz of 1st Course Capital points out there are less “expensive” and risky ways to finance this type of investment than VC (for full quote see Appendix 2)
3. **Time** is another factor. Sarah Nolet explained *“[We look for] a certain timeline for returns; our fund is 10 years with two one year extensions. Traditionally, people in venture are looking for a roughly five-to-seven-year exit timeframe.”* This is hard in agriculture where there may be only one harvest per year to trial a product, or scaling may be hampered by slow technology adoption.
4. The ability to **exit** an AgTech investment is also a challenge. Because VCs typically make equity investments, someone must buy those shares to turn it back into cash. This is harder in AgTech than other sectors because it is so highly consolidated. Domination by a few huge companies means fewer potential acquirers.

Nonetheless, many of the VC investors in AgTech I spoke to are called “Impact Investors”, seeking both good financial returns AND environmental (or social) impact. It's this which makes AgTech especially interesting. Sarah Nolet of Tenacious Ventures described a hurdle which any potential investment must exceed for both financial return and environmental impact. She felt that *“Agriculture is a unique opportunity where doing “good” and doing “well” are truly aligned”* (see Appendix 2.xiv).

7.2 Finding a model that works better

VC investment isn't the right fit for many AgTech companies. Nonetheless, these investors have an outsized influence on the type of capital available. This means lots of potentially important, innovative, viable businesses struggle to find the investment they need.

I spoke to academic, author and angel investor Aunnie Patton-Power who said *“We are restricting risk capital to only those organisations that are projecting being the next Facebook or Uber... that basically takes out 99% of businesses. And those businesses need risk capital as well”*.

Moreover, many entrepreneurs don't want VC investment, because of the implications. Aunnie continued *“You want to have capital that allows you to go in the direction of travel that you want to go in as a company,”* she says. *“So when you're pushed into this hyper-growth*



mentality... of Silicon Valley, it can be really antithetical to what a lot of founders want, both out of their business, but also their personal lives.”

If VC isn't a great fit, what are the alternatives?

7.2.1 Private (Angel) Investing

One of the oldest sources of startup investment is a wealthy individual. I spoke to Wayne Gordon from the Chief Investment Office of the private bank UBS. He described an increasing interest among very high net-worth individuals in adding agriculture to investment portfolios. He noted a growing interest in food and the environment prompting some individuals to look at investing directly in things like vertical farming and alternative proteins, sometimes offering their own skills as well as capital. Wayne put it:

“I would argue that the acceptance of private markets and this sort of startup investing is much more well accepted than what it has been previously. And as that was often a hurdle to investing in things like agriculture and food, that acceptance has become more broad based.”

Done well, the relationship between angel investor and entrepreneur can be a real partnership, with timescales for growth or exit made on a case-by-case basis, and the importance of environmental financial or social impact weighed individually.

However, there are drawbacks. The model is hard to scale and replicate and matching the individual investor to the entrepreneur often depends on luck. It also relies on both the alignment of interests and interpersonal relationships remaining strong. If an angel investor relationship goes sour, the experience is dreadful for everyone.

7.2.2 Crowd Funding

Instead of one wealthy individual investing a large sum, a different model is lots of people to investing smaller sums. This is known as crowdfunding.

EIT-Climate KIC (Knowledge and Innovation Community) is a European public-private innovation partnership focused on innovation to mitigate and adapt to climate change. Its Head of Financial Innovation, Ben Honan, focuses on how investment can support startups aiming to impact the climate-change agenda. He described the benefits of crowdfunding:

“Crowdfunding offers an interesting nexus point to open up and make your business visible to more people, some of which may be potential customers ... [and] say: ‘Look, the world needs to change and I’m trying to change it. Why don’t you come along for the ride?’ ... And the crowd element, I think, allows a bit of democratisation and gets more people into thinking about what investing in a startup might mean for climate action, and how that can have a local impact,”

This matters because crowdfunding allows farmers to buy into a vision they believe in, without expecting them to have the money, time or expertise to be an Angel Investor. Several UK start-ups (e.g. the livestock platform Breedr) have used this dynamic, benefitting the AgTech ecosystem as well as individual ventures.

However, the crowd must understand and value the startup's idea, so deeply technical companies might struggle to benefit. Moreover, the total cash invested is still relatively small, and companies requiring large amounts of capital must still look elsewhere. Finally, Crowdfunding is typically an equity investment which means the a “liquidity event” or “exit” is still required.



7.2.3 Innovative Finance

The choices for a company seeking investment can feel as rigid as laws of nature: choose between an equity investment (e.g. from a VC, crowd funding or angel investor), or a debt-based loan (e.g. from a bank). However, it doesn't *have* to be like this. When private capital is being invested, there are no rules about how an investment can be made, or how the investor gets their return.

Aunnie Patton-Power specialises in 'innovative finance'. She's passionate about helping investors and entrepreneurs suit the investment to the startup, rather than seeking companies that meet the needs of the finance. For example Aunnie gave me two examples of how investors could get around the 'exit' problem (see 7.1.1) with "structured exits", giving investors a healthy return and the business scope to develop as the founders choose:

7.2.3.1 Convertible Revenue Based Finance (C-RBF) builds on relatively common high-street bank loans called Revenue Based Finance. It allows the startup to take a loan knowing the cost of that capital and having a repayment schedule tailored to a startup context. The investor gets both the (relatively) lower risk of a loan and the upside of growth, if it happens, because the debt can be converted to equity.

