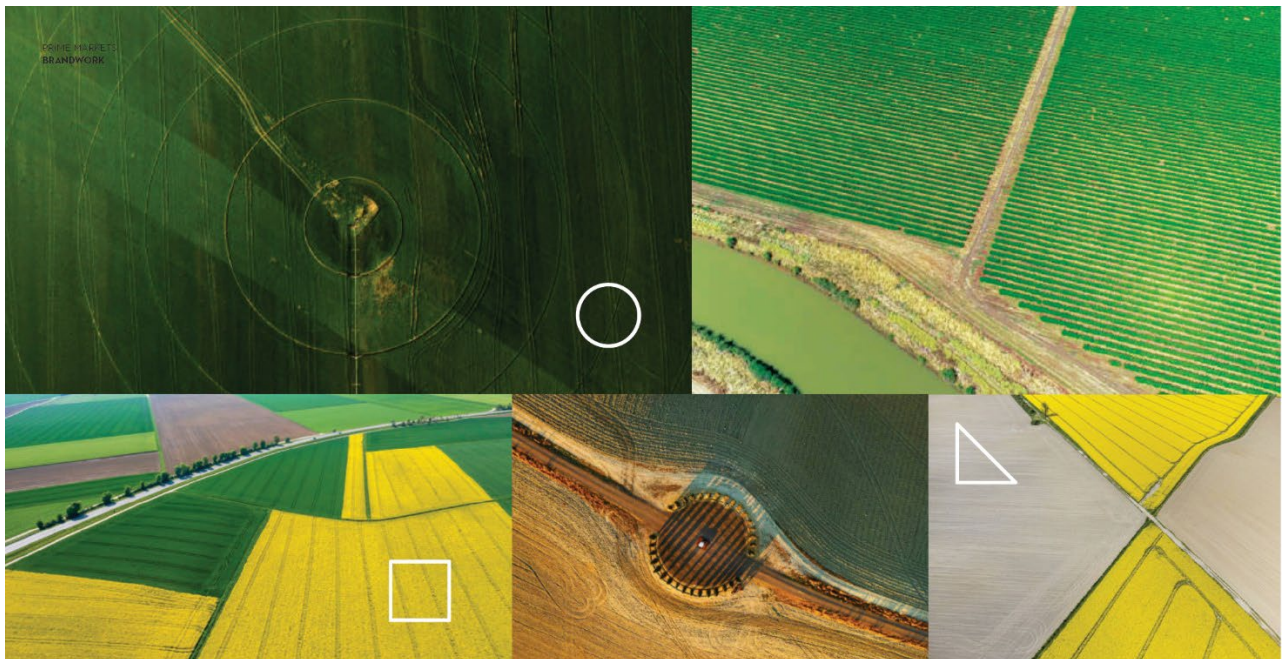




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Commercialisation Learnings for Agritech

What are the key denominators to enhance commercial success for an agritech business?

Kellogg Rural Leadership Programme

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I wish to thank the Kellogg Rural Leadership Programme Investing Partners for their continued support.

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1. Executive Summary

There is a growing global demand for agritech to solve major global issues, such as climate change, water use and quality, and increased yields from food and fibre to feed the world's population.

Whilst New Zealand has a proud history of primary sector innovation, there are only a handful of agritech companies of international significance. The 2020 Aotearoa Agritech Unleashed Report opined; "Compared to our international peers we are punching below our weight in our relative economic value and export earnings from agritech".

What can New Zealand agritech companies do better to commercialise their innovations to grow the sector, but ultimately to help solve these global challenges and in the process advance New Zealand's international competitiveness in primary production and grow our export earnings.

This report has undertaken to seek learnings and insights of what successful commercialisation of innovation looks like and apply this to a New Zealand agritech context to present key denominators for successful commercialisation of agritech.

The study completed literature reviews of academic, industry and business publications across innovation and agritech, together with semi-structured interviews with New Zealand agritech practitioners.

Thematic Analysis was applied to the body of research and interviews to capture the Key Findings and related Recommendations as follows:

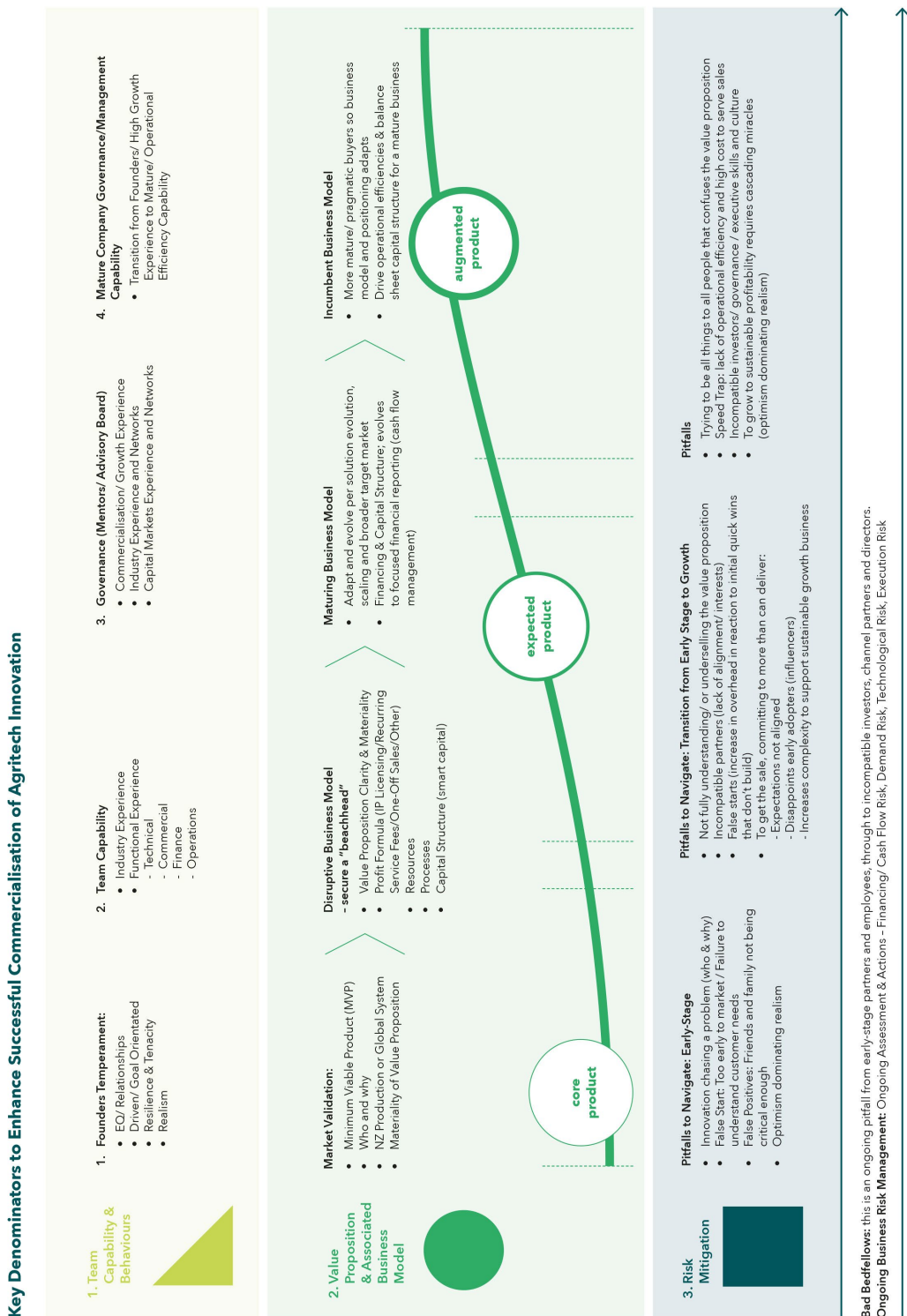
- **Engage in Critical Self-Assessment:**
 - Critically evaluating whether the agritech founder has a minimum viable product with initial customers to get to the start line. To be commercially successful at scale requires ongoing discipline for critical self-assessment of:
 - **Total addressable market;** develop a clear understanding at the outset of the addressable market, validating the innovation to that addressable market, what investment is required and the profit model.
 - **Founders' skills, traits and shortcomings;** actively build a team with complementary skills and capabilities requiring the right industry and functional expertise (technical, operational, commercial and financial) with an ability to execute.
- **Value Proposition:** develop and define a clear and (relatively) material value proposition for the adopters of the innovative solution. The Founders need to be focused on delivering a client solution (not an innovation).
- **Business Model:** bring together the component parts to execute the commercialisation growth, including:
 - **Product and market lifecycle;** recognise and plan for the innovation to evolve from the initial core product and early adopter market to an augmented solution delivered and serviced for a mainstream market which requires active planning for channel to market, wrap-around solution, communication strategies and services model.
 - **Resources;** The resources required to execute, not just the team and governance, but broader relationships, suppliers, channel partners, components, facilities etc.
 - **Profit Model & Capital structure;** continually evaluate the commercial model and align with a fit for purpose capital structure. If external capital is required to support the company to break-even, then ensure that "smart" capital is pursued with the right industry experience and networks for execution.

The approach and recommendations have been brought together into a Framework of Key Denominators to Enhance Successful Commercialisation of Agritech (Figure 11 below)

The key themes, or denominators are all inter-related, they cannot be approached or applied in isolation. The framework is not a one-size-fits-all but a valuable roadmap to be evaluated and adapted for each unique agritech innovation and market opportunity.

Figure 11

Framework of Key Denominators to Enhance Successful Commercialisation of Agritech



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3. Introduction

Let's start with what is agritech and why commercialisation of agritech is important for New Zealand and the globe:

1. What is agritech? For the purposes of this study, we refer to the New Zealand Government Ministry of Business, Innovation and Employment (MBIE) Aotearoa Agritech Unleashed 2020 report, which defines agritech as follows. *"Agritech refers to manufacturing, biotech, and digital-based technology companies that are creating product, service, intellectual property (IP), and value chain solutions for the agriculture, horticulture, aquaculture, apiculture, and seafood sectors, to improve yield, efficiency, profitability, sustainability, reliability, quality or adding any other kind of value."*
2. Why does the commercialisation of agritech matter? - It matters for resolving some key global challenges and trends, such as:
 - An increasing world population requires farmers to be more productive.
 - Changes in consumer demands, such as increasing demand for high-nutrition foods and alternative proteins.
 - Labor supply and skills shortages.
 - Increasing pressure from regulatory bodies and society to farm more sustainably, including finding solutions for fresh-water standards and methane reduction.
 - New generations of consumers increasingly use data in their decision-making.
 - There are also increased global political shifts and volatility that are driving a focus on domestic self-sustainability and supply chain solutions to mitigate some of the international political and trade volatility.

To address these global challenges we need to develop and commercialise agritech solutions. New Zealand's proud history in agribusiness innovation through world-leading farmers, Crown Research Institutes, agritech entrepreneurs and innovators means we are well placed to develop these innovations. But we need to put more focus on commercialisation of agritech if we are to have a real impact on growing our global influence to resolve these big issues.

Developing and commercialising agritech solutions will further enhance our primary sector production and grow our export earnings from primary sector innovation.

To provide context to the value of the broader sector and opportunity, there are some key metrics to understand the current status and what it can mean for New Zealand's primary sector and broader economy.

- The New Zealand Government Ministry of Primary Industries (MPI) reported in August, that year to 30 June 2023 New Zealand's food and fibre sector generated New Zealand \$57.4Billion in export earnings.
- Whereas AgFunder (<https://agfunder.com/research/>) projected in 2022 that agritech's worldwide value is US\$250Billion and is forecast to continue to grow.
- MBIE 2020 Aotearoa Agritech Unleashed Report outlined that agritech exports for New Zealand only made up \$1.2Bn of earnings (for the 2019 year).
- New Zealand Trade and Enterprise (NZTE) together with Callaghan Innovation estimate there are approximately 950 agritech firms in New Zealand, with the top twenty agritech exporters estimated to contribute circa \$800 Million of the \$1.2Bn.

