

Harvesting Innovation: Navigating Enablers and Challenges for Chilean Startups on the Path to Sustainable Food Ecosystems



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Abstract

The global food and agriculture industry faces multiple challenges in production, demand and regulations. Known as the largest industry worldwide, this industry plays a vital role in Latin America as the breadbasket for its significant contribution to the global production and export of agricultural and fish commodities. This thesis emphasizes the critical need to reevaluate and transform existing systems. It explores the concepts of food sustainability and food ecosystem, examining how a comprehensive transformation in food production and consumption can lead to a broader shift towards sustainability. Addressing the complexities of the food ecosystem involves collaboration across various levels with multiple stakeholders and their dynamics. Therefore, this research explores the role of AgriFoodTech startups and their ecosystem, in Chile specifically, in developing innovations that enable transition pathways towards transformed systems. A mixed-methods approach based on preliminary literature review and the enabler theory focuses on internal and external factors that impact startups, while the MLP framework offers a broader view by analyzing niche-regime interactions across social, technical, economic, political, and organizational aspects. Combining these approaches helps stakeholders better understand the challenges AgriFoodTech startups face and develop effective strategies for advancing a sustainable food ecosystem. Furthermore, perceptions of not only AgriFoodTech startups but also governmental entities, consultants/intermediaries and associations bring an overview of the ecosystem dynamics. The findings reveal that mature AgriFoodTech startups are obtaining the benefits of a growing support system and expanding market opportunities in recent years, despite potential contextual challenges. This supportive environment has enabled them to scale and innovate more effectively. Governmental programs in Chile played a key role in nurturing startups, yet there is still substantial scope for enhancing policies, regulations, and frameworks, to provide better support aiming to create more effective environment within the food ecosystem. Challenges remain, particularly with older generations of farmers who are often hesitant to adopt new technologies introduced by AgriFoodTech startups, necessitating targeted efforts to change traditional attitudes. Entrepreneur-founded associations and consultants/intermediaries have the potential to address specific startups needs, although sustaining transformative efforts remains crucial. Fostering a collective vision among startups regarding their role within the broader ecosystem and incorporating Sustainable Development Goals (SDGs) into their strategies can effectively align their efforts towards a unified transformation of the food ecosystem.

Key concepts

Food Sustainability, Food Ecosystem, AgriFoodTech startups, Startups ecosystem, Multi-Level Perspective framework, Enabler Theory, Chile

List of abbreviations used

3F – Family, Friends and Fools
AI – Artificial Intelligence
ANID – National Research and Development Agency
APICAL – Association of edible insect producers
ASC – Aquaculture Stewardship Council
CEAP – Center for Processed Food Studies
CeBiB – Biotechnology and Bioengineering Center
CEO – Chief Executive Officer
CETA – Food Innovation Technology Center
CORFO – Production Development Corporation
CSO – Chief Sustainability Officer
CTO – Chief Technology/Data Officer
EE – External Enabler
FIA – Foundation of the Ministry of Agriculture for Agricultural Innovation
FIC – Fund of Innovation and Competitiveness
GDP – Gross Domestic Product
GMO – Genetically Modified Organism
GPS – Global Positioning System
IE – Internal Enabler
INACAP – Gastronomic Innovation Center
INDAP – Agricultural Development Institute
INIA – National Agricultural Research Center
IoT – Internet of Things
ML – Machine Learning
MLP – Multi-Level Perspective
ODEPA – Office of Agricultural Studies and Policies
R&D – Research and Development
RFID – Radio frequency identification
RQ – Research Question
SDG – Sustainable Development Goals
SERCOTEC – Technical Cooperation Service
SME – Small and medium-sized enterprises
SNA – National Agricultural Society
SNA – National Society of Agriculture
Sofofa – Industrial Development Society
SQ – Sub-research Question
SSAF – Flexible Allocation Seed Grant
TBI – Technology Business Incubators
VC – Venture Capital

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1. Introduction

The food and agriculture industry are the biggest industry globally with customers over 8 billion globally. Approximately 10% of the world's Gross Domestic Product (GDP) is divided between food and agriculture, equating to around \$8 trillion globally estimated by the World Bank (2019). Especially Latin America plays a crucial role in global food production, often referred to as the breadbasket, also it contributes 13% of the global production and 17% of the net export value of agricultural and fish commodities (Forward Food, 2023). Despite that, the industry faces notable challenges in production, demand, and regulations because of consumer trends (Moro-Visconti, 2021). Numerous dietary guidelines are promoting environmentally friendly diets, prioritizing sustainability, health and freshness. This shift is driving innovation within the food industry, making it necessary for food systems¹ to align with Sustainable Development Goals (SDGs) (Valentini et al., 2019).