Aunnie describes it as "*a riskier version [of RBF], that might allow longer repayment periods, or have a caveat where the investor can gain equity in future if the organisation does raise other financing.*"

7.2.3.2 Redeemable Equity involves buying shares in the company (equity), but with up-front agreement about when and how the shares can be repurchased by the startup itself. The repurchase price can be specified in advance or "it can be a negotiation at some point in the future where you decide the fair value potentially based off of an external valuation. Or it can be a combination of the two." (see Appendix 2.xv)

In this way, the investor gets an equity investment without needing an exit event to realise their return while the startup secures capital for growth without being tied indefinitely to the investor's priorities.

Both these models are highly relevant to Agtech entrepreneurship because they help address challenges identified in Section 7.1.1 in relation to VC. But, Aunnie explained, investors must be willing to think differently about how they build their portfolios. She described how investors who have done this achieved similar or higher returns; "*80% of their companies are hitting a three times return on investment, as opposed to 10% of your companies hitting a ten-times return. And actually, when you do the math, it's similar.*" (see Appendix 2.xv)

The implication is that investors who want to invest in innovative AgTech, particularly those like family offices who have more scope to try new things, would do well to be more innovative in how they themselves operate, "*playing with that full spectrum. So, paint with your whole set of colours, as opposed to just one.*" (see Appendix 2.xv)

7.2.4 Tearing Up the Investment Rule Book

Coralus (formerly named SheEO: the company changed its name in 2022) takes an even more radically different perspective. It is a non-profit VC focused on transforming how female and non-binary entrepreneurs are supported and financed. Capital is gifted by "Activators" in



the Coralus community, aggregated, and loaned at 0% interest to revenue-generating ventures working on the UN's sustainable development goals.

The founder Vicki Saunders doesn't see Coralus as philanthropy due to its extraordinarily high payback rate (almost all the startups repay 100% of the capital loaned), but the organisation goes beyond this, aiming to disrupt the power structures in investing:

"The big issue really is the power dynamic ... we're practicing "power with" to see what kind of results you get when your capital goes out the door in this kind of environment versus "power over". Clearly you can't have equitable systems, when a small group [of investors] is just trying to be the supremacy of rights for what they think matters"

At Coralus, the Activators vote for the companies to invest in and portfolio companies gain as much from the Activators' engagement and help as from the loan.

Coralus also has a radically different perspective on the Silicon Valley idea that "go big or go home" is the only way to have impact. Vicki goes on: "I think we're kind of upside down [in conventional finance] where we have centered and given supremacy to people with money. And what we really need is the people with the ideas to help us get out of this. That is what should be on stage, not the money."

As with the other models I've discussed, SheEO's radical model won't suit every business or circumstance. But it does challenge how we think about investing, the power dynamics at work, and what this means for AgTech innovators trying to make agriculture more sustainable, profitable, and productive.

7.3 Conclusions

Investment thinking in the AgTech entrepreneurial ecosystem is dominated by the framework of making equity investments in startups and the expectations of Venture Capital. However very few companies are appropriate for VC, a situation exacerbated in AgTech by the characteristics of agriculture.

This means other mechanisms are urgently needed. But while lots of people I spoke to recognised this need, I found few examples of innovative finance in any sector, let alone AgTech. It strikes me as ironic that early stage investors who invest in innovative businesses are themselves so unwilling to innovate their approach. Why would this be?

Possibly, investors within the current frameworks are well-rewarded and sufficient high-profile successes occur. If it ain't broke, why fix it? Alternatively, it may be that cultural aversion to risk is the cause (the "Nobody gets fired for buying IBM" mentality).

Yet, alternatives *do* exist and brave investors are blazing a trail to prove the value of independent thinking both for financial return and for wider environmental and societal impact. No "one size fits all" solution exists but financial innovation occurs often in pockets addressing the needs of particular demographics or geographies. Therefore the question becomes how can we deploy and expand on these innovations to benefit the wider goals for AgTech and the agricultural community?



8 SYSTEMS THINKING, AND THE CHAIN OF EXTRACTION.

After these conversations I felt frustrated. Almost everyone recognised that things needed to be done differently to unlock the potential for AgTech to make agriculture more profitable, sustainable, and productive. But most felt that making the changes in how we invest, or how we involve farmers was very difficult. I began to wonder why. What makes change so hard? Part of the answer lies in the concept of “systems”.

What is a system? An example is a Food System, something Brent Loken of the WWF explained as: *“everything that we do to get the food from the farm to the fork”* (see Appendix 2.xvi). It is a complex web of activities that includes everything involved in producing, transporting and processing food, the people and environments impacted, and the waste created. Interconnected food systems exist at different scales, from a single house, to a city, or a country ... and finally the global food system.

Agriculture sits within the food system, and the food system interacts with other systems: the economy, the planetary ecosystem, our human value systems. I came to understand from conversations with Brent (WWF), Vicki Saunders (Coralus), Peter Herz (1st Course Capital), and others that behaviour in systems results from a series of forces, feedback loops, structures and incentives, and these can create very complex patterns. The outcomes of interventions are not always as expected, which explains why there are so many unintended consequences when we introduce new technologies.

This reinforced messages from Sarah Mock (author), Ben Hogan (Climate KIC), Pete Nelson (AgLaunch) who stressed that the problems modern agriculture faces are extremely difficult to solve because incentives are not aligned for the various participants, although the domains of profit, planet and people are intertwined. Throwing technology into the mix won't necessarily change the patterns that underpin the problems agriculture faces.