Growing New Zealand's agritech sector can deliver the following additional benefits:

- The MBIE Agritech Transformation Plan of 2020 reported that average wages in agritech enterprises were \$94,956 and produced average revenue per person of \$296,197; and
- The same report quoted work completed by Sapere New Zealand that was based on an Australian Farm Institute study on economic benefit through the application of agritech that estimated in an New Zealand context that successful implementation of agritech could enhance the value of the

total food and fibre sector for New Zealand by 21% (which was projected at the time of the report to be \$9Billion of additional value from sector earnings of circa \$46Bn in 2019).

- The Aotearoa Agritech Unleashed Report opined that “New Zealand relative to our global peers, is punching below our weight regarding agritech’s economic value and export earnings.”

The project sets out to understand what learnings we can take from successful commercialisation of technology and innovation to provide a framework of key denominators that New Zealand agritech innovators can apply to assist them to commercialise and scale their solutions to more materially contribute to solving these global issues and lifting New Zealand’s economic earnings.

4. Objectives of the Study and Report

Scope and Objectives:

To better achieve New Zealand's growth aspirations for the agritech industry, and secure the benefits this would provide, the objectives of this report are to:

- Identify key denominators that New Zealand agritech companies can use as a framework to enhance their chance to achieve greater commercial scale and business success.
- Achieve New Zealand's broader economic objectives for the agritech industry of a higher wage economy, increased output, and efficiency from the primary sector; and
- Ultimately contribute to delivering global solutions to more sustainable food, fibre, and protein solutions for the world's population.

The scope is to use literature, case study research, and interviews to gain insights and develop a framework that New Zealand agritech innovators can reference as key themes and denominators to consider in their approach and business planning before embarking on their commercialisation journey. It is intended that applying these insights and frameworks can enhance the agritech business founders' chance of building a commercially scalable business.

The project has evaluated the key commercialisation denominators from the perspective that the agritech business has a minimum viable product through to the innovation achieving scalable commercial success. The study is also predominantly focused on agritech solutions for farmer applications (as opposed to consumer or supply chain applications for the downstream food and fibre sector).

Many factors within and outside an innovator's control will influence their success or failure, including having "some luck" on their side. No innovation opportunities are the same, they will all have their unique challenges and nuances. Therefore the framework developed should be considered and adapted within the context of the agritech innovators innovation, situation, and market opportunity.

Outside of Scope:

There is a body of research around early-stage product innovation and further material related to growth pains per the transition from a successful mid-sized company to a corporate business that sits outside of this project scope.

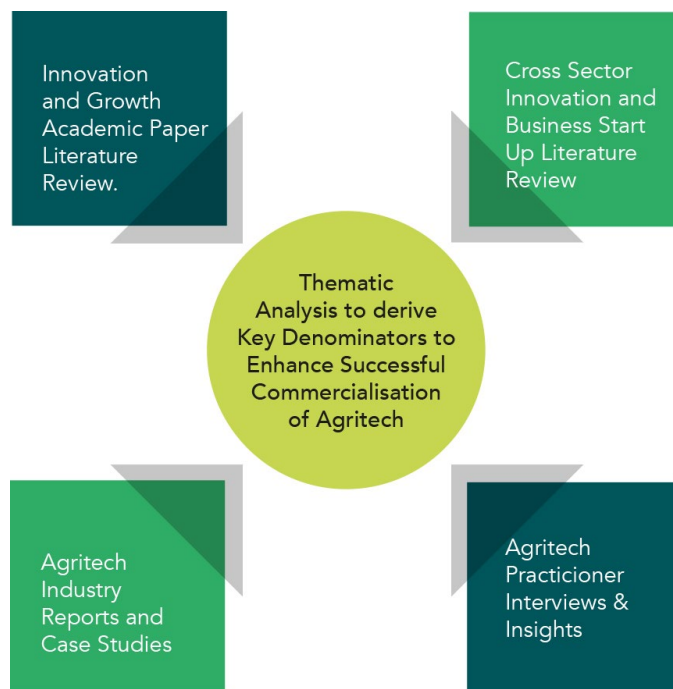
The work also touches on an evolving target markets and channels into market segments. This project scope does not cover the different communication strategies into market segments but would like to acknowledge the importance of communication strategies (especially in the age of using social media for positioning and marketing innovations) and that this is an area that founders should seek to understand and leverage as part of their capability building.

5. Methodology and Approach

To deduce if there are key denominators that can be used as a framework to enhance the opportunity to successfully commercialise agritech innovation the approach has been using a Thematic Analysis Framework, Braun and Clarke (2006), to review, compare and contrast four areas of research and analysis. The methodology and approach are diagrammatically described in Figure 1 below.

Figure 1

Research Material Methodology and Approach



Note: This figure classifies the areas of research and interviews that will feed into Thematic Analysis of the material to derive key denominators for commercialisation of agritech.

The rationale for this approach is as follows:

- 1. Innovation and Growth Academic Paper Literature Review;** There is a strong foundation of academic work studying successful commercialisation of innovative products and services. This are of literature review provides a foundation of key themes, but alone does not provide the insights needed for New Zealand agritech.
- 2. Cross-Sector Innovation and Business Start-Up Literature Review:** There is a range of business books and case studies (success and failures) covering commercialisation of new products and services. This material written by business leaders, consultants, and academics provide valuable practical insights into the challenges of commercialising innovations and growing businesses.
- 3. Agritech Industry Reports and Case Studies;** There is increasing material from government and non-government industry bodies, alongside specialist publications and industry advisers (putting aside any self-interest) on the science and business of agritech sector to provide industry context to the above research.
- 4. Agritech Practitioner Interviews & Insights:** This consisted of 9 interviews with agritech business founders, advisers, funders, and users. These semi-structured interviews helped to identify key areas to further explore and helped join the dots of key denominators for commercialisation of agritech for New Zealand agritech innovators.

From this research work and interviews conducted the approach was to use Thematic Analysis to identify and link key themes, conclusions and key denominators for a commercialisation framework for New Zealand agritech businesses.

6. Literature Review

6.1 Published Research

The project's academic research workstream was to understand relevant and proven foundation principles for commercially scaling an innovation. This started with the founder, through to the innovation itself and its relevant market and market approach, together with what resources are required to execute the growth strategy.

Therefore the research areas included the following approach:

1. Start with what common criteria enhanced a founder innovators ability to develop a commercially successful business from the innovation.
2. Are their common approaches for the founder's product or service and associated business model to achieve commercial success; and
3. How to evaluate and adapt to different consumer behaviours and reach those consumers to achieve the critical mass required.

Why Founder Innovators:

As reported above, New Zealand's agritech sector is made up of circa 900 agritech companies. The nature of the industry (and New Zealand's broader economy) is dominated by small and medium-sized enterprises (SMEs) led by innovative founders.

New Zealand has a relatively small number of large successful agritech companies, such as LIC and Gallaghers. Therefore the study challenge is how can we make more of these SME businesses led by innovative founders into the next generation of large and successful agritech exporting companies.

The drive from small innovative start-up businesses to commercial scale and success will be heavily influenced by the capability and potential of the founders. Therefore, it is important to first understand common traits or behaviours that founders need to have as an individual or a group to enhance their chance of commercial success.

The Harvard Business School (through the Harvard Business Review) has put a great deal of focus into the area of successful business founders, the project has drawn on work by Bonstetter (2012) & Miller (2020).

Bonnstetter (2012) conducted extensive research and analysis of a group of serial entrepreneurs (one can assume if they were serial entrepreneurs, they were successful serial entrepreneurs).

Bonnstetter distilled the skills down to five key traits, which he described as follows:

1. *"Persuasion; ability to convince others to change the way they think, believe or behave., whether to recruit a team or get buy-in from investors and stakeholders."*
2. *"Leadership; entrepreneurial leaders that were innovating had a compelling vision for the future."*
3. *"Personal Accountability; demonstrating initiative, self-confidence, resilience, and willingness to take responsibility for their actions."*
4. *"Goal Orientation; defined as energetically focusing efforts on meeting a goal, mission or objectives."*
5. *"Interpersonal skills; this was defined as the glue that holds the other four traits together, ability to effectively communicate, relating well to all people and building rapport."*

Whereas in a more recent work Miller (2020) researched and reported a broader range of common characteristics defined as follows:

1. *"Curiosity; the drive to continuously ask questions and challenge the status quo can lead them to valuable discoveries overlooked by other businesses."*

2. *“Willingness to Experiment; but to drive this to commercial success it needs to be structured design- thinking/ experimentation.”*
3. *“Adaptability; to successfully commercialise requires an ability to adapt or pivot and continue to evolve the product offering to drive the success.”*
4. *“Decisiveness; ability to make difficult decisions and move forward.”*
5. *“Self-Awareness; aware of their strengths and weaknesses to be able to build a well-rounded team to complement those strengths and weaknesses.”*
6. *“Risk Tolerance; comfortable with risk, but more importantly directly related to efforts to mitigate the risks.”*
7. *“Comfort with Failure; rather than let fear hold them back, they maintain a positive attitude to allow the possibility of success to propel them forward.”*
8. *“Persistence; willingness to learn from mistakes, ask questions and persist until reaching their goal.”*
9. *“Innovative Thinking; innovative thinking to meet challenges, changing market needs and therefore can go hand in hand with problem-solving skills.”*
10. *“Long-Term Focus; it's easy to start a business, but hard to grow a sustainable and substantial business and so is a long-term venture.”*

Bonnstetter (2012) and Miller (2020) have consistent themes, albeit Miller (2020) has introduced self-awareness, innovative thinking and risk tolerance into the equation that are important attributes.

In summary, it is important for agritech company founders to be self-aware of their traits and capabilities to be able to attract and build the complementary skills to successfully execute the commercialisation strategy. We start with the innovative agritech founder having a minimum viable product to take to market, so we need to explore what the innovation or product needs for the business to grow. This leads us into the next area of research on the product characteristics.

The Product or Service Innovation:

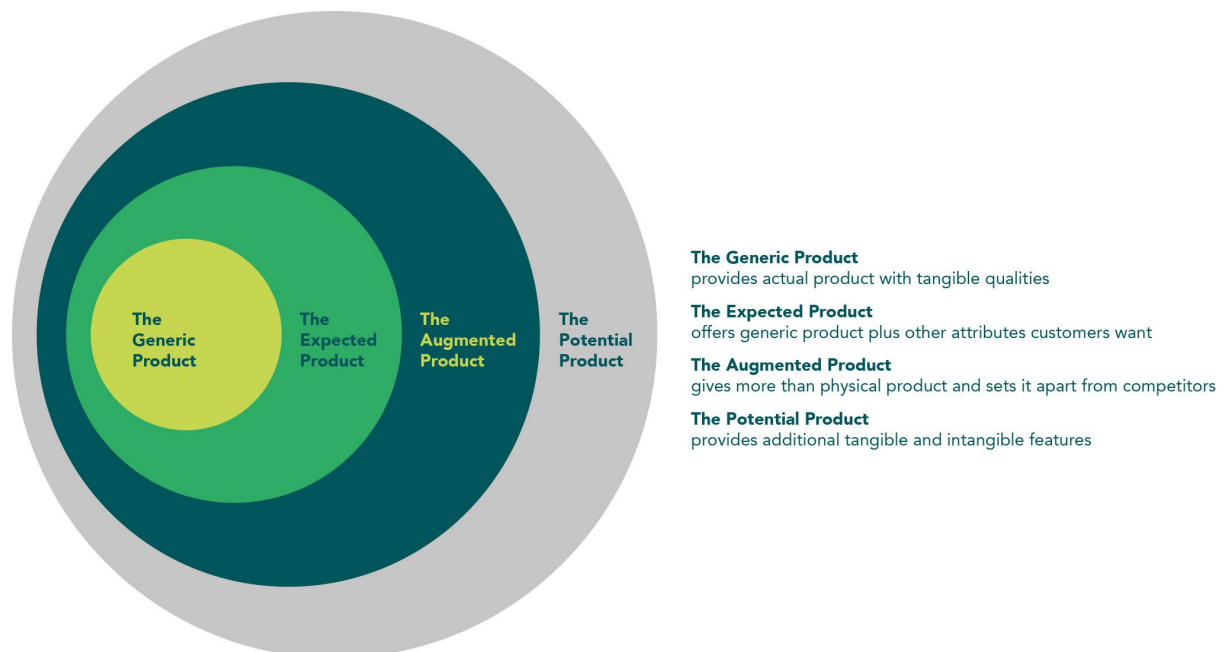
From a product development perspective, a long-standing and internationally recognised study and framework on successful development and commercialisation of new products and services was captured by Levitt (1983). This work studied a large number of business case studies to determine what made a product or innovation commercially successful.