Food sustainability involves producing sufficient food as the global population keeps growing and global food prices reach remarkable levels, the significance of our food supply becomes increasingly crucial (Morawicki & Díaz, 2018; Müller, 2022). The urgency of transforming our existing food systems has intensified, especially after Covid-19 and Ukraine crisis. Additionally, based on McKinsey & Company reports that roughly one-third of the food produced each year is either lost or goes to waste in any stage of the food chain (Ali et al., 2022). In addition to harvested food, most food is produced on farms, making food sustainability closely tied to sustainable agricultural practices (Morawicki & Díaz, 2018). Challenges such as inefficiencies in planting, harvesting, water usage, and transportation, along with the uncertainties of crop diseases, climate interference, and consumer demand further complicate this issue and contribute to significant losses in the sector (Moro-Visconti, 2021; Ali et al., 2022).

Moreover, food systems require innovations beyond just improvements in production and consumption practices; they require advancements that reinforce the appreciation of produced food (De Bernardi & Azucar, 2020). The adverse impacts of our food ecosystem extend beyond natural resource degradation and nutritional health. Given its intricate interconnections, various social issues arise from food ecosystems, including resistance to new innovations (e.g., insects as food, GMOs, meat substitutes), gender inequality, and more (Taub, Minch Dixon, & Gridley, 2019). Essentially, the food system does not strictly enterprising, instead it demands for more sustainable food companies, either by innovatively transforming existing businesses within the food sector or by launching new startups that offer unique products and services to address these challenges (De Bernardi & Azucar, 2020). Research has shown that startups play a decisive role in multi-level

¹ This research does not comprehensively explore into 'food systems' as it considers them simply as the concrete components of food supply chains, including retailers, producers, stakeholders, producers, and institutions (De Bernardi & Azúcar, 2020), while food (eco) system is more dynamic. Therefore, food ecosystem will be used and explain in section 2.2.

toward sustainability, emerging as new market competitors with radical environmental innovations that drive the industry's transformation (Horne & Fitcher, 2022). Furthermore, entrepreneurship has been framed as a dynamic interplay among multiple levels: the established landscape and regime, alongside the innovative solutions emerging within niches, then this Multi-Level Perspective (MLP) is recognized as an empirical framework that supports theories of sustainable transition, demonstrated in Germscheid (2020). Researchers also emphasize the significance of integrating enabler theory with MLP, which significantly impacts the growth and sustainable development of startups (Horne & Fichter, 2022).

Integrating innovation into agriculture can be seen in different ways, as Sparapani (2017) mentioned. For instance, the use of sensors on fields and crops provides comprehensive data on soil conditions, wind patterns, fertilizer needs, water availability and pest infestation. Additionally, drones can monitor fields, notifying farmers to crop ripeness or potential issues. Global Positioning System (GPS) units on tractors optimize equipment usage, while data analytics can prevent decomposition and speed up product movement. Radio Frequency Identification (RFID) systems offer real-time traceability of farm products throughout the supply chain, tracking individual plants for nutrients and growth rates. Collectively, these innovations and others contribute to the broader concepts of 'Agricultural 4.0' and 'Food 4.0' (Klerkx & Villalobos, 2024).