I began to recognise a Chain of Extraction along the AgTech value chain. I saw a pattern by which transactions tend to benefit parties more in one direction than the other each link in the chain, even though the currency of the extraction varies:

- Agriculture extracts from the environment. To feed and clothe humanity, farmers take biodiversity, carbon, water etc from nature.
- Entrepreneurs extract from farmers. To develop and test ideas takes time, expertise and goodwill from farmers, and greater risk is often imposed on farmers too.
- Investors extract from entrepreneurs. Not just financial returns on successful investments, but also pay a toll of energy, mental health and lifetime earnings which is often overlooked.
- Added to this, everyone is extracting something from the public purse in tax breaks, incentives, subsidies and publicly-funded research.

Each link depends on others, but the extraction dynamic erodes one party's capacity to continue to deliver value to the other. Ultimately the environment comes off worst of all because it has few powerful forces protecting its interests.

It's important to realise there is no single “villain” to point to. Everyone in the chain is trying to do the right thing for the business or organisation they work for, typically with good intentions. It's clear the interests and incentives along the chain aren't aligned, but this is not the handiwork of an evil genius.



Realising this posed difficult questions for me. If we're in a chain of extraction, how realistic is it that we can use AgTech to address agriculture's environmental, social and commercial challenges? Can AgTech entrepreneurs really make farming better, more sustainable and more equitable or will the extraction dynamic undermine the best efforts and return us to an unsustainable pattern?



9 DISCUSSION: DOING THINGS DIFFERENTLY

So how do we overcome these challenges? My research and conversations took me to some unexpected places!

9.1 Systems Thinking

I came to realise that we need a different set of tools to solve this type of complex problem. Peter Herz explained how he as an engineer was trained “*in a methodology called Reductionism, which tries to break things down into bite size chunks that people can study, work on and solve for. And unfortunately, there are systems and classes of problems that will not yield to that methodology*”. Put bluntly, he says “*We don't believe reductionism is a good methodology to develop solutions around food or biological systems*” (see Appendix 2.xvii)

To find answers we must use a different toolkit such as “Systems Thinking”, which helps us to

- identify how/where to make change in complex systems,
- understand collateral impacts of decisions and actions,
- understand how various forces can deflect us from our stated goals.

Daniel Zimmer, the Director of Sustainable Land Use at Climate KIC reinforced this:

“We (Climate KIC) are convinced that you cannot transform the way we produce, the way we consume, in taking a sort of piecemeal approach and addressing successively and small issues. We need to have a holistic or all-encompassing approach, because transforming the way we consume produce is not something that is easy.”

Daniel gave an example of this in relation to the transition to electric vehicles, explaining how producing the cars is just one element. Skills for servicing, infrastructure for power supply, subsidies from government are also needed in a holistic approach. He went on “It's the same for food, for farming practices.” (see Appendix 2.xvii).

9.2 The Economic System

Even with Systems thinking we are not adequately equipped. Humans have cultural and structural biases that lead to prioritising certain outcomes or using certain models we've absorbed without questioning.

The economist Kate Raworth challenges these assumptions in her 2017 book Doughnut Economics. Most economists, politicians and businesspeople think the purpose of the economy is to make humans increasingly wealthy. She challenges us to ask if this makes sense. Can this really be an endless path to progress when the resources to make ‘stuff’ must be taken from the planet?. There are limits to what can be mined, extracted or grown on our planet but the prevailing economic models doesn't take this into account. Our economic system largely ignores environmental or wider social impacts that have no financial value ascribed to them (“externalities”). Traditional thinking doesn't allow for the complex web of relationships between people, profit and planet.

I believe successful business is one that profitably meets the needs of consumers, provides needed products and services, while generating the financial autonomy to reinvest and ensure stability. However, this sometimes forces businesses (VCs, startups and farms alike) to focus primarily on the economic at the cost of longer term wellbeing.



Sarah Mock, demonstrated the implications of this, highlighting how environmental aspirations in AgTech's earliest incarnations were eroded when they were not financially rewarded:

"I think in general the technologies that are still around...are the companies that have set their environmental goals aside, and have focused on creating maximum returns and listening to farmers where they are. Until, like, 18 months ago, the general consensus from most farmers in America was that climate change didn't exist" (see Appendix 2.xix)

The challenge is how to change our investment, economic and agricultural systems so they improve lives while ensuring we stay within planetary resources.

9.3 Collaboration

To make change across a whole system, cooperation across many parties is required. This is critical, but very difficult to achieve. In relation to AgTech, entrepreneurship and agriculture, Daniel Zimmer explained:

"The startup world is a highly competitive world [where] only the best will succeed ... But when you start working with farmers in the landscape, or with different stakeholders in landscapes, you also need to create cooperation, because scale is very important. If only one farmer is doing something, you're almost sure that you will not transform the entire system".

Attitudes to collaboration are very culturally driven and vary widely: compare Denmark with its strong tradition of cooperatives vs very individualist countries such as the USA. Daniel Zimmerman described how systems transformation relies on three elements for collaboration to be in place: Trust, Risk and Value Creation. Enough **value** must be generated to make it worth engaging in the change, the **risks** associated with it need to be understood and shared acceptably so they don't become a barrier, and there must be **trust** that everyone will do what they say.