In Levitt’s book he cautions “that taking advice from a single successful businessperson will determine that the only way to successfully commercialise an innovation was the way they did it, as it was successful, so it must be the way to do it”.

Levitt sought to distil a wider body of research into a framework for innovators to adapt and apply to their product and target market. He termed this framework "The Total Product Concept" that identified and classified a successful innovation or product as having tangible and intangible components, and that these additional benefits evolve from the core, or generic product.

Levitt describes that for the new product to be truly successful requires an ongoing evolution to secure sales into a larger market, which he describes through the different stages of a product lifecycle, The Total Product Concept in Figure 2 below.

Figure 2
Total Product Concept (Levitt 1983)



Note: Figure 2 The Total Product Concept shows the evolution of the Generic or Core product through to full product offering to deliver the value proposition to an evolving and growing target market.

A new innovation (Market Development Stage) is early-stage market ready, often referred to as a Minimum Viable Product (MVP) brought to market before there is sustainable consumer demand, or the product is yet to be fully built out. Therefore, sales are limited as the product only contains the minimum of functionality. The next stage identified by Levitt was Market Growth, where demand begins to accelerate, which can also create scaling issues that need to be carefully managed.

Levitt went on to explore Market Maturity (Stage 3) and Decline (Stage 4) that all companies need to be mindful of for long-term sustainability, but for this study, we are focused on Market Development and Growth Stages to get to a level of commercial scale or a tipping point of successful commercialisation.

Understanding the product lifecycle goes hand in hand with the consumer profile and target market, which we need to explore.

Consumer Behaviour:

Linking a product lifecycle to reaching its target market and achieving critical mass (i.e. commercial success) can be explored through Rogers (1962) published work: Diffusion of Innovation. This work sought to explain how, why, and at what rate innovation spreads to a mass market.

Rogers was linking communication of an innovation through and across social systems, he broke this down into five key elements:

1. The innovation itself; what is the core product or service.
2. Adopters; who are the early adopters of the innovation.
3. Communication channels; how do you reach the early adopters, so they are aware of the innovation.

4. Time; how long does it take to reach the customers for a business to be successful the quicker you can get to customers the better.
5. A social system; as the target market evolves and changes, there will be different influencers or channels that will succeed across these evolving consumer markets.

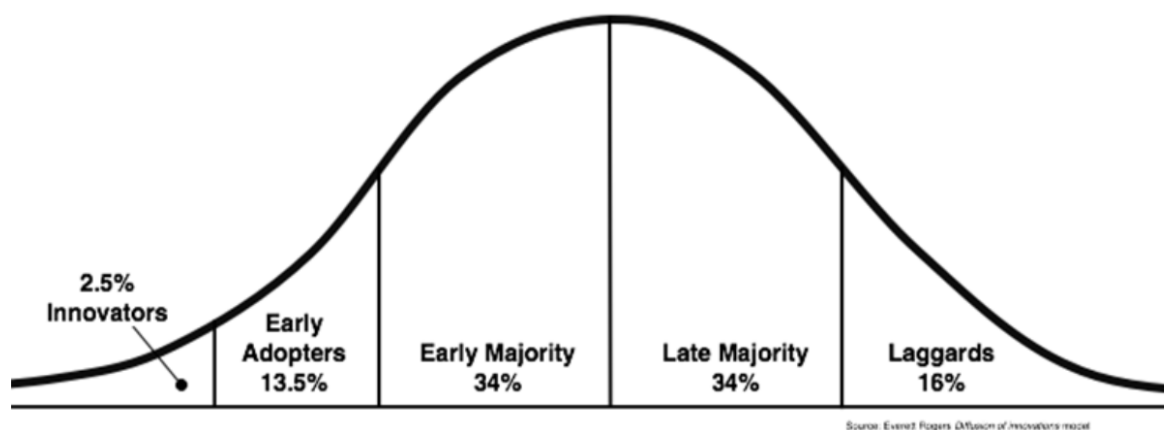
Rogers outlined that the spread and success of a product relies heavily on social capital, who influences what group, and how each group differs in its risk profile and requirements to adopt an innovation, or change from an incumbent product to a new product.

Rogers describes the groups as starting with innovators, moving to early adopters, and then the early majority to secure the scale and commercial success. When an innovation becomes mature and an incumbent of the industry Rogers argues the late majority will then adopt the product, but to reach these target customers the business needs to understand the different influences or channels that will result in securing the market share.

Growing into this market share requires the need to adapt the product, channel to market, and communications to target these new market segments. Rogers outlined these market segments, and his projection of the percentage of each consumer type against the total addressable market. Rogers' diagrammatic description of this is per Figure 3 below:

Figure 3

Diffusion of Innovation Model (Rogers, 1962)



Note: Figure 3 shows consumer types from the innovators and early adopters through to achieving commercial scale with the early and late majority consumer sets.

To achieve successful commercialisation and reach a “Tipping Point” Regis McKenna, an early-stage Silicon Valley management consulting company, deemed the tipping point to lie at the boundary of early adopters and the early majority.

The founder of an agritech business planning to get to commercial scale will need to be aware of, and plan to achieve commercial success with the following consumer types:

- Innovators; consumers who want to be the first to try the innovation, they are willing to take risks; then
- Early adopters; are the key opinion leaders who embrace innovation and change. The early adopters are aware of a need to change/ to do things better. The agritech founders need a strategy to target and support these early adopters with awareness and information on the innovation; and
- Sustainable commercial success is upon securing the early majority; this group of consumers are not thought leaders but are more likely to adopt new technology before the average person. However, they need to see evidence that the innovation works and delivers what they expect of the product. This needs a clear communication strategy to support their requirements and resolve any risks or concerns.

Targeting these evolving consumer types, will require an evolving business model, starting with a disruptive business model that then evolves as the product and target market grows and matures.

Disruptive Business Models:

A successfully commercial business has many component parts that need to be coherent and aligned. This is achieved through the formation of a business plan that can be successfully executed. Christensen (2016) work distils the complexity of a business model into a matrix of four key components arranged as priorities or capabilities. Christensen outlined them as follows:

- “Priorities”
 - “Value proposition; the clear value proposition for the target customers.”
 - “Profit formula; a clear understanding of the cost structure, assets and what is the revenue model.”
- “Capabilities”
 - “Resources; the people, capability, products, facilities, branding, and capital to profitably deliver the value proposition.”
 - “Processes; what are the ways of working together and processes to deliver recurrent tasks in a consistent and scalable way.”

It is important to understand that the development of the business case and model is not static, it needs to continue to develop and evolve. Christensen went on to outline three stages of a business model within the same matrix approach outlined above. Christensen’s work outlined the stages as follows:

- “Business Creation: This is with a relatively small team of founders and therefore a flexible business model that is wholly focused on delivering a compelling value proposition to the target market and therefore clear metrics and data on what that success looks like.”
- “Sustaining Innovation: this requires developing repeatable and scalable business processes to deliver more sales, capturing data points, and developing of clear financials.”
- “Efficiency: focus on efficiency innovations with ratio metrics, financials, and balance sheet.”

Further work in this area by Giovanni Sordi Schiavi and Ariel Behr in their “Emerging technologies and new business models; A review on disruptive business models” covers similar ground with a focus on the value proposition, but goes on to discuss key components of a business model as:

- Central strategy;
- Value proposition;
- Target market and revenue model
- Resources

These business model areas are used as signposts to bring together the parts of the enterprise's innovation, capabilities, and market into an executable plan.

6.2 Cross-Sector Business Publications and Journals

This section builds on understanding and insights of these core frameworks from cross-sector business publications. As expected, a successful business brings together the different facets of these core principles, namely; founders skills and capabilities, resources, market, product and capital structure into a framework of key denominators.

In 2018 Harvard Business Review published an Entrepreneur's Handbook that defined (Bygrave, 1997) an entrepreneur as "someone who not only perceives an opportunity but also creates an organisation to pursue it". It references (Page 1 Introduction) "Thomas Edison's real genius was not only developing an incandescent light bulb, but he also brought together the human and financial resources to implement his vision, the forerunner to General Electric"

It is this same application of innovation, human and financial resources that is required to successfully grow New Zealand's agritech sector.

Consistent with the profile of many founder led agritech companies the publication picks up broader studies on the key traits of an innovator to be able to successfully develop and commercialise a business opportunity. The publication provided a useful overview of the founder's "common entrepreneurial traits" (Ruback & Yudkoff, 2018) per Figure 4 below.

Figure 4

Common Entrepreneurial Traits (Harvard Business Review: Entrepreneurs Handbook, Ruback & Yudkoff, 2017)

Common entrepreneurial traits

Ideas and drive	People skills	Work style	Financial savvy	Entrepreneurial background
Creativity	Leadership	Goal oriented	Comfortable with finance	Family members have started businesses
Vision	Persuasion	Comfortable with uncertainty	Comfortable with financial governance	Friends have started businesses
Ability to identify opportunities	Influence	Self-challenging		You have worked at a small business or startup
Passion	Network building	Perseverance in the face of adversity		
	Ability to excite people by vision	Solitary: don't like working for others; prefer being own boss		
		Rarely satisfied or complacent; can't sit still		
		Driven to plan and be prepared		
		Tendency to continuously look for a better or different way to do things		
		Ability to close a deal		
		Ability to listen, trust, take advice		

Sources: Bill J. Bonnstetter, "New Research: The Skills That Make an Entrepreneur," HBR.org, December 7, 2012; Daniel Isenberg, "Should You Be an Entrepreneur? Take This Test," HBR.org, February 12, 2010; Harvard Business Review, "For Founders, Preparation Trumps Passion," *Harvard Business Review*, July-August 2015; HBS Working Knowledge, "Skills and Behaviors That Make Entrepreneurs Successful," June 6, 2016; Veroniek Collewaert and Frederik Anseel, "How Entrepreneurs Can Keep Their Passion from Fading," HBR.org, June 16, 2016.

Note: Figure 4 captures the various aspects of common entrepreneurial traits from innovative thinking, people skills, through to background, working style and financial

Whereas Eisenmann (2021) opined that successful enterprises have deep industry experience combined with functional experience (finance, technical, operations, commercial). Eisenmann acknowledged the importance of the temperament of the founders "to be able to build the relationships and make the right judgment calls to enhance the success of a start-up business".

Eisenmann also explores what entrepreneurs get backed by venture capital (VC), and whether the VC firm backs the founders or the product (which he refers to as "backing the jockey over the horse") in that if the founders have the right stuff, they will problem-solve to overcome any product or market issue to build a successful enterprise.

The Harvard Entrepreneurs Handbook (Harvard Business Review, 2018) provides a good step-by-step guide from idea inception through growth and exit of an innovative business, whilst it is a good reference document it is a more generic technology focus and for the United States context, i.e.. a large domestic market with the world's most mature venture capital market, as opposed to a New Zealand agritech sector. However, it does provide a useful roadmap for entrepreneurial founders to reference.

Eisenmann (2021) set out to determine why start-ups have failed in an attempt to identify potential pitfalls to be avoided. Eisenmann's research outlines six patterns below that in his view strongly contributed to start-up failures.