Complete acceptance of these technologies might result in productivity boost hidden since the era of mechanization, leading to a new era called 'Agriculture 4.0' and 'Food 4.0', both concepts support transformative pathways that link together all participants in the food supply chain (Klerkx & Villalobos, 2024). Agriculture 4.0 and Food 4.0 are driven by innovations predominantly originating from startups in AgTech, AgriTech, and FoodTech, collectively known as 'AgriFoodTech' startups (Vlachopoulou et al., 2021). The evolution of AgriFoodTech startups has allowed companies such as Venture capital invests into the agricultural technology (ag tech) space, experiencing for example the \$300 million investment in Farmers Business Network, a data analytics startup (Hathaway, 2021). Investors recognize that this new era has the potential to revolutionize the entire food chain, from farm to table (Moro-Visconti, 2021).

Moreover, researchers have established key stakeholder groups capable of facilitating a transformative shift towards sustainable food pathway seen in the startup ecosystem. According to Germscheid (2020), some of these pivotal actors include politicians, civil society, scientists and entrepreneurs are seen as essential in driving the transition and shaping this new era. Based on Mungila Hillemane (2019) Technology Business Incubators (TBI) are the actors that aim to foster the growth of local innovative startups by encouraging technology exchange and facilitating the distribution of the new products/services. Through the creation of supportive entrepreneurial environments, TBIs have significantly enhanced the survival rates of technology-based startups (Aerts et al., 2007)

For this research is worth to mention that in Latin America and the Caribbean highlights the region's richness in natural resources, including a third of the world's freshwater reserves and high-quality soil for agriculture (Loukos & Arathoon, 2021). J.P. Morgan Private Bank states that 14 million

smallholder farmers in Latin America contribute to the 50% of the total food production, but many lack access to essential equipment and technologies for improved productivity and supply chain participation (Stambuk, 2023). However, based on the first report of AgriFoodTech investment in Latin America, almost 8 billion dollars was invested in Foodtech and Agtech in the region during the last five years and with \$1.7 billion dollar raised in 2022, representing one-fifth of all venture capital activity in the region (AgFunder et al., 2023). In addition, a recent flow in investor interest has resulted in a rapid expansion of investment potentials in countries like Chile, Colombia, and Mexico, establishing Latin America as an emerging hub for AgriFoodTech innovation (Forward Fooding, 2023). Based on Endeavor (2023) specially Chile has acclaimed itself as a significant player in the advancement of Agtech and Foodtech, with four companies in the sector successfully establishing international distinction on a global scale (Endeavor,2023).

The 'Radiografía AgTech' by Endeavor (2023) provides an initial expert exploration of Chilean Agtech, aiming to assess entrepreneurs' perceptions of the regional and national entrepreneurship and innovation landscape. That study covers economic, technological, political, social, legal, and ecological dimensions, collecting data from 58 entrepreneurs and ecosystem stakeholders through surveys and interviews between 2021 and 2022. However, this initial overview may lack detailed insights, especially regarding the shift to more sustainable food practices.

Sustainable food pathways transformations require short and long-term solutions to become more productive, cost efficient, transparent, sustainable, and resilient. Innovations in the food industry are essential, focusing on digitalization, sustainable input supplies, new financing solutions and localized value addition (Müller, 2022). While the significance of AgriFoodTech startups in introducing and spreading sustainable innovations for a sustainable food transition is acknowledged, it is still unknown how individual startups expand and provide to these transitions particularly in Chile. This research aims to close this gap by studying key players, challenges, limitations and the impacts in this emerging field, contributing to a sustainable food pathway.

1.1. Research Design

The central aim of this research is to understand AgriFoodTech startups with their innovations which contribute to sustainable transition pathway in Chile to transformed systems using enablers theory linked with MLP framework.

The central research question is (RQ):

How do AgriFoodTech startups in Chile aim to contribute with their innovations to a more sustainable food system?

Sub-question 1 (SQ1)

Who are the key players in AgriFoodTech startups in Chile?

The goal of this question is to comprehend the key actors in AgriFoodTech startups and their role in Chile.

Sub-question 2 (SQ2)

What are the key challenges and limitations faced by Chilean AgriFoodTech startups?

The goal of this question is to investigate the challenges and limitations that AgriFoodTech startups have in the short and long-term behind their alternative food pathway in Chile, considering external and internal factors as enablers in social, organizational, economic, technical and political aspects.

Sub-question 3 (SQ3)

How do AgriFoodTech startups aim to impact food ecosystems in Chile?