He observed, *"We see that it's also much more difficult to share value within systems than to share risks, because risk automatically transfers and spreads across the actors. Value is not the same. So there is much more competition when you talk about value, and much more cooperation when you talk about risk."*

He added, *"If one actor is facing a risk, it's a risk also for the others. And then it became also very clear that we needed to create trust in the ecosystems that we were building and trust comes with transparency, creating contractual mechanisms, [and] having more traceability."*

A New Zealand organisation that has successfully created stronger foundations for collaboration in agriculture is TeHono. General Manager Kimberley Ansell described their goals, saying *"TeHono was founded on our founding principles, and that's around trust capability and action. So we're really looking at building trust"*.

The organisation selects CEOs, industry leaders and civil servants working in the Primary Industries with an openness to change and innovation. These people go on a week-long bootcamp at Stanford University (in California) to be inspired and to learn about innovation, collaboration and the interconnectedness of business, environment and society.

"You'll have people in the room who are competitors and have a history and perhaps don't like each other very much. But generally, by the end of an intensive program up at Stanford, they're usually much more comfortable... talking about the challenges."



This process has a transformative effect on those who participate. In the words of Baba Shiv, one of the Stanford Professors involved in the programme *“We [in business] talk a lot about competitive advantage. In this programme we build collaborative advantage”*

9.4 Other World Views

A final interesting element TeHono draws on, is Maori culture. As Kimberley Ansell describes it, this teaches: *“If you harm the land, you're harming the people. So adding \$their [Maori] world view into the program really created a richness in a deeper understanding around what makes New Zealand different and actually how can we be the best in the world”*.

The idea that people are somehow separate from nature seems to be something peculiar to western, educated, industrialised, rich and developed (“W.E.I.R.D.”) countries, and Vicki Saunders of Coralus also drew attention to the value of learning from indigenous cultures when it comes to recognising what needs to be done to reduce our impact on the environment:

“Cultures that came before us that have very, very different philosophies around economy. Their collective economy process talks about “increase”, not about “growth”. And so: increase in connectedness, increase in health, increase in collective wealth and wellbeing... what are all those other benefits besides just the financial return?”

For Saunders, our economic model doesn't make sense: *“If we did actually look at this, from a “full picture” perspective... there isn't a single sector, no one on the planet that would be profitable, if you included the environmental and social costs. Not one. So we do not have a model that can get us to being more in harmony with the biosphere we're living in.”*

9.5 Doing things differently - Conclusions

Agriculture is more connected to the complexities of biological, environmental, social and economic systems than many areas of the economy. However in the UK, like other “WEIRD” countries, we tend to overlook the implications of this. Our culture tends to rely on reductionist thinking. Society tends to compartmentalise different domains rather than acknowledge their interconnectedness, and our business environment tends to privilege competition over collaboration. These characteristics mean we limit the tools available to address the challenges we face.



10 INNOVATING AGTECH ENTREPRENEURSHIP: CONCLUSIONS

I began with questions about how to make our AgTech entrepreneurial ecosystem into one which better aligns the interests of the environment, farmers, entrepreneurs and investors. The journey confirmed my belief that agriculture faces serious issues, especially economic, environmental and labour sustainability. It also confirmed that novel agricultural technology can help address these issues.

However, my views became more nuanced. Technology is an important tool to address these concerns, but it is not the sole solution. In fact, hoping tech will solve a problem without understanding the wider context can be counterproductive. Innovation must happen since the path we're on cannot be sustained, but sometimes technology isn't the solution we need.

Nevertheless, innovation and entrepreneurship are *critical* ingredients in bringing dynamism and sustainability to food and fibre production. I came across inspiring examples of innovators developing new ways of working within agriculture, but I also saw drawbacks such as when farmers are inadequately compensated for providing expertise and insight to startups, or the mismatch between the Silicon Valley model of entrepreneurship and agriculture's needs.

Little by little I realised how deeply entwined economic, environmental and social spheres are. For instance, mainstream methods of finance affect what innovations are developed and how startups behave even if their stated goals are, for instance, to change the working of the food system.

It became clear to me that meaningful change requires a wider range of tools and approaches than are typically deployed. For example, collaboration is critical but under-used. Most of the problems agriculture faces can't be solved by single entities operating alone. Equally, finding ways to understand and balance the impact of ideas on people, the planet and companies' profit is important. Systems Thinking gives us tools to do this.

Reflecting back on these conversations, a prevailing tendency to extraction was visible across agriculture, entrepreneurship and investment: a chain of extraction. Of course transactions can be, and usually are, two-way. But when the benefit accrues more in one direction than the other it erodes one party's ability to sustainably create value. When investors extract from entrepreneurs, entrepreneurs extract from farmers, agriculture extracts from the environment the collective effort brings us to unsustainability even when everyone is trying to do the right thing.

10.1 Regenerative Agriculture – An Analogy

At the Nuffield Farming Conference in 2021 I listened to a scholar talking about his research into regenerative agriculture. He reminded us how monocropping allows us to maximise yield and can be extremely efficient, but also impacts biodiversity, is vulnerable to pests and diseases, and depletes the soil which lies at the heart of production.

Many farmers, recognising this, have taken a regenerative approach on their farms, aiming not just to take out over the short term, but also put back. Regenerative agriculture considers the specific on-farm context and uses general principles rather than rules to build long term generative potential. This creates visible increases in biodiversity and a greater diversity of on-farm practices.



Maybe we need to learn from this within the AgTech entrepreneurial community? If our cultural and economic framework leads to a chain of extraction, then maybe other ways of doing things are worth experimenting with, ways which aim to put back as well as to take out:

- Can we integrate the agricultural community more into decision making and wealth creation to solve more problems and share the financial upside?
- What if we used a diversity of investment models? Could we have more solutions coming to market, to address different needs?
- Can we create the right conditions for more companies to be financially successful *as well as* environmentally and socially sustainable?
- What if we were to focus on building businesses for the *really* long term, not for a 5-7 year exit?