This work provides a valuable reference point of the key challenges, or pitfalls, that New Zealand agritech founders should be aware of to navigate their way past to be commercially successful. Eisenmann termed the following primary pitfalls to be aware of:

- *“Early-Stage Failure”*:
 - *“Good Idea, Bad Bedfellows”*; good innovations have failed due to dysfunctional relationships with funders and governance, team members, or strategic partners, such as partnering up with the wrong distribution partner.
 - *“False Starts”*; failure to fully research/understand the customer's needs before presenting the product, they had a product looking for a solution that was not wanted by the market, or lack of a real value proposition.
 - *“False Positives”*; strong response for test market/ initial customers does not convert to sustainable market demand, and the business scales up the cost structure for a market that is not there. There is a risk here from testing with friends and family that are do not want to be too critical and their positive affirmation presents a false positive.
- *“Late-Stage Failure”*:
 - *“Speed Trap”*; a relentless focus on the growth of products and markets with a high-cost structure for sales and marketing that financially challenges the business when sales don't transpire or slow down. i.e. don't define commercial success as relentless growth.
 - *“Help Wanted”*; financing and resource fit is not suitable for the growth stage, and therefore the business fails as it has not evolved the management and team capabilities, or the capital structure to support increasing demand on capital and cash flow.
 - *“Cascading Miracles”*; the business model is very ambitious requiring several challenges to align, such as: a critical mass of customers fundamentally changing behaviour, mastering new technology, partnering with large corporations to achieve scale in the channel to market, regulatory change, raising vast amounts of capital to develop and sustain the innovation through to critical mass.

The research identified that getting a successful innovation to market is a good start, but it is only the start of the journey to be able to get to commercial scale. It is important to be able to plan for and successfully navigate through these pitfalls and challenges.

In evaluating the challenges of this growth journey we can reference Moore (1991) excellent work (subsequently updated to incorporate more recent technology innovations) on the challenges for growth companies. The key insights from this publication for a New Zealand agritech company wanting to achieve commercial success are:

- Referencing the Diffusion of Innovation Model (Figure 3 above) and believing that the tipping point for commercial success is upon securing the early majority to get to a commercially viable scale, then it is important to understand, and plan for the fact that the graduation from early adopters to early majority is not a seamless or linear process, there are cracks, or chasms in the growth bell curve.
- The most challenging chasm for an enterprise is from the early adopter market to an early majority. The business needs to be resilient and have the right financial structure to navigate and survive

the growth chasm. According to Moore's analysis this is when a business is most likely to fail as they have built up their capability (costs) to deliver but don't secure the revenues in a timely or linear fashion.

- Moore also discusses that an innovative business may try lots of new things to grow, but that they need to focus on a single market entry point with a clear value proposition. Moore refers to this as securing a "beachhead" in a suitably sized niche area. It is not unusual for a start-up company to chase different market segments without the discipline to segregate the market and put real focus on a subset of the total market and gain traction and credibility in this market subset (the "beachhead").
- Moore also builds on Levitt's Whole of Product Concept in that the innovators and early adopters may accept the Core Product but to cross the chasm to the early majority you are dealing with more pragmatic and risk-averse buyers. These buyers will require demonstrable proof that the product can seamlessly be incorporated into their business, which means a much broader offering is required, such as: product support, documentation, and potentially complementary partnerships.
- To transition from the beachhead to the mainstream will also require different market positioning and messaging. The early majority will want to have confidence that it is a tested and proven system, so the proposition is not about the leading-edge innovation but focuses on the proven system, looking more like a market incumbent. Therefore, the business model needs to evolve to better represent and support this whole product offering into the more mainstream market.

The literature review developed some clear themes and frameworks for the successful commercialisation of an innovation that needs to be overlaid that with a New Zealand agritech context, covered in the following two sections.

6.3 Agritech Industry Papers

This area of the literature review was to look at the status of New Zealand's agritech sector, along with industry reports and commercialisation case studies to provide context to the prior innovation commercialisation concepts reported.

New Zealand Agritech Status and Context:

Over the course of the last few years there has been a concerted joint effort by the New Zealand Government, Ministry of Business Innovation and Employment (MBIE), Ministry of Primary Industry (MPI) and Callaghan Innovation to work with Agritech New Zealand (as an industry group) to better understand the agritech sector, challenges, and opportunities to develop and drive a joined up agritech growth and commercialisation strategy.

The papers published between 2020 and mid 2023 include:

- MBIE Agritech Industry Transformation Plan published in July 2020
- July 2020 Agritech New Zealand Aotearoa Agritech Unleashed: Driving Productivity, Sustainability & Economic Growth
- January 2023 MBIE, together with MPI Agritech Industry Transformation Plan (updated)

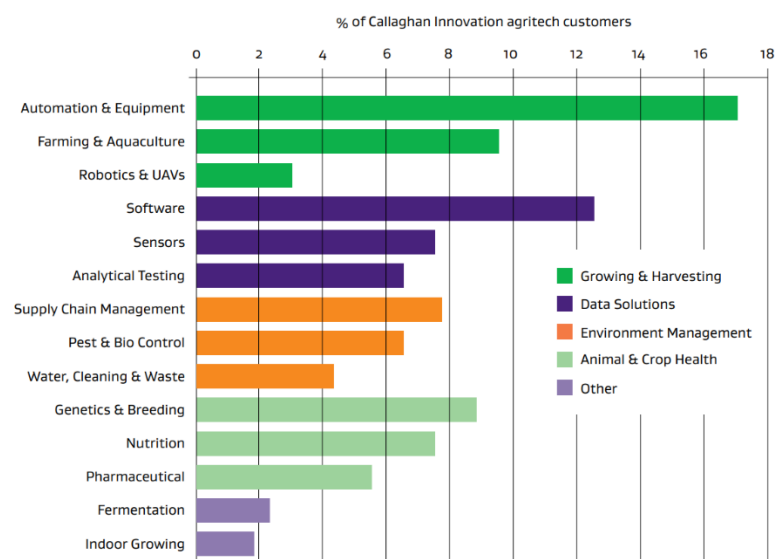
This work has identified New Zealand's history and track record of successful agribusiness innovations. One notable example was the material economic lift to New Zealand that refrigerated shipping of 1882 had on New Zealand farmers and the broader economy. There have been ongoing innovations such as electric fencing, grass cultivars, selective genetics, etc, that have provided material improvements in farming yields, operation efficiencies, and export earning opportunities.

The Aotearoa Agritech Unleashed report notes that New Zealand agritech is underperforming relative to our global peers, and therefore can the Government and industry develop a more joined-up strategy to accelerate this sector to solve the major global issues we are facing whilst growing New Zealand export earnings.

The 2020 Industry Transformation Plan captured a breakdown of the New Zealand agritech companies that are working with Callaghan and the type of agritech activity they are engaged in, outlined in Figure 5 below.

Figure 5

% and Type of Callaghan Innovation Agritech Customers (Prepared by MBIE of Callaghan Innovation, New Zealand Trade and Enterprise, Agritech New Zealand databases, 2019)



Note: Figure 5 outlines the type of agritech innovation companies, and the % as a total share of agritech companies that are working with Callaghan Innovation to develop their agritech innovations and businesses.

The same 2020 report provided an overview (refer to Figure 6 below) of the development stage of these companies with 62% of them classified as early/ growth stage companies that are on their commercialisation journey.

Figure 6

Callaghan Innovation agritech customers by life stage ((Prepared by MBIE of Callaghan Innovation, New Zealand Trade and Enterprise, Agritech New Zealand databases, 2019)

Callaghan Innovation agritech customers by life stage



Note: Figure 6 provides a high level overview of what stage of commercialisation the agritech companies working with Callaghan Innovation are at

In developing and executing commercialisation strategies for New Zealand agritech companies it is important to understand some of the obstacles and constraints that exist. The 2020 MBIE Industry Transformation Plan captures the following obstacles and constraints as follows:

- New Zealand’s agritech expertise has largely been in specialist areas, such as pasture-based farming and domestic purposes with limited export potential.
- There is a disconnect between R&D spend (the report quotes \$640M spent on food & fibre R&D in 2018) against agritech annual earnings of \$1.2Bn is a poor return.
- Shortage of growth capital and lack of an agritech cluster (geographically spread across the country) to provide a critical mass of agritech expertise; and
- Lack of commercialisation skills, defined standards, or regulatory frameworks to support the development of agritech in New Zealand.

The Industry Transformation Plan Report also explores the potential barriers for on-farm up-take of agritech. It is important for agritech founders to understand and develop strategies to successfully navigate these potential barriers. The Report outlined the following points:

- “Owner/ operators tend to rely on their peers rather than experts as a key source of information when making change; new ideas take time to gain favour;”
- “Production systems based on biological systems tend to be more difficult to adapt to change because of their complex nature and long production timeframes;”
- “New ways of doing things can introduce risk (even if it is just perceived risk) into the system (especially when it comes to food safety), potentially damaging the integrity of the food system, so risk and change need to be balanced carefully;”
- “There are difficulties accessing relevant independent advice or capital to adopt innovations;”
- “The skills required to implement significant change are quite different to those required for traditional food processors;”
- “Skills shortages overall in the food and fibre sector;”
- “There is uncertainty about whether the change will deliver benefits or create stranded assets in the face of other requirements (this is a particular issue when considering efforts to deal with water quality and climate change mitigation);”
- “Some rural infrastructure limitations (such as rural wifi) hinder uptake;” and

- “Some technologies are not being developed with the needs and abilities of the end user in mind; if the value proposition is not clear, then uptake will be limited.”

The Industry Transformation Plan goes on to identify the following comparative advantages and opportunities when it comes to New Zealand’s agritech sector:

- International reputation for pastoral farming systems and innovation together with strong research institutions, regulatory models, and legislative frameworks;
- Geographical advantage (counter to North Hemisphere growing season), access to Asia Pacific, North America, and traditional international partnerships and free trade agreements;

Comparatively the Agritech New Zealand Aotearoa Agritech Unleashed Report provides an overview of New Zealand’s agritech competitive advantages, as outlined in Table 1 below.

Table 1: Agritech New Zealand Aotearoa Agritech Unleashed Report 2020

TABLE 1: New Zealand s Agritech Competitive Advantages					
AGRIBUSINESS HERITAGE	FREE & OPEN MARKETS	AGRIFOOD BUSINESS MODEL	GEOGRAPHIC ADVANTAGES	GOVERNMENT/ POLICY ADVANTAGES	SOCIAL ADVANTAGES
<ul style="list-style-type: none"> - strong global supply chains. - clean, green heritage. 	<ul style="list-style-type: none"> - Active in Free Trade Agreements (FTA)s & World Trade Organisation (WTO) engagement. - FTAs with China, CPTTP & Europe. 	<ul style="list-style-type: none"> - national cooperatives providing global scale. 	<ul style="list-style-type: none"> - island nation borders protected by distance. - East/West cross roads. - multiple growing climates. 	<ul style="list-style-type: none"> - #1 globally for ease of doing business. - proactive Government support for the sector. 	<ul style="list-style-type: none"> - small connected and collaborative ecosystem. - Māori world view aligned with global megatrends.