The goal of this question is to examine the perception of stakeholders, organizations and components that are already involved in AgriFoodTech startups in Chile and find how out their innovations aim to impact or are already impacting sustainable food ecosystem pathways.

1.2. Societal relevance

The world has always been in constant transformation, but in the last few decades, changes have accelerated and deepened (De Zan et al., 2021). As is well known, there are global challenges with the fast population growth, social and demographic changes, urbanization is increasing, natural resources scarcity is becoming widespread, the planet's temperature is rising and there is a multidimensional environmental crisis that most governments recognize as one of the greatest challenges they face (Cervilla & Giner, 2021).

Although entrepreneurship's role facilitating technological and societal shifts has not been the primary focus of transitions research, it has consequently been recognized as relevant (Van de Poel, 2000). AgriFoodTech startups often describe their products as crucial to sustainability transformations within the food sector, mostly to secure investment in a form of greenwashing. They tend to emphasize the critical challenges of sustainability and the essential role their innovations play, thereby overlooking the difficulties the full complex food ecosystem has (Klerkx & Villalobos, 2024). Therefore, this underlines critical issues and potential misalignments that AgriFoodTech startups can have in their actual impact on society and the environment.

This research contributes to bridge the gaps by encouraging stakeholders, such as public-private entities and farmers, to adapt economically and support the transition towards sustainability in both the short and long term. For instance, it highlights the persistent challenge of effectively committing small and vulnerable producers in Latin America (Müller, 2022). Over the long term, the corporate sector in Latin America and the Caribbean is limited, especially when compared with the growth driven by corporations in other significant AgriFoodTech regions worldwide (Vitón et al., 2019). Understanding the challenges and limitations AgriFoodTech

startups encounter with these stakeholders could clarify optimal strategies for facilitating this adaptation particularly within the Chilean context.

1.3. Scientific relevance

As Agriculture 4.0 and Food 4.0 technologies continue to evolve, focusing on sustainable industrialization is essential to secure a resilient food future (Müller, 2022). To effectively address not only short-term issues of undernourishment but also facilitate long-term food sustainability, balancing the need to meet quantitative food demands with the necessary implementation of less harmful process is crucial (De Zan et al., 2021).

In-depth scientific research into the dynamics of the AgriFoodTech ecosystem remains limited (Klerkx & Villalobos, 2024). This research seeks to explore the contribution of AgriFoodTech startups to the food ecosystem by identifying and analyzing various factors that either facilitate or hinder their effectiveness. Such analysis is crucial for fostering growth and advancing a comprehensive understanding of the Agrifood sector. However, it is also vital that this growth accommodates transformative changes and adapts to emerging circumstances (Cervilla & Giner, 2021).

Furthermore, by integrating MLP framework and enabler theory with practical examples from AgriFoodTech startups, this research enhances the application of these theoretical models to real-world scenarios. This approach not only argument the theories in empirical evidence but also enriches the scientific discourse by demonstrating how these frameworks can be effectively applied to understand and support the dynamics of startups in food ecosystems in this case.

2. Literature Review

Agriculture 4.0 and Food 4.0 encompass advanced technologies that revolutionize food production through bioprocessed ingredients, food delivery platforms, alongside ‘smart farming’ innovations such as drone-based farming management, modular farming, etc. (Klerkx & Villalobos, 2024). These technological developments have stimulated the creation of ‘AgriFoodTech’ startups, which apply these innovations across various sectors in the supply chain to enhance productivity and efficiency (Vlachopoulou et al., 2021; Endeavor, 2023). The term ‘Agriculture 4.0’ broadly includes not just farm production but also food processing, logistics, and consumption, reflecting the expansive scope of these technologies (Klerkx & Villalobos, 2024).

However, the emerging field of AgriFoodTech presents complex challenges that need addressing to ensure sustainable food pathways, where experts anticipate that navigating these challenges will require a comprehensive understanding of the institutions involved in this complex system (PolyNatural, 2022). By exploring the historical development of AgriFoodTech alongside concepts of food sustainability and food ecosystems, this research seeks to establish a connection between entrepreneurship and sustainable development suggested in De Bernardi & Azucar (2020).