20 years ago proponents of regenerative agriculture were a bit fringe. Suggesting this more regenerative approach to entrepreneurship and finance feels similarly unconventional. But pools of experimentation exist as Te Hono, Coralus and AgLaunch demonstrate. These *are* different ways of practicing and financing entrepreneurship, and if they persist and connect with each other, I believe the evidence to demonstrate what works will develop, generating credibility and momentum over time.

A priority is to start with the methods of financing, since this drives the system. Diversifying approaches to investment is possible if we're willing to innovate, allowing alternatives which offer different benefits to entrepreneurs, society, and the environment, while still meeting the needs of the investor. Crucially, this also means diversifying not just *how* we invest but *who* invests. If farmer organisations or environmental charities, for instance invested in not just research but also the startup businesses capable of changing on-farm practice, it could have a range of benefits including diversifying the priorities present at the investor table, steering cash to a greater diversity of businesses, and sharing the economic upside of success more widely.



11 RECOMMENDATIONS

Developing new technologies in agriculture is important. Entrepreneurship is crucial to bring new technologies to market and to change how we do things in agriculture more generally. Yet the reliance on technology and the way we support entrepreneurship needs to change.

To meet the challenges of the future my recommendations boil down to two imperatives for the UK agricultural sector, and three for the AgTech ecosystem (both the UK and globally), all of which government can and should support.

For the UK agricultural sector as a whole,

1. More collaboration. This offers huge potential for value creation but requires building trust and managing risk.
2. More systems thinking. We have to become as skilled at working through complex and interconnected problems as we are with the reductionist approach which breaks problems down into limited bite-sized components.

For the AgTech entrepreneurial ecosystem,

3. Much more engagement with farmers, growers and their representative organisations.
4. More diversity in how we fund startups. VC is great where it fits, but we also need longer term, more flexible options which are less dependent on a few massive wins.
5. More diversity in who invests in startups. Money talks, and presence at the boardroom table drives change. If we diversify who gets a voice here and ensure the value of non-cash investments are felt (trials, expertise) it would not only support a greater range of startups, but spread benefits more widely too.

All this might seem idealistic, but massive changes can happen in short periods of time. It would be foolish to limit what we could achieve if we applied ourselves.

After all, if we put ourselves in the shoes of farmers in 1922 and looked forward 100 years, the transformation that technology has brought would be unimaginable. I hope that the future will bring equally incredible advancements, not just in our technology, but in our understanding of how agriculture, entrepreneurship and technology can work together more sustainably and in concert with our environment.

Being entrepreneurial about how we do *that* is as good a place to start as any.



12 AFTER MY STUDY TOUR: POSTSCRIPT

I developed my thinking, completed my travels and drafted this report between 2019 and 2022. These covid years saw a surge of interest in agriculture and a boom in capital invested in AgTech companies. However, busts usually follow booms. As lockdowns eased and the economy attempted to return to normal, early-stage investors became much more wary of *all* their investments, especially in agriculture. Risk aversion escalated, and all the reasons that AgTech may not be the best fit for VC (Section 7.1.1) were highlighted.

AgTech's turn on the boom-bust roller-coaster has similarities with other scenarios, not least the "dot com bubble" bursting, or when the first wave of investment in the Clean Energy sector fell away. Consequently in the last two years fewer new ventures have emerged and many high profile AgTech startups ceased trading (e.g. AeroFarms in vertical farming and the Small Robot Company in agricultural robotics). To survive, companies had to 'pivot' to new and/or more immediately lucrative markets. The AgTech startups I've worked most closely with had to focus ever more pointedly on generating revenue, managing costs and getting a clear line-of-sight to profitability.

Despite this, the need for innovation in agriculture has never been more apparent. The plight of the environment continues to worsen (e.g. 2024 was the hottest year on record), geopolitical instability affecting food production increased (e.g. the 2022 invasion of the Ukraine) and farming businesses battled to remain solvent in an inflationary environment. One could take a pessimistic view, but positive change is happening.

The last few years have seen innovation in investment and economic thinking aligned with my insights and recommendations emerging with more frequency.

- The Nature Conservancy, a US charity, now brings its expertise to the start-up board room, investing directly in ventures working on problems relevant to the environment, e.g. soil health. This is a pioneering example of diversifying *who* invests in innovation.
- I attended the first Regenerative Food Systems Investment Forum held in Europe, and it was invigorating to see joined-up thinking being celebrated. Nobody has all the answers yet, but there is emerging humility in the face of the problems' complexity.
- I was delighted to see a recent Agfunder article reflecting on how thinking has changed during 2024, which mused "*Some even believe we're on the path to new financing models for agtech, particularly as the venture capital approach may not always be the best fit for the industry*"⁹.
- Dieter Helm spoke at the venerable Oxford Farming Conference in 2025 about the need to dramatically rethink our economy to address the climate and biodiversity crises. It's far from being mainstream thinking yet, but the discussion is more widespread.

We have a long way to go and the problem has never felt more acute, but the reasons for optimism are everywhere.

Hannah Senior, January 2025.

⁹ <https://agfundernews.com/2024-was-a-year-of-reckoning-for-agtech>



APPENDIX 1: CONTRIBUTORS

With thanks to the following contributors and the *many* others I have probably forgotten to add to this list.