Source: Agritech New Zealand, 2020

To assist in the development of the Agritech sector and commercialisation the Industry Transformation Plan Report of 2020 captures existing agency work programmes. The commercialisation process for many New Zealand agritech companies will benefit from broader industry networks and financial support. For reference purposes the funding and support programs available to New Zealand agritech businesses are listed below:

- R&D and Innovation Support:
 - MBIE Endeavour Fund, Partnerships Scheme, National Science Challenges and Strategic Science Investment Fund;
 - MPIs Sustainable Food and Fibre Futures Programme.
- Increasing Agritech adoption:
 - Callaghan Innovation Emerging Technology Workshops;
 - MPIs Extension Services Model; and
 - MBIE arable farming small business uptake ICT pilot.
- Direct Firm Support for Growth:
 - *Scale for Global Growth*; whereby New Zealand Trade and Enterprise (NZTE) and Callaghan will run cohort programs to help New Zealand Agritech companies think and scale for global growth;
 - *NZTE Global Opportunities*; work to raise awareness and capability to pursue global growth opportunities;
 - *Callaghan Innovation international immersion program*; to connect Agritech companies to early adopters overseas;

- *Callaghan Innovation Global Signals*; helps New Zealand Agritech companies monitor and interpret early market disruption signals;
- *Callaghan Innovation Agritech Support Explorer*; tool for Agritech companies to navigate over 130 private and public funding and support mechanisms;
- *Elevate New Zealand Venture Fund* and its commercial funding partners;
- *Farm2050 Global Future of Food Ecosystem*; for Agritech entrepreneurs to partner to deliver global solutions, with a focus on:
 - Supply chain efficiency, sustainability, and innovative business/ distribution models;
 - Financial services/ products to drive technology adoption and farm profitability;
 - Effective and sustainable crop inputs;
 - Next-generation food products and development platforms

Work undertaken as part of Lincoln University Agribusiness and Economics Research Unit that included a Conference and related paper titled: Proceedings of the International Conference on Invention, Innovation and Commercialisation with Special Emphasis on Technology User's Innovation, and specifically Chapter 22, Commercialisation of Intellectual Property (IP) for inventors and SMEs and why so many ideas fail to enter the market.

In this paper, John Fairweather discusses the issue of ensuring there is a clear and timely commercial execution strategy supported by the right complementary skills, such as commercial skills around the project and financial management, alongside production management and patent/ legal skills. This paper also raised the important issue of commercialising IP, where many international treaties have relatively limited deadlines for IP protections, and therefore the importance of securing the legal and commercial arrangements when entering global markets with New Zealand agritech IP.

Other Country Agritech Insights:

The above material has provided New Zealand agritech market context and insights, but to evaluate agritech commercialisation material more broadly the Australian AgriFutures National Rural Issues Report, titled Challenges and Opportunities for effective value proposition design in Australian ag-tech, by Sarah Nolet and Cass Mao of AgThentic from September 2018 reported on a study with practical insights.

This Report discusses the implications of agritech innovation and commercialisation being just as much an entrepreneurial activity now as compared to more traditional Government research bodies, universities, or well-established R&D businesses. It discusses the implications of bringing these entrepreneurial and Venture Capital backed innovations to market, and what that means for adoption and commercialisation.

The report notes that primary producers and the agritech sector report low levels of technology adoption, and often cite weak value propositions as the reason. The analysis through stakeholder interviews seeks to identify ways that farmers, entrepreneurs, and other sector supporters can help to overcome weak value propositions and contribute to the development of Agritech solutions worth adopting and commercializing.

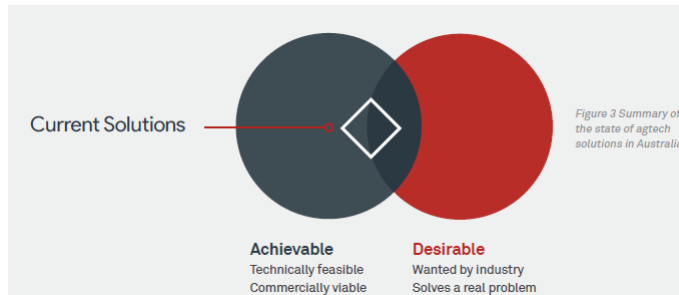
The Report identifies several barriers for farmers in adopting agritech solutions, they include:

- "Infrastructural challenges such as lack of connectivity or access to foundational data sets;"
- "Implementation challenges such as lack of viable models for installation, support, and maintenance of agritech solutions on farm"; and
- "Lack of strong value propositions – the product or service does not deliver tangible value (e.g. efficiencies, profitability or convenience) or an unclear Return on Investment (RoI)"

This is represented with the following diagram (Figure 7) which represents that the Agritech solutions coming to market are not wanted by industry, or seen to be solving a real problem, and what's more they are not always technically or commercially feasible.

Figure 7

Challenges and opportunities for effective value proposition design in Australian ag-tech (Nolet & Mao, 2018)



Note: Figure 7 describes that there is not complete alignment of current agritech solutions of what is technically feasible and commercially viable that is desired by the industry, or solves a material issue.

Nolet and Mao (2018) in the Australian report outlines the value proposition problem for agritech as affected by three key characteristics of new industries:

1. "Promise of low competition and large markets (global agri) can attract many new innovators that can often result in a flood of new similar products hitting the market simultaneously, and often in unpolished states;"
2. "Entrepreneurs can enter a market lacking detailed information and insight about their users, and they are trying to build new and novel products, rather than incrementally better versions of existing products – so no consumer knowledge about what makes a product good or bad;"
3. "For innovations, entrepreneurs lack the time and budget to go slowly and get it right on the first try, it's a get it out and see approach."

The report then identifies several challenges for effective value proposition design to bring new agritech products to market:

- Enhance domain expertise and industry networks.
- The farmers buying the product need to be offered a functional product (not a partially developed solution that has no real value proposition).
- Balance the need for testing and customer feedback with product/ commercial incentives for the farmers vesting time to evolve from an unproven innovation to a valued solution.

The Report concludes with the following considerations to enhance the adoption of agritech:

- *"Engage at the right time"*; the means of engagement and benefits for farmers need to be well understood."
- *"Build awareness of emerging technologies and capabilities for evaluating solutions"*; This is building awareness for producers to understand what is out there and the benefits that can come as co-creators of an innovation.
- *"Get out on the farm, talk to farmers, and bring samples"*; entrepreneurs must follow the best practice of value proposition design, including engaging with users early and often.
- *"Work with industry professionals to help segment the market"*; this links back to the diffusion of innovation model to identify early adopters and industry influencers.

- *“Communicate transparently about what is being built and when it will be ready”*; An MVP must fully solve a problem for a pilot customer and recognise that limited functionality and poor functionality are two distinct issues.
- *“Identify and invest in translators between agriculture and agritech”*; ensure the innovator and the prospective farmer customer are speaking the same language.

Expanding on what is required to enhance the adoption of agritech, research from Suhas P. Wani et al (2021) explored the need to focus on the delivery of innovations. Many agritech innovations focus on the science and don't sufficiently progress the channel to market, or application of the science and therefore whilst the science may have value, it is not delivered as a solution that has value and is therefore not successful in evolving to a commercially viable product.

6.4 Agritech Practitioner Interviews

Industry practitioner insights were secured through 10 interviews with New Zealand agritech company founders, advisers/ investors, and users of agritech. These were conducted in a semi-structured approach, covering:

1. Describe the Agritech innovation you have been involved with (development of/ adviser to/ or user of).
2. The commercial model/ adoption strategy.
3. Broader issues affecting uptake of the innovation/ or stalled uptake.
4. Broader industry thoughts/ insights on agritech success/ failure the interviewee can/ wants to share.

This process provided insights and ideas in a New Zealand agritech context that helped to sculpt the broader framework of the key denominators for the successful commercialisation of agritech. Key insights, or points of interest from the interviews were then arranged per:

- Key Denominators for Success
- Key Challenges of Commercialising Agritech
- Insightful Quotes from Interviewee's

These are outlined in Table 2 below, Agritech Practitioner Interview Insights and Quotes.

Table 2: Agritech Practitioner Interview Insights and Quotes

Agritech Practitioner Interview Insights and Quotes	
Key Denominators for Success	Key Challenges
<ul style="list-style-type: none"> ▪ Speed of customer acquisition is key. ▪ Ability to adapt/ package the core innovation into a broader solution for the customer that may require ongoing evolution of the product and business model. ▪ Clear/ demonstrable value proposition around: <ul style="list-style-type: none"> ▪ Yield or revenue enhancement ▪ Efficiency or cost savings ▪ Employee quality of life/ ability to attract and retain staff (big issue with a shortage of skilled staff) ▪ The value proposition needs to be real and material (saving 0.25 of an FTE will not cut it). ▪ The innovation needs to have a very clear value proposition and ideally a compelling network affect, whereby industry participants will promote and influence wider market adoption. ▪ Investment partners need to bring capability and support to assist the company in growth (capital alone is not enough). ▪ Right-sizing organisation per capital structure and financials, getting the balance right of not ramping too early, but also not 	<ul style="list-style-type: none"> ▪ Many agritech innovators are fixated on developing the product/ innovation and do not spend the time to understand what delivering a solution needs to look like. ▪ Innovation for New Zealand agritech is often for New Zealand farming systems. Whereas in many cases investment required to fully develop and deliver a solution requires a global market for a scalable/ profitable business. ▪ The seasonal aspect of farming and resource pressure means that limited opportunity to pitch and secure sales of agritech – it needs to be easy to understand, deliver a solution to a tangible problem the farmer has, and be easily implemented within the farming system. ▪ Farmers are highly fragmented, and as such costly to sell to. Therefore innovators can evaluate channel partners for sales, but: <ul style="list-style-type: none"> ▪ This requires commercial alignment that is not always aligned. ▪ Reputation risks (is the channel partner truly representing the innovation and is the channel partner taking on a new unproven technology that by association could erode their standing in the market). ▪ Farmers have varying degrees of technical capability and so to achieve critical mass they

<p>sufficiently investing and able to respond to growth.</p> <ul style="list-style-type: none"> ▪ The investment partner needs to understand start-ups and that the product/business will need to pivot and change and they support that – a mindset that having to change tack is not a failure of the business. Pivoting is a common process for a start-up to survive and grow. ▪ Capital structuring is key, finding the right balance to enable and encourage investment whilst maintaining incentives for initial founders whose equity will be diluted. ▪ Complementary skill sets so that a technologist is paired with commercial and financial skill sets. ▪ Clear plan to move from innovation to a defensible position through unique selling point/ IP protection/ delivery model etc. ▪ Alignment between the founder, key team members and capital investor – establish performance based financial incentives for long-term value creation (not just drawing a salary). 	<p>need to deliver an easily implemented intuitive solution.</p> <ul style="list-style-type: none"> ▪ Agritech innovations are one component of a complex farming system and therefore innovators need to understand how it can integrate into the broader farming system, it is not enough just to have stand-alone innovation. ▪ Going to market too early (cash flow pressures drive sub-optimal outcomes) and therefore failing to gain position/ momentum. ▪ Developing a sales channel that understands the innovation and the farming system and how the two go together. ▪ Challenger innovation strategies to get alongside or navigate around the incumbents' market position. ▪ Building teams around technically brilliant innovator founders to leverage commercial networks when they are not naturally comfortable or capable of commercialising innovation in a real-world business environment.
<p><i>Some Insightful Quotes from the Interviewees:</i></p> <p>In response to the project question an Interviewee offered up “six key Issues for successful commercialisation as”:-</p> <ol style="list-style-type: none"> 1. “Is there a market for the tech – who wants this and why?” 2. “Does it work reliably on-farm/ in situ?” 3. “Do you have enough capital to get this to market/ scale?” 4. “Do you have the right management?” 5. “Do you have the right governance – directors that understand the game/ have been through the start-up/ growth?” 6. “Then you need some luck and to be tenacious.” <p>“New Zealand primary sector is blessed with an industry of innovators that see a problem first hand and have the initiative and capability to develop a solution”</p> <p>“many agritech founders have not had experience in scaling a business before, and they are challenged in finding/ attracting the right talent to be able to support them to scale”</p> <p>“many sellers of agritech don't appear to really understand farming systems”</p> <p>“From a farmer perspective, any agritech solutions that can enhance the effectiveness of the team and enable a better work-life balance for the farm workers which enables us to attract and retain key staff is of great interest to us”</p>	

“nearly every agritech business that goes through a transition from a cottage industry to a real scalable business will have some near-death experiences and therefore need to plan for that and have the resilience to continue moving forward”

“the innovation is just the start, having or attracting the capability and being able to execute is critical”

“If serious about scaling, it will take 3 times as much money, takes 3 times as long, and deliver 1/3 of the projected revenue, so make sure your business case has allowed for, and you can survive this”

“you need a bit of luck alongside all the hard work”

“sometimes an agritech initiative will come along and they present their proposition as saving a few hours per day of a resource – that is not a strong enough value proposition to change a process that we currently know and understand”

“still a disconnect between the Government funded innovation hubs and commercial operators who have the skills and experience to be able to commercialise R&D work. If we get this right then everyone benefits as this should lead to greater commercial returns that can then be recycled back into future R&D programmes and innovation hubs, creating an ecosystem that is financially viable and self-sustaining.”