2.1. Food sustainability

Defined as “A food system that supports food security, makes optimal use of natural and human resources and respects biodiversity and ecosystems for present and future generations, is culturally acceptable and accessible, environmentally sound and economically fair and viable, and provides the consumer with nutritionally adequate, safe, healthy and affordable food” (SUSFOOD, 2021). Food sustainability involves producing food at a level sufficient to support the human population while considering environmental health, economic viability, social equity, and human health (Garrett & Feenstra, 1999; Morawicki & Díaz, 2018). Figure 2 visually summarizes this concept, illustrating the multifaceted approach required to achieve food sustainability.

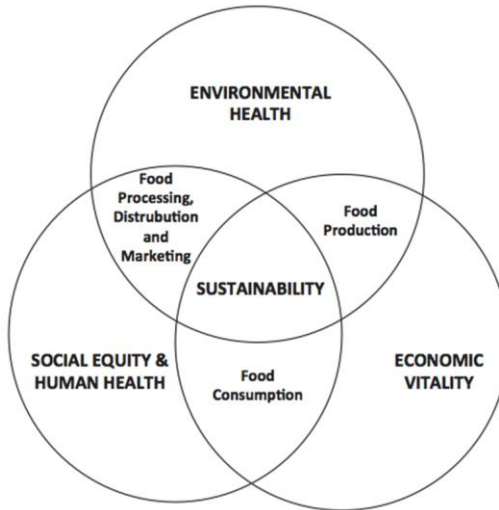


Figure 1: Food sustainability (Garrett & Feenstra, 1999)

2.2. Food ecosystem

Following De Bernardi & Azucar (2020), the proposition that 'food systems'—known as the simply as the concrete components of food supply chains, including retailers, producers, stakeholders, producers, and institutions —should transform into an 'ecosystem' when the interconnected relationships among the participants and the systems themselves are acknowledged as key influencers of the overall system's procedures, culture, and transformation (De Bernardi & Azucar, 2020).

Then, the term 'ecosystem' refers to the dynamic interactions between individuals, innovative activities, and their environment (Mercan & Goktas, 2011, p.103). Unlike systems with predefined rules, ecosystems are characterized by associations formed within communities of living beings. Within these ecosystems, components establish networks for resource exchange, both tangible and intangible, to support and develop their activities (De Bernardi & Azucar, 2020).

The adoption of the food ecosystem concept is crucial for ensuring food sustainability, which focuses on the long-term viability and responsibility of food systems. Consequently, this perspective on food ecosystems emphasizes the natural and ongoing exchange of knowledge among diverse members of the system (De Bernardi & Azucar, 2020).

The natural structure of food ecosystems establishes connections among their components, subsequently shaping their behaviors and capabilities. Within these ecosystems, members are interdependent and can mutually influence each other's motivations and capacities to drive change (De Bernardi & Azucar, 2020). Recent guidelines that provide insights into creating and assessing the sustainability of food systems, for instance, originate from these interconnected relationships within the food ecosystem as defined above. Governments, businesses, farms, consumers, and all other stakeholders have the authority to impact the overall performance of the system, fostering

change and shaping the conduct of fellow members (De Bernardi & Azucar, 2020). As a result, the ecosystem structure is consistently shaped by an evolutionary process (FAO, 2018). Therefore, ecosystems are viewed as collaborative or partnership models that capitalize on emerging business opportunities while also promoting social and environmental impacts (Okker et al., 2023)."

2.3. Startup ecosystem

The concept of startup has been debated among multiple experts. People who search for innovation, driven by the idea of looking and recognizing gaps related to understanding a problem and fulfill the needs of consumers or companies of simplifying process (Skawińska & Zalewski, 2020) are commonly the ones interested in creating startups. Based on Ries (2012), a startup is a human enterprise specifically designed to create products or services under conditions of significant risk and unpredictability.

Moreover, he describes startups as nascent and provisional companies that base their business models on innovation and technology. (Krejčí et al.,2015). These entities are chiefly distinguished by their quest for scalable business models through the development of highly innovative solutions that require minimal human and financial resources (Berg et al., 2020; Clarysse & Bruneel, 2007). Therefore, this research examines startups specifically focusing on technology-based products and services in the Agrifood industry.