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Baba Shiv	USA	Professor, Stanford Business School
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Victoria Hamlin	New Zealand	Farmax
Wayne Gordon	Singapore	Global Asset Allocation, UBS
Zal Bhilamoria	USA	VC investor, including in AgrTech



APPENDIX 2: VERBATIM QUOTES (WHERE PARAPHRASED)

Section 3.1:

Juliet Ansell of Zespri International discussing how technology can help with labour challenges:

- i. *"There's a lot of technology out there... In terms of helping with harvesting. We can look, first of all at human assist: the apple industry have been looking at a sort of a picking platform. It's still basically people doing the picking, but you make their lives easier, faster, maintaining quality... I guess the other solution we're thinking about is actually designing the architecture of the orchard to make it much more amenable to robotics... because that's longer term that needs time to develop. And eventually, we would have hopefully a selective, automatic harvester that can go 24 hours a day, up and down."*

Brent Loken of WWF discussing why we shouldn't be tempted to rely on technology to tackle the environmental impact of the food system:

- ii. *"What we don't need though, is to kick the can down the road and say, 'we just have to rely on technologies, on some invention of something that's going to come in and save us and reduce, you know, methane emissions'. Because we know what exactly we have to do. We have the practices in hand, it's more just creating the conditions and allowing them to happen".*

He goes on, *"The technologies that work in an industrial farming system might be very different than the technologies that will work on small shareholder farmers, of which there are hundreds of millions, all over the world. And being able to get those technologies into places that actually need them is also going to be very difficult"*

Section 4

Rasmus Hartman of Copenhagen Business School explaining why we look to Silicon Valley to learn about entrepreneurship:

- iii. *"There was a time when people would go to the UK, to Manchester, to see "what is this factory thing"? And today, if you want to understand what does it mean to have ... an IT based company, the natural place to look is to the west coast of the US. ... There's sort of a particular ideology around entrepreneurship, technology innovation, in those leading areas. I'm sure if you'd gone back to Manchester, or London, you would have seen a very particular ideology around ... "How does one become a great entrepreneur of the Victorian variety?"*

Section 4.2.3:

Juliet Ansell of Zespri International describing the Sprout Business Accelerator (with whom she works as an Industry Partner):

- iv. *"Sprout, basically, invites applications from anyone, any startups to apply for an accelerator program here in New Zealand. And they have industry panel and venture capital panel members who do a bit of a Dragon's Den".*



"If they're developing something for horticulture, they can come and meet some of my team or go out on orchard... or I might see something that they did develop for horticulture, but I think oh, that would really help us".

"My counterpart in Frontier or LIC or, you know, the other big companies, we can kind of swap ideas as well about how you do innovation, or challenges...The way that Sprout works is very close to industry. It's trying to nurture the startups through and end up with a product that's better than it would have been without the accelerator."

Section 4.2.3

Pete Nelson of AgLauch describing the organisation, why it was founded and how it operates:

- v. *"The non-profit has funding from the federal government, state government and philanthropy in order to create a better environment for farmers to position themselves into what we see are future opportunities ...That's around measured sustainability, monetising ecosystem benefits, a broader range of crops that are being valued based on nutritional density, and not necessarily on sort of a commoditisation."*

He goes on "Our system is fundamentally different because our incubator... is a network of farms. And the way we scale is creating feedback loops across multiple soil types, crop types, to help grow and commercialise the companies... That's work that a startup company would not be able to fund for themselves. It also, by nature, sits outside of the corporate driven models that we have in the United States right now around innovation."

Section 5.1

Pete Nelson of AgLaunch describing how the AgLaunch model benefits entrepreneurs on the business accelerator programme:

- vi. *"There's kind of two platforms, from a business perspective, on what we do... one is assisting technologists that are creating AgTech companies, by connecting them with farmers very early in their iteration cycle, and essentially creating a partnership where farmers help proof of concept, beta test and scale technologies; the [second], the AgTech startups get a path to market that is more efficient, effective than the current offerings."*

Also, describing how the needs of farmers are met:

"We go out and do challenge events where we advertise internationally for companies or technologists that want to try to address those problems, and then match those up," Nelson explains. "The farmers are engaged at every step of identifying what we're targeting, screening the technologies and the deals, giving feedback. The things that we choose to invest in and grow are because our farmer partners have recommended those."



Section 5.3.3

Pete Nelson of AgLaunch describing why hype about AgTech is misplaced:

- vii. *“One of the up and down issues we have to deal with is how much hype is hyped around certain things... there's still a prevailing attitude, even 10 years into this modern boom of venture capital and interest in agriculture... that there's some big silver bullet, that if you just figure that out, then we're gonna be able to feed the world.... “There's not going to be any silver bullet, but there's going to be a portfolio of solutions that are constantly adapting.”*

Section 4.3.4

Sarah Nolet of Tenacious Ventures discussing how supply chain incentives are driving adoption and investment in new technologies.