“there are some accelerator programs that promote a big bang approach securing external capital and ramping up. However, this type of approach isn’t suitable in all cases and some founders / innovations may be better to take a more evolutionary approach to build a smaller but ultimately profitable and successful business. Capital structure and investment partner approach should be horses for courses”

“New Zealand capital structures are relatively conservative with pool of equity options for key team members, this can be up to 20-25% offshore but with appropriate legal protections vested over three-year period subject to performance and conditional on team member being with the company for the full duration – this is a good way to provide long term incentives to commercialise and grow shareholder value.”

6.5 Compare and Contrast

The Literature reviews focusing on commercialisation of innovation came back to many of the same key principles, and observations, albeit with some New Zealand and agritech nuances. The key compare and contrast points being:

- The founders' skills and traits combined with the broader teams capabilities and track record of successfully executing a growth business. Whereas a number of the practitioner interviews touched on having some "luck" alongside the hard work, resilience and tenacity.
- The core product being a valid market product and the value proposition it offered came through in all the literature and the practitioner interviews. However, getting critical feedback to enhance the product and the value proposition can be challenging for agritech due to misalignment between entrepreneurial founders and prospective customers.
- Addressable market and capital structure – some of the respected academic and business literature out of America did inherently assume a more accessible scalable market (i.e. large US domestic market for innovation founders to pursue) alongside an assumption of a mature and well-functioning venture capital market. The agritech case studies and New Zealand practitioner interviews were used to overlay key principles with a New Zealand agritech context.

7. Method

7.1 Thematic Analysis

The study and reporting of the key themes, conclusions and ultimately key denominators for successful commercialisation of agritech have drawn on a process of Thematic Analysis.

Thematic Analysis as described by Braun and Clarke (2006) is a method for identifying, analysing, and reporting patterns, or themes across a research topic that uses qualitative data and insights, such as the literature review insights combined with the interview notes outlined above.

7.2 Key Themes

The recurring ideas or concepts from the research material and interview notes have been captured and arranged into relevant themes relating to the research question, in this context, what are the key themes for the successful commercialisation of innovation with a New Zealand agritech context.

The key insights and concepts for a critical review of the research material and development of the key denominators as a step one has been arranged per the area of the research material. Using Thematic Analysis from the three strands of the literature reviews together with the interviews to draw out the Key Themes for the Commercialisation of Agritech.

8. Findings and Discussion

8.1 Key Findings

Applying Thematic Analysis (Braun and Clarke, 2006) to the respective areas of the literature review and agritech industry practitioners have drawn out key ideas and concepts to derive key themes for successful commercialisation of agritech as outlined in Figure 9 below.

Figure 9

Thematic analysis of key themes for commercialisation of agritech drawn from research material



Note: Applying Thematic Analysis using a post-it-note and whiteboard model for capturing recurring ideas and concepts from each area of the literature review to draw out the key themes.

The key denominator themes identified as:

1. *Founders' Traits and Behaviours*: the founders traits and capabilities will influence the success or otherwise of commercialising the agritech innovation.
2. *Team Capability*: linked to the founder's traits and capabilities are the broader team they build around them, the complementary skills and capabilities needed to successfully build an agritech business to commercial scale.
3. *Value Proposition*: is there a clear value proposition for the innovation to the potential users/ buyers of the technology.
4. *Business Model*: does the innovation have a clear business model. The Business Model needs to bring together the resource requirements with the product, target market, and capital structure.
 - a. *Product Lifecycle*: The product will need to develop and evolve to be commercially successful as it moves from early adopters to the mainstream (per the Target Market Lifecycle below)
 - b. *Target Market Lifecycle*: to commercially scale will require an evolving target market and offering. Securing customers from early adopters through to mainstream requires an evolving market strategy.
 - c. *Capital Structure & Financial Model*: the financial model (profit formula) and capital structure go hand in hand with the product, target market, and resourcing strategy.
5. *Navigating the Pitfalls*: You need a lot to go right to be commercially successful, and so understanding the potential pitfalls of those who have gone before is a valuable reference point to navigate the common pitfalls and roadblocks to be successful.

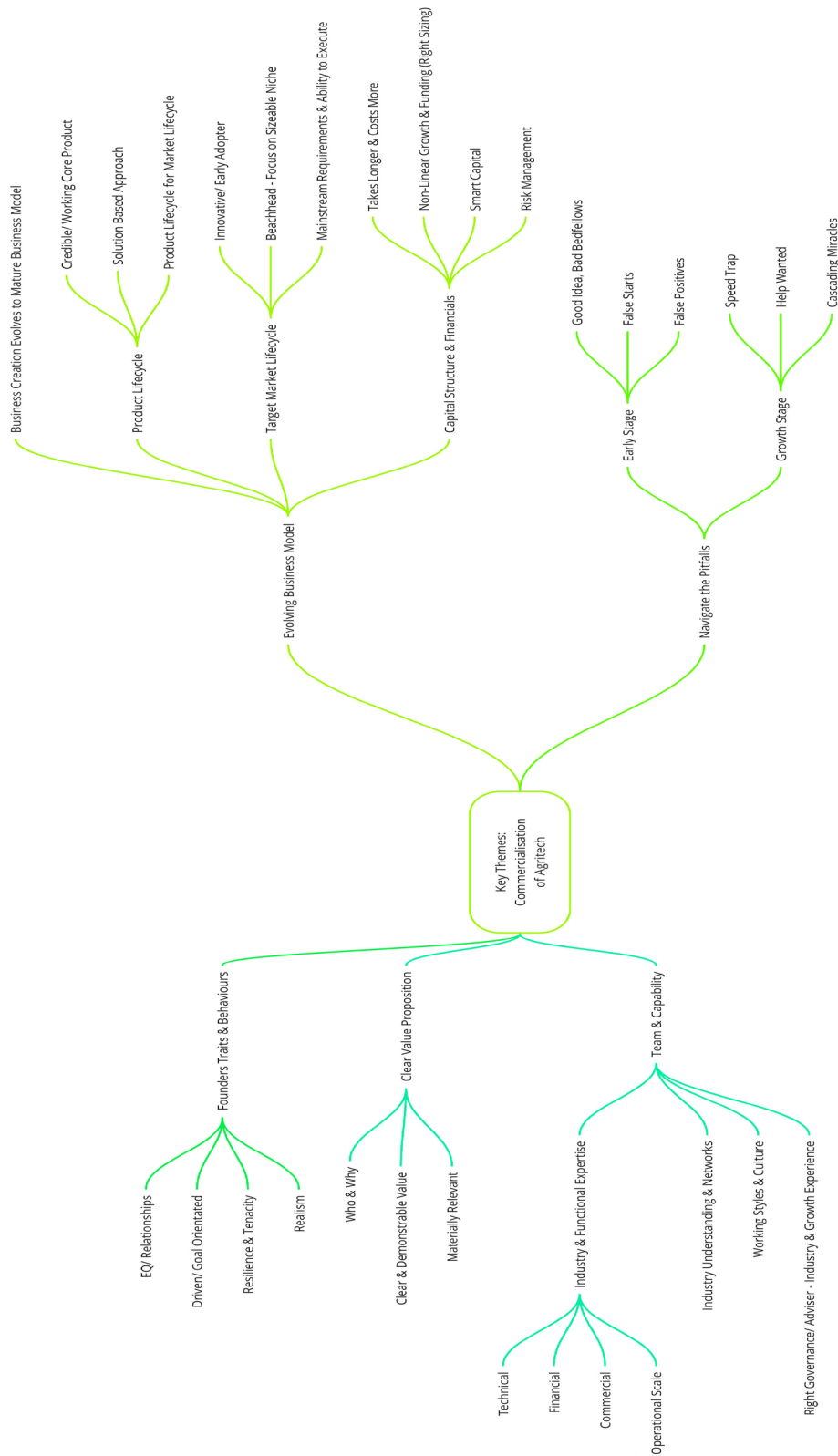
The objective was then to build on these key themes to develop the key denominators for the successful commercialisation of agritech. The process of discovery by mapping the key themes down to the next level of what are the key denominators within those key themes. A Mind Map (Braun & Clarke, 2006) approach has been used to build out from the key themes to key denominators.

8.2 Key Denominators

The process to determine and identify the Key Denominators was undertaken with the assistance of the Miro Mind Map online tool (www.miro.com).

Using the Mind Map approach (Braun & Clarke, 2006) the Key Themes have been built out to capture the key denominators for the successful commercialisation of Agritech as outlined in Figure 10 Key Denominators for Successful Commercialisation of Agritech below.

Figure 10
Mind Map of Key Denominators to Enhance Commercialisation of Agritech



Note: Figure 10 takes the key themes and links the key denominators for each theme to enhance successful commercialisation of agritech.

8.3 Agritech Commercialisation Discussion of Key Themes

Whilst New Zealand has a proud history in agritech innovation, we only have a handful of internationally relevant agritech companies. For New Zealand's economy and rural sector to grow we need to support more of these small and medium-sized agritech enterprises to be commercially successful with economies of scale that can help deliver these global food and fibre challenges and present a step change to New Zealand's primary sector and GDP growth.

Statistics New Zealand report that only ~37% of small business start-ups in New Zealand exist after two years of establishment. So it is hard enough just to survive and even harder to get to a commercially scalable business.

What the research tells us is that once an agritech innovator has developed a minimum viable product the work has only just begun and they need to have the right skills, capabilities, and business model, with a bit of luck to achieve scale and commercial success.

The research, interviews, and insights have developed key themes and related denominators for commercial success as follows:

8.3.1 Addressable Market and Disciplined Return on Investment

There is a relatively material investment in food and fibre Research & Development (R&D) in New Zealand but as reported by the Aotearoa Agritech Unleashed Report New Zealand agritech is punching below our weight against our global peers in commercialisation and earnings from agritech.

New Zealand has relatively limited access to venture capital, and therefore we need to ensure that appropriate discipline is in place to understand what the commercialisation strategy and commercial return is going to be for each additional dollar invested.

Agritech business founders need to clearly understand what the potential addressable market is?, is it a subset of a New Zealand farming system, or a truly global agritech market solution. Once this question has been critically evaluated, then you can start to plan for your "right-sized" capital structure to implement your commercialisation strategy with an understanding of your realistic commercial opportunity.

8.3.2 Founders Traits

For a founder or founders to take an Agritech innovation from a minimum viable product through to commercial scale will require an awareness of their traits and capabilities to be able to identify what support, or complementary skills they will require across the broader team to enhance that success.

Along with a clear sense of purpose, being resilient and tenacious, the founders will need to build relationships with potential customers, staff members, investors, and advisers, so emotional intelligence is an important trait in a founder to bring all the stakeholders together for a common purpose.

The founders will also need a bit of luck, but as they say, you make your own luck, so being driven, articulate and building your networks will enhance your chance of finding luck and commercial success.

8.3.3 Team Capability

The founders being aware of their capability, but more importantly, their limitations will assist them to understand what skill set and capabilities they will need to attract into the team.

The team needs to have the right mix of industry expertise with functional expertise (finance, commercial, and operational skills). The founders will benefit from having an advisory board that has been there before, they need to have had real experience of a growth company, what it takes to

succeed and grow. But also where the pitfalls are to provide the strategic advice and experience to navigate around the many challenges to achieve commercial success.

8.3.4 Value Proposition

The value proposition will fit into one or more of the following three criteria:

- Yield or revenue enhancing innovation.
- Operational/ process efficiency.
- Meets a regulatory obligation.

Agri-tech innovators must ensure they do not have tunnel vision purely on their idea or innovation itself, they need to broaden their focus to what the customer solution and commercial proposition will be. This starts with:

- The innovators need to understand the customer and their practices. So it is important to get out in the field and understand how the innovation can be moulded into a solution of value.
- The innovator needs to ensure they validate the core innovation, and that a broader solution may need to be packaged around the core product. It is the whole commercial and operational package of the innovation that needs to be thought through and delivered in an economically viable way.
- The value proposition needs to be easily articulated, verifiable, and materially relevant enough for the prospective customer to adopt and incorporate the innovation into their farming or production process.

8.3.5 Business Model

The Business Model needs to bring together all the parts. What are the resources and skill set required (team capability) along with what is required to deliver the value proposition. The key coherent factors need to be as follows:

8.3.5.1 Product and Market Lifecycle

There is a direct interplay between the product and market lifecycle. The initial minimum viable product that has been delivered and tested with friends and family will need to evolve to a more polished solution as you start to target the early adopters.

The early adopters are where you refine the full product offering to secure a market position (a beachhead) and provide the springboard to grow. The founders and team need to be disciplined to get clear on the solution delivery and commercial model, and how to iron out the creases to be able to sell and service the customer base in an economic/profitable way.

There are several pitfalls at this stage, such as:

- the friends and family/ innovators not being sufficiently critical of the solution and has therefore not evolved to be sufficiently attractive to a more mainstream customer base.
- founders spending uneconomic resources to support a workaround to deliver a value proposition to these initial customers that is not able to be streamlined/ scaled; or
- initial surge in interest leads to scaling up of resources and costs that is not then sustained beyond the early innovators adopting the technology. Then sales stall, resulting in unsustainable cost structure and cash flow constraints and failure before getting to commercial scale.

The market lifecycle from innovator to early adopter and through to mainstream will require enhancements to the initial or core product, and the channel to market, including how you communicate or influence the evolving target market to adopt and use your innovation. This will go alongside a clear understanding and plan on how to evolve the sales process from founder lead to a known network, to a scaled sale and service model to the broader mainstream market.

The founders need to be consciously aware and plan to evolve or even materially change the initial innovation so that it can be scaled. The founders (with the help of an advisory board) need to critically

review what they have – it is too easy to be overly optimistic and charge on with a product that is not delivering an economic solution for the customer, or a route to profit for the founders. Disciplined and regular review of status and what is required to continue to commercial success.

8.3.5.2 Capital Structure & Financial Model

The capital structure will be determined by the commercial model, product, and target market. For example Deeptech innovation, or where you are targeting a global market from day one, will require material upfront investment and therefore most likely require early-stage venture capital funding.

Careful consideration needs to be given to who the capital partners are. Are they bringing smart capital with industry experience, functional experience and the networks required to not only provide the capital but also enhance the market position of the business.

The external funders need to be aligned with the founders and ensure that an equitable arrangement is pre-agreed if multiple rounds of funding are required as there are implications for equity dilution and alignment/ motivation of the founders to get the business through to a financially sustainable and profitable financial position.

Whereas a New Zealand farming solution innovation may be able to be bootstrapped where costs can be more closely aligned with revenue. This is an opportunity to develop a sizeable niche for the product so that it has a baseline profitable business that does not require external funding, or with an established and profitable domestic business can then raise capital on more beneficial terms to the founders, and with a track record to go onto a further international growth stage.

As per the broader team capability, financial discipline and realism must be ingrained in the financial model, the growth model is not guaranteed or linear and therefore financial resilience needs to be allowed for, supported by clear financial reporting and cash flow management. Cash flow management is critical to ensure the business navigates through a non-linear growth phase to commercial scale.

The key themes, or denominators are all inter-related, they cannot be approached or applied in isolation, and they are not a one-size-fits-all. Every innovation and market opportunity will be unique and nuanced and therefore these recommendations and the Framework of Key Denominators are for signposting only, they will need to be adapted to each individual opportunity.

8.4 Key Denominators Framework

The Key Denominators Framework brings together the key components to advance the business from a minimum viable product through to a value add solution attractive to an early majority providing a sustainable economic return to the founders and partners.

The Framework brings together the key denominators into these market development stages as follows:

- Minimum Viable Product Stage:– is there enough of a foundation to take the agritech innovation from a cottage industry to commercial scale. At this stage, the agritech founders need to critically assess:
 - Do they have the right skills, capabilities and temperament to commercially scale, or attract the right skills?
 - Have they properly validated the market opportunity?
 - Do they have a compelling value proposition – who and why?
 - What is the capital structure, or capital partners required to be able to successfully execute?

- Do they clearly understand the shortcomings/ risks in achieving the commercial success, and able to mitigate those risks

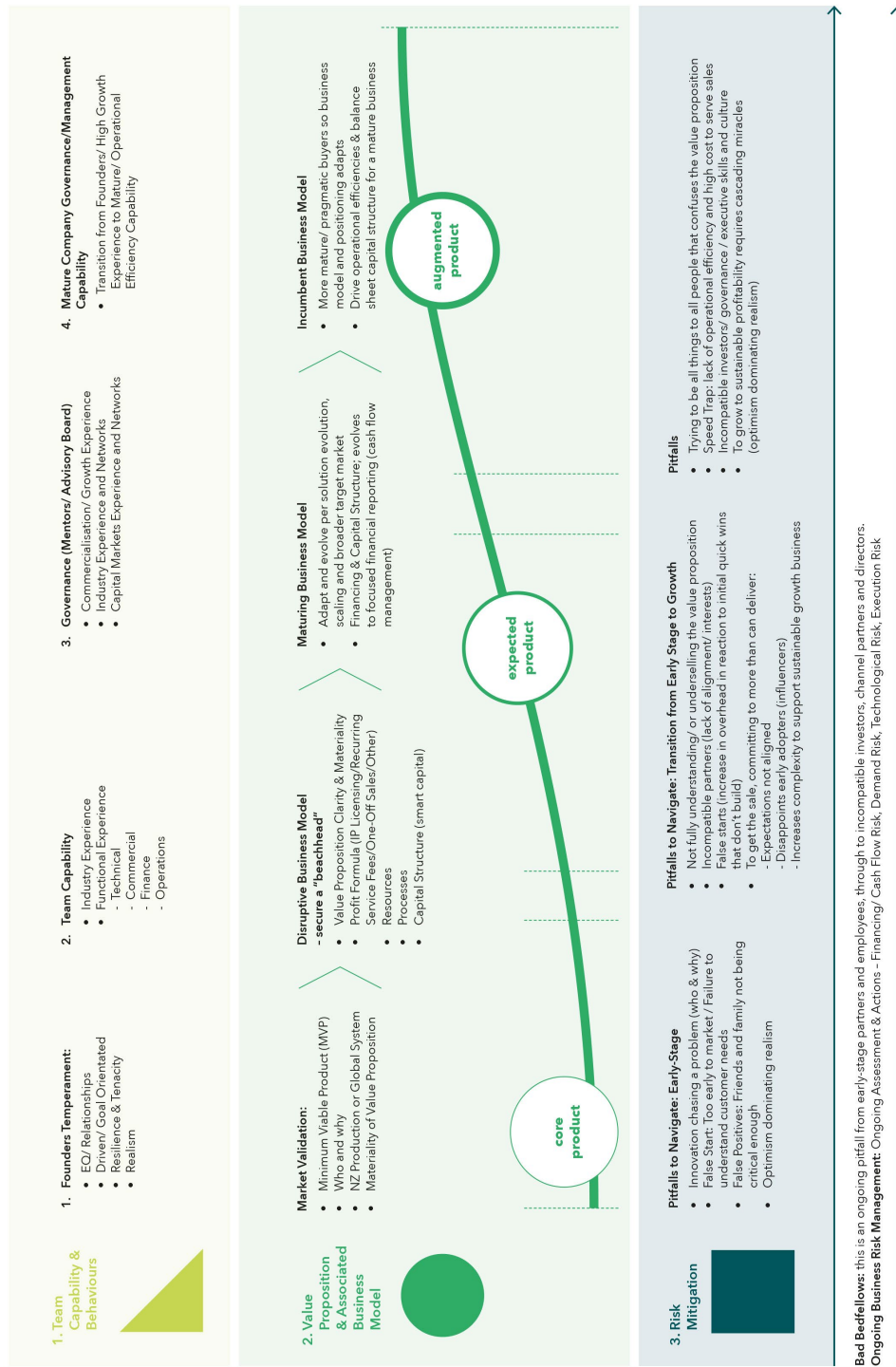
Then understanding who and why, with the minimum viable product, and a clear value proposition, implementing a plan to refine the commercial model and secure initial commercial sales to the innovators of the target industry.

- Disruptive Business Model to Grow Market Share (secure a beachhead):
 - The agritech business will need to be able to deliver and service the innovation at greater scale than initial founder/s have been delivering themselves – so the team capability is critical to get right to be able to build a scalable product.
 - The innovators will have provided feedback on the product and commercial model that will need to be filtered and incorporated into the expected product (what does an average consumer expect of the product).
 - The growth will be non-linear, so does the business have the right capital structure and profit model to be able to achieve break-even and an economic return whilst continuing to market to a larger, and changing target market.
- Tipping Point to Commercial Success:- has the innovation evolved to a broader offering attractive to an early majority of the addressable market. Alongside the product, has the business model, capital structure, market positioning, governance and team capability kept ahead of the business potential to successfully execute this growth. The areas of focus evolve per:
 - Governance and team capability combining industry experience and networks with a track record of successfully scaling a business.
 - The product offering is much broader and compelling to a much larger target market.
 - The potential pitfalls get larger and potentially more terminal if not planned for and mitigated, such as the build-up of material overhead costs (e.g. team size, physical inventories and facilities) when confronted with stalled or non-linear sales and associated impact on cash flows during this growth period can be catastrophic.

This evolving commercialisation journey is diagrammatically captured in Figure 11 Framework below, Key Denominators to Enhance Successful Commercialisation of Agritech Innovation.

Figure 11
Key Denominators to Enhance Commercialisation of Agritech

Key Denominators to Enhance Successful Commercialisation of Agritech Innovation



Note: Figure 11 diagrammatically demonstrates the initial critical assessment of the agritech innovation and founders capabilities through the product, market and business plan execution stages to commercial success.

9. Conclusions

The research and insights have concluded the following key denominators to enhance commercial success for an agritech founders business:

9.1 Founders Self-Assessment of Total Addressable Market & Related Team Capability

Founders require the courage and discipline to critically assess what the innovations true addressable market opportunity is. Is it really a global opportunity, or a subset of a New Zealand based primary sector system, as this will determine what skills, capabilities, capital, and networks are required to be implemented.

The founders then need to critically assess their skills, traits, and shortcomings for three main reasons:

- a. Do the founders have what it takes to grow a commercially scaled agritech business (EQ to develop and manage stakeholder relationships/ driven & goal oriented/ resilience & tenacity/ optimism but with a strong dose of realism).
- b. Linked to the addressable market, what is the broader team skill set required to commercialise the innovation? This skill set needs to be industry and functional expertise (commercial growth, finance, operations). The founders need to recognise that as the business grows the required skill set needs to evolve ahead of the growth; and
- c. Focus on execution capability. The need to attract a team, including governance, that does not just have industry experience but has execution and growth experience. The question is whether you have access to team members/ advisory board that has successfully grown a business and dealt with the potential pitfalls to deliver a high-growth business, and whether can they bring that experience to your benefit.

9.2 Clear & Material Value Proposition

The founders need to validate the innovation with prospective customers, and what value proposition does it deliver to secure the customers. Get clear on who, why, and what value it delivers, is the value meaningful (saving 0.1 of an FTE is not meaningful), and can it be delivered in a scalable and economic way.