- viii. *“What we're seeing now is unlocking the big incentives in the supply chain ...Processors and brands are responding to pressure and demand from consumers, investors, sourcing risks and ESG pressures, and so for them incentivizing adoption of something at farm level makes sense ... And for a farmer, saying ‘okay, I'll use this technology so that my customer, who I'm already selling to, will give me a premium so that I can actually sell to them or open up a new market’”. In this way, she explains “You really change the economics and incentives,”.*

Section 6.2:

Ashwin Madgavkar of Ceres Imaging gives an example of a fresh perspective he brought from his background in other industries:

- ix. *“I saw how some of these large farms made decisions around chemical or fertiliser applications to their crops, and I was struck by how little data was collected or used in order to guide those decisions. I observed that farmers would apply these inputs with a healthy margin of safety, so to maximise yield, but weren't able to get the granular data to customise how much they put on based on the soil type, or topography”*

Section 6.3

David Smith of Ceres Tag describing how various types of investors contribute to the success of the venture:

- x. *“We have in our company high net worth individuals, we have some organisations, we have two corporates that have invested. But not a controlling stake ... they're strategic for us. So one [investor] is related to the satellite, another to communications, and one's our manufacturer... people who shared the vision, and where they wanted to see this a success”.*

Bethany Deshpande of SomaDetect describing the advantage of having different perspectives around the boardroom table and in the investor group:

- xi. *“It helps [the business that] VCs or folks that don't necessarily understand dairy or agriculture to that same level of detail, to nonetheless have confidence in the*



technology you're creating". [For the strategic investors] "it's an incredible opportunity, they get early insight into new developments and really innovative stuff ... SomaDetect [has] has a clear mission and impact both on the welfare of farmers as well as the sustainability of dairy operations. And so it's kind of this like, win/win/win, from the point of, you know, for the startup, for investors involved in this space, and for the large companies, as well, that are seeking to be innovative to be at the cutting edge and to stay up to date "

Section 6.5

Rasmus Hartmann of Copenhagen Business School talking about the toll entrepreneurship can take:

- xii. *"The toll that it takes on the individuals and their families to dedicate themselves to such a stressful, demanding and uncertain enterprise, the costs that it imposes on the entrepreneur. very real, right? One thing is what we just talked about: entrepreneurs make less money on average, over the course of their life. The figures vary, but some come to like 20%, less over the course of a life. Right? That's a non-trivial amount of money, they should know that it's super stressful, and very high demand.."*

"With that actually also comes a whole range of psychological issues. We know that entrepreneurs are more depressed, they're more anxious, and have higher rates of psychological illness. People should also just know that, right? This is a high risk, not in just financial terms, but also in mental health ... mental illness is much more common"

Section 7.1.1

Peter Hertz of 1st Course Capital talking about what type of capital suits infrastructure or inventory heavy businesses:

- xiii. *"If you need expensive infrastructure to do an innovation [a better way than VC is to] build out a mix of capital sources, where the equipment, the infrastructure, the plant, whatever it is, can be financed with debt that's secured by the plant itself," [That way] the risk equity that you need to raise is much smaller"*

Section 7.1.1

Sarah Nolet of Tenacious Ventures describing how they seeks to get both financial return and environmental impact:

- xiv. *"We're an impact fund, so everything we do has an impact lens. If you think about a kind of floor for returns that we wouldn't invest [below]... we also have a floor for impact, and so we need things that clear both of those bars... Given all the pressures and trends around climate risk and climate mitigation potential and consumer sentiment in agriculture ... agriculture is a unique opportunity where doing "good" and doing "well" are truly aligned."*



Section 7.2.3.2

Aunnie Patton Power, author of Adventure Finance, talking about how Redeemably Equity can work:

- xv. *“One of the ways that I really like the application of redeemable equity is for the founders to sell this equity to an investor and then when they repurchase it, they use the repurchasing to distribute it [the equity] to a broader base of their employees”. The repurchase price can be specified in advance or “it can be a negotiation at some point in the future where you decide the fair value potentially based off of an external valuation. Or it can be a combination of the two.”*

Aunnie Patton Power, author of Adventure Finance, explaining how returns to “alternative finance” can be as good or better than traditional VC:

“There's a difference around how you [the investor] put together portfolios ... instead of looking for one or two organisations that are going to provide all of the return for your portfolio, you're actually looking at investing in companies that are [individually] likely to provide a lower return...”

Multiple investors that have now done this, have created these portfolios that actually return on a cash-on-cash basis, very similar [and] in some cases, higher returns than traditional venture capitalists ... but the way they've put together that portfolio is very different; 80% of their companies are hitting a three times return on investment, as opposed to 10% of your companies hitting a ten-times return. And actually, when you do the math, it's similar.”

“Funders like family offices, foundations, corporates, governments, essentially “development funders”; [should] think about how you use ... capital that has more of a development risk associated with it, and actually playing with that full spectrum. So paint with your whole set of colours as opposed to just one. “

Section 9

Brent Loken of WWF describing the Food System:

- xvi. *“A food system is everything that we do to get the food from the farm to the fork. So it's everything from how we produce food, and the environmental consequences of that, how we actually transport food to get it from where it's produced, all the processing that goes into the food, and then the waste ... this complex web of activities that we call the food system. There is one global food system, which has this interconnected, local and regional food system. There's food systems everywhere. There's food systems in backyards, there's food systems within cities. But when you add up all those collective activities, you've got the global food system and the impact that that has.”*

Section 9.1

Peter Herz of 1st Course Capital explains how different approaches are needed to solve systems problems:



xvii. *“Everyone has been trained, I have as an engineer ... in a methodology called Reductionism, which tries to break things down into bite size chunks that people can study, work on and solve for. And unfortunately, there are systems and classes of problems that will not yield to that methodology*

“Engineering is perfectly suited to solve information problems. You're bringing the right tools to the party. We don't believe reductionism is a good methodology to develop solutions around food or biological systems”

Section 8.1

Daniel Zimmerman of Climate KIC explaining how changing the Food System needs a holistic approach:

xviii. *We (Climate KIC) are convinced that you cannot transform the way we produce, the way we consume, in taking a sort of piecemeal approach and addressing successively and small issues. We need to have a holistic or all-encompassing approach, because transforming the way we consume produce is not something that is easy.*

“Just take the example, for instance, of the electric car transformation; you cannot just produce electric cars, you need to ensure that there is training for those who will be servicing these cars... but also that maybe the subsidies and the support from the government are targeted in the right way. So, you really need a completely holistic approach. And it's the same for food, for farming practices.”

Section 9.2

Sarah Mock, Author & Journalist, explains how financial returns can sideline other (environmental) aims:

xix. *“In 2008 we were really excited about green tech,” she said. “At first we were really into precision agriculture. It was all about reducing fertiliser use, reducing pesticide use, reducing water use.... [But] AgTech has moved away from the ideas of hyper-efficiency... I think in general the technologies that are still around...are the companies that have set their environmental goals aside, and have focused on creating maximum returns and listening to farmers where they are. Until, like, 18 months ago, the general consensus from most farmers in America was that climate change didn't exist. So, I think AgTech listened to their customers and kind of got on board with that for a while”*



APPENDIX 3: RESOURCES & BIBLIOGRAPHY

For a more in-depth exploration of the issues in this report listen to the **Innovating AgTech** podcast documentary.

Books (see <https://www.betterworldbooks.com>)

- Adventure Finance - Aunnie Patton Power
- Burn Rate - Andy Dunn
- Dirt to Soil - Gabe Brown
- Dispossession - Pete Daniel
- Doughnut Economics - Kate Raworth
- Farm and other F Words – Sarah Mock
- Feeding Britain - Tim Lang
- Linked: How Everything is Connected to Everything Else – Albert Laslo Barabasi
- The Entrepreneurial State - Mariana Mazzucato
- The Omnivore's Dilemma – Michael Pollan
- The Third Plate - Dan Barber
- The Wizard and the Prophet by Charles C Mann
- The Value of Everything - Mariana Mazzucato
- Thinking in Systems – Donella Meadows

Further reading recommended by interviewees.

- Hog Wild – Lynn Waltz
- Freedom Farmers – LaDonna Redmons and Monica M White
- How to Avoid a Climate Disaster – Bill Gates
- 10% Entrepreneur - Patrick McInnes
- Humanity at Work - Pierre Battah
- The 10 Types of Innovation - Larry Kelly
- The Dawn of Humanity - David Wengrow and David Graber
- Sand Talk - Tyson Yunkaporta
- Dream Reaper - Craig Canine

Online Resources

- The National Food Strategy <https://www.nationalfoodstrategy.org>
- Bringing it Down to Earth – Nature Risk and Agriculture: https://wwf.panda.org/wwf_news/?2660466/nature-finance-risk-and-agriculture
- Milked by the Immigrant Dairy Farmworkers in New York State: <http://www.iwj.org/resources/milked-immigrant-dairy-farmworkers-in-new-york-state>
- Towards an Untrepreneurial Economy? The Entrepreneurship Industry and the Rise of the Veblenian Entrepreneur by Hartmann, Spice and Krabbe: https://papers.ssrn.com/sol3/papers.cfm?abstract_id=3479042
- Entrepreneurial Strategy by Joshua Ganz and Scott Stern: <https://www.entrepreneurial-strategy.net/about>
- AgFunder AgriFood Tech Investment report 2021: <https://agfunder.com/research/2021-AgFunder-agrifoodtech-investment-report/>
- How Silicon Valley Set Agtech back by a decade: <https://blog.agthentic.com/how-silicon-valley-set-agtech-back-a-decade-b9d46e0acf0d>
- Technological change and economics: <https://carlottaperez.org>
- <https://store.hbr.org/product/founders-apply-the-scientific-method-to-your-startup/H05ZW3>
- AgFunder AgriFood Tech Investment report 2021: <https://agfunder.com/research/2021-AgFunder-agrifoodtech-investment-report/>
- How Silicon Valley Set Agtech back by a decade: <https://blog.agthentic.com/how-silicon-valley-set-agtech-back-a-decade-b9d46e0acf0d>
- Acceptance and diffusion of hybrid corn seed in two Iowa communities: <https://dr.lib.iastate.edu/entities/publication/b4549cc5-dffb-48a6-b253-cc69d750ad80>
- International Society of Precision Agriculture: <https://www.ispag.org>

Innovating AgTech Entrepreneurship by Hannah Senior

A Nuffield Farming Scholarships Trust report, generously sponsored by Elizabeth Creak



- Zebras Fix What Unicorns Break: <https://medium.com/@sexandstartups/zebrasfix-c467e55f9d96>
- Venture capital and cleantech: The wrong model for clean energy innovation: <https://energy.mit.edu/publication/venture-capital-cleantech/>
- 10 ways to redesign venture finance for a more inclusive post-COVID world: <https://impactalpha.com/10-ways-to-redesign-venture-finance-for-a-more-inclusive-post-covid-world/>
- The Important Role of Crowdfunding for Agriculture: <https://crowdsourcingweek.com/blog/the-important-role-of-crowdfunding-for-agriculture/>
- None of the world's top industries would be profitable if they paid for the natural capital they use: <https://grist.org/business-technology/none-of-the-worlds-top-industries-would-be-profitable-if-they-paid-for-the-natural-capital-they-use/>
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