The value proposition will evolve for different customer segments, what is a value proposition to an innovator will not be for an early or late majority target consumer, and therefore the concept of the value proposition is not static at development of the initial innovation.

9.3 Product & Market Lifecycle

Recognise that having developed an innovation used by some friends and family only gets you to the starting line.

To reach a larger target market and get to critical mass the innovation and delivery mechanisms will need to continue to evolve. Start with the core / tangible product and build out how to augment it to differentiate in the market.

Clearly define how the innovation needs to be delivered and serviced in a scalable manner so that it can provide value, and an economic return to the founders when delivering to a much larger share of the market.

Define what broader resources are required to deliver the value proposition, what suppliers, channel partners, facilities, outside advisers will be required to successfully deliver the commercialisation strategy related to the evolving product and target markets.

9.4 Capital Structure and Financial Model

A clear and realistic understanding of your total addressable market. Is it a niche within New Zealand farming systems, or realistically an international export opportunity (to other pasture-based farming system counties or broader global potential).

With the market and value proposition understood and validated, then look at right sizing the capital structure to be able to manage a non-linear revenue model. As whilst costs are likely to be more consistent, sales and revenue (cash flow) will be non-linear.

The non-linear nature of commercialisation is especially critical as you move from early adopters to mainstream which can take longer than expected and therefore cost more in business development and sales overheads.

Identify the capital structure and requirements early and if venture capital is required identify and align early with “smart capital” that can bring execution skills and networks.

10. Recommendations & Framework

To enhance successful commercialisation of agritech the founders should follow these key recommendations:

- Critically evaluate the market and the founders skills and traits:
 - Validate the true addressable market (ensure realism trumps optimism) for the innovation as this will form the basis of what capital structure, skills and capabilities will be required.
 - Capture a matrix of the founders skills, traits and shortcomings and use this in planning to:
 - Identify what skills and traits are required to enhance the chance of success;
 - Identify how the skills and capabilities will change as the business targets the different factions within the addressable market
 - Focus on execution skills, identify industry and functional expertise with a successful track record with high growth companies
- Clearly develop and define the value proposition. Ask the who and why, is the agritech businesses innovation sufficiently material to change a consumers behaviour to select your innovation over a competitors.
- Ongoing review and refresh of the business model that takes on market conditions, consumer requirements and commercial model so that it evolves and adapts the product to reach larger factions of the total addressable market. Including:
 - Regularly review how the core product needs to evolve to an augmented product (tangible and intangible benefits) with additional value add services;
 - Review and anticipate what resources are required to successfully execute the growth strategy; and
 - Ongoing review of the financial and commercial model with the associated fit for purpose capital structure. Allow for contingency, as sales growth is non-linear and therefore the business needs to be able to navigate through slow sales and cash flow constraints to achieve a critical mass and commercial success.
- Leverage the Framework of Key Denominators to Enhance Commercialisation of Agritech (Figure 11) as a roadmap for agritech founders to navigate their way from a minimum viable product to scaled commercial success.

Key Denominators to Enhance Successful Commercialisation of Agritech Innovation

1. Team Capability & Behaviours

1. Founders Temperament:

- EQ/ Relationships
- Driven/ Goal Orientated
- Resilience & Tenacity
- Realism

2. Team Capability

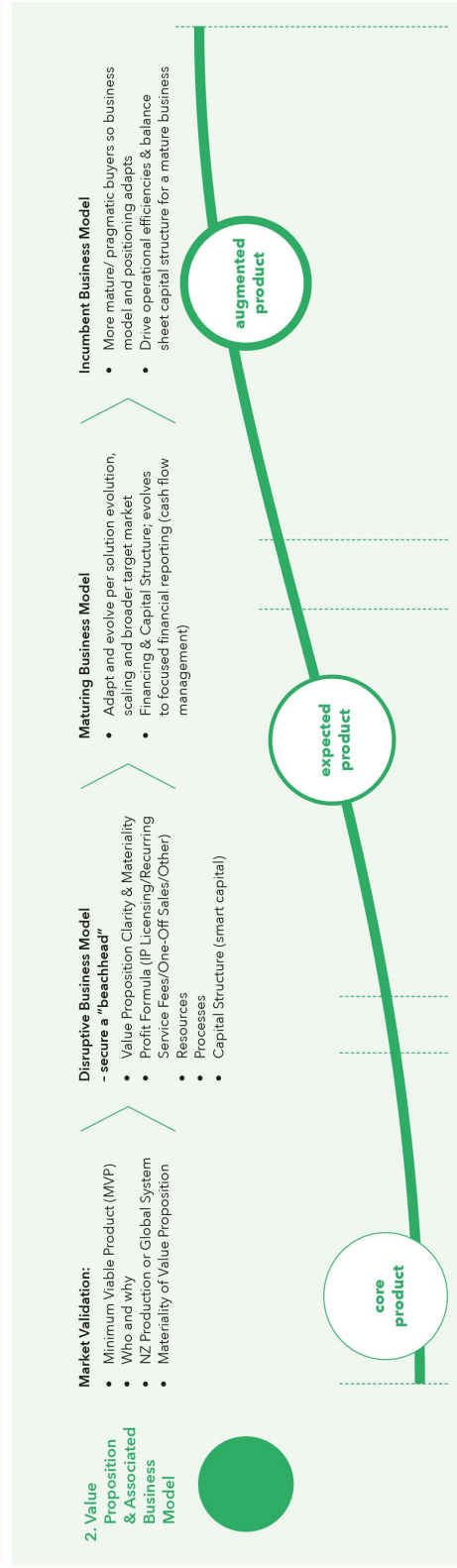
- Industry Experience
- Functional Experience
 - Technical
 - Commercial
 - Finance
 - Operations

3. Governance (Mentors/ Advisory Board)

- Commercialisation/ Growth Experience
- Industry Experience and Networks
- Capital Markets Experience and Networks

4. Mature Company Governance/Management Capability

- Transition from Founders/ High Growth Experience to Mature/ Operational Efficiency Capability



3. Risk Mitigation

Pitfalls to Navigate: Early-Stage

- Innovation chasing a problem (who & why)
- False Start: Too early to market / Failure to understand customer needs
- False Positives: Friends and family not being critical enough
- Optimism dominating realism

Pitfalls to Navigate: Transition from Early Stage to Growth

- Not fully understanding/ or underselling the value proposition
- Incompatible partners (lack of alignment/ interests)
- False starts (increase in overhead in reaction to initial quick wins that don't build)
- To get the sale, committing to more than can deliver:
 - Expectations not aligned
 - Disappoints early adopters (influencers)
 - Increases complexity to support sustainable growth business

Pitfalls

- Trying to be all things to all people that confuses the value proposition
- Speed Trap: lack of operational efficiency and high cost to serve sales
- Incompatible investors/ governance / executive skills and culture
- To grow to sustainable profitability requires cascading miracles (optimism dominating realism)

Bad Bedfellows: this is an ongoing pitfall from early-stage partners and employees; through to incompatible investors, channel partners and directors.

Ongoing Business Risk Management: Ongoing Assessment & Actions – Financing/ Cash Flow Risk, Demand Risk, Technological Risk, Execution Risk

11. Glossary

AgriTech: refers to manufacturing, biotech, and digital-based technology companies that are creating a product, service, intellectual property (IP), and value chain solutions for the agriculture, horticulture, aquaculture, apiculture, and seafood sectors, to improve yield, efficiency, profitability, sustainability, reliability, quality or adding any other kind of value."

Bootstrapped; Investopedia describes bootstrapping as a situation in which an entrepreneur (company founder) starts a company with little capital, relying on money other than outside investments. An individual is said to be bootstrapping when they attempt to found and build a company from personal finances or the operating revenues of the new company.

Commercialisation; Investopedia describes commercialisation as "the process of bringing new products or services to market. The broader act of commercialization entails production, distribution, marketing, sales, customer support, and other key functions critical to achieving the commercial success of the new product or service." In the context of this project the additional description is achieving commercial scale as a profitable and economically sustainable business.

Deeptech; Wikipedia defines Deep technology (also deep tech or DeepTech) or hard tech is a classification of organization, or more typically [startup company](#), with the expressed objective of providing technology solutions based on substantial scientific or engineering challenges. They present challenges requiring lengthy [research and development](#), and large capital investment before successful commercialization.

EQ: Wikipedia defines Emotional Intelligence or EQ as the ability to perceive, use, understand, manage, and handle emotions. People with high emotional intelligence can [recognize](#) their own [emotions](#) and those of others, use emotional information to guide thinking and behaviour, discern between different feelings and label them appropriately, and adjust emotions to adapt to environments.

GDP: www.stats.govt.nz describes Gross Domestic Product (GDP) as New Zealand's official measure of economic growth. The production approach to GDP measures the total value of goods and services produced in New Zealand, after deducting the cost of goods and services used in the production process. This is also known as the value-added approach.

IP; Investopedia describes Intellectual Property as a set of intangible assets owned and legally protected by a company or individual from outside use or implementation without consent. An intangible asset is a non-physical asset that a company or person owns.

MVP: www.gartner.com defines Minimum Viable Product (MVP) as the release of a new product (or a major new feature) that is used to validate customer needs and demands before developing a more fully featured product. To reduce development time and effort, an MVP includes only the minimum capabilities required to be a viable customer solution.

Smart Capital; investor or funding partner that brings additional expertise and networks, not just money, to successfully execute profitable growth.

Total Addressable Market; Wikipedia describes total addressable market as a term that is typically used to reference the [revenue](#) opportunity available for a product or service. TAM helps prioritize [business opportunities](#) by serving as a quick [metric](#) of a given opportunity's underlying potential.

Venture Capital; Investopedia defines venture capital as a form of private equity and a type of financing that investors provide to [startup](#) companies and small businesses that are believed to have [long-term growth](#) potential.

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13. Appendix

13.1 Semi-Structured Interview Questions

Section 1 Questions
1. Tell me about your product/business (or tell me about a recent innovation you have adopted)?
2. How did your business/ product idea/ innovation come about (or how did this product requirement come about)?
3a. Was your product/ innovation to solve an identified industry issue/ or is the product a new innovative idea? 3b. and how did you become aware of the issue?
4. How do you think your product/ innovation differs from the competition?

Section 2: The Commercial Model/ Adoption Strategies

1a. Did you think of the product technology/ innovation in isolation - or all the product thinking - such as channel to market/ commercial model/ service model, etc? 1b. Are you able to share your broader market commercialisation strategy?
2. From 1-5 where on the commercialisation journey are you? 1. Alpha product for free testing 2. Beta-tested product that is being paid for by test customers 3. commercial sales but not yet profitable 4. good commercial sales and small profit but not scaled 5. You have a streamlined/ scalable profitable business in multiple markets
3. How did you get your first commercial sales?
4. Can you discuss what your broader commercial offer/ value proposition is – what that looks like/ differentiates (e.g. after-sales service/ support/ data insights etc)?
5. Can you discuss key denominators that you think your product has supported its success?
6. Can you please discuss how you have adapted your commercial/ business model through your journey? 7a. Can you discuss the key constraints/ barriers to commercialising the product? 7b. And can you discuss how you overcame these constraints?

Section 3: Broader environmental issues affecting uptake/ stalled uptake

1. Were there any broader regulatory/ economic factors outside of your control that contributed to commercial sales success (or failure)?
2. Can you discuss whether you had an investment partner and any broader role they have played?
3a. Can you discuss whether any broader networks played a part in your success? 3b. Can you discuss how you found those networks? 3c. Can you discuss what role those broader networks played?

Section 4: Broader Industry Insights:

1. More broadly what do you think is the biggest challenge in successfully commercialising agritech?
2a. What is the most successful agritech innovation you have seen in the market? 2b. And why do you think it has been successful?
3a. Are you aware of any good agritech technologies that in your view have commercially underperformed? 3b. And why do you think that it may have commercially underperformed?
5. What's the one piece of advice you have for an innovator to successfully commercialise their technology?