Moreover, startups have a life cycle based on the stage and key players involved; for the purpose of this thesis, it is necessary to comprehend these stages and players. There are various models for categorizing the stages of a startup's development and the stakeholders. For this research, the conceptual framework by Mungila Hillemane et al. (2019) will be utilized to delineate these stages and to identify the specific stakeholders known as Technology Business Incubators (TBIs).

A broad categorization of TBIs is presented in table 1, where different actors like Government, University, Research and Development (R&D) centers, companies, and private individuals are shown.

Typology Revenue objective	Classifications				
	Not-for-profit			For-profit	
Sponsors	Government	University		Companies	Private individuals
Location	Industrial centers	University	R&D center	Company	Commercial centers
Method of selection	No sector focus	Sector focus	Technology focus	Stage focus	No sector focus
Focus of support	Pre-emergence to emergence stage	Emergence to stability stage	Emergence to stability to growth stage	Post-emergence stage	Pre-emergence to emergence and post-emergence to growth stage
Period of evolution	I Phase: basic infrastructure	II Phase: infrastructure + knowledge-based services		III Phase: infrastructure + knowledge-based services + external networks	
Title	TBIs or business innovation centers	Science parks, research parks, knowledge parks		Accelerators or virtual incubators	Co-working spaces, technopoles

Source: Empirical literature

Table 1: Broad categorization of TBIs (Mungila Hillemane et al., 2019).

Following Mungila Hillemane et al. (2019), the classification is based on their revenue orientation or strategic objectives: non-profit and for-profit. Non-profit TBIs typically include government agencies, universities, local development organizations, and other non-profit entities, while for-profit TBIs typically include private companies and private individuals (Von Zedwitz & Grimaldi, 2006).

In phase I TBIs provide startups with essential resources such as affordable office space and shared services. According to Okker et al. (2023), government policies significantly influence innovation and entrepreneurship, emphasizing the importance of a supportive regulatory framework. Paradis (2023) expands on this, perceiving that government initiatives promoting research and development can strengthen innovation through a public-private partnership.

Startups in technology normally face challenges due to a lack of business wisdom and marketing expertise, hindering their long-term growth. In response, TBIs in phase II offer knowledge-based services at Universities or Research centers, enhancing their value proposition to better meet startups' needs (Bruneel et al., 2012). Then, the commercialization of academic research and technologies can foster the formation of startups that will eventually develop into independent, successful businesses (Rasmussen et al., 2006; Sithole & Rugimbana, 2014).

Phase III, TBIs are focusing more on external networking to include all critical stakeholders needed for startups subsistence, this includes companies, investors, suppliers, potential customers, and technology partners (Bruneel et al., 2012). By leveraging the resources and expertise of sector companies such as other startups, big companies and suppliers are pivotal as they offer industry-specific knowledge, raw materials, and distribution channels that startups can take advantage of (Porter & Heppelmann, 2020).

In this phase, financial entities also persistently seek new opportunities for returns and investment, such as venture capital (VC) (Stephen & Wolf, 2023). Moreover, VC impacts the investors in mission-driven organizations illustrates the trend of integrating social innovation into

financial markets. It is a type of private equity that provides funding for startups with significant long-term growth potential (Hayes, 2024). Lastly, the evolving client-producer relationship in the sector fosters a collaborative environment that benefits from continuous feedback loops, facilitating the creation of tailored solutions to meet specific challenges (Sumberg & Reece, 2004). Engaging these producers as clients is crucial as their firsthand experiences and feedback are invaluable, enabling the refinement and optimization of technological innovations within the industry (Klerkx & Leeuwis, 2008). This collaborative interaction enhances the relevance and effectiveness of the solutions developed, ensuring they are finely tuned to actual needs and conditions.

Afterwards, the framework by Mungila Hillemane et al. (2019), shown in Figure 2, details the pre-incubation, incubation, and post-incubation phases of startup development, covering both the startups undergoing incubation and the TBIs involved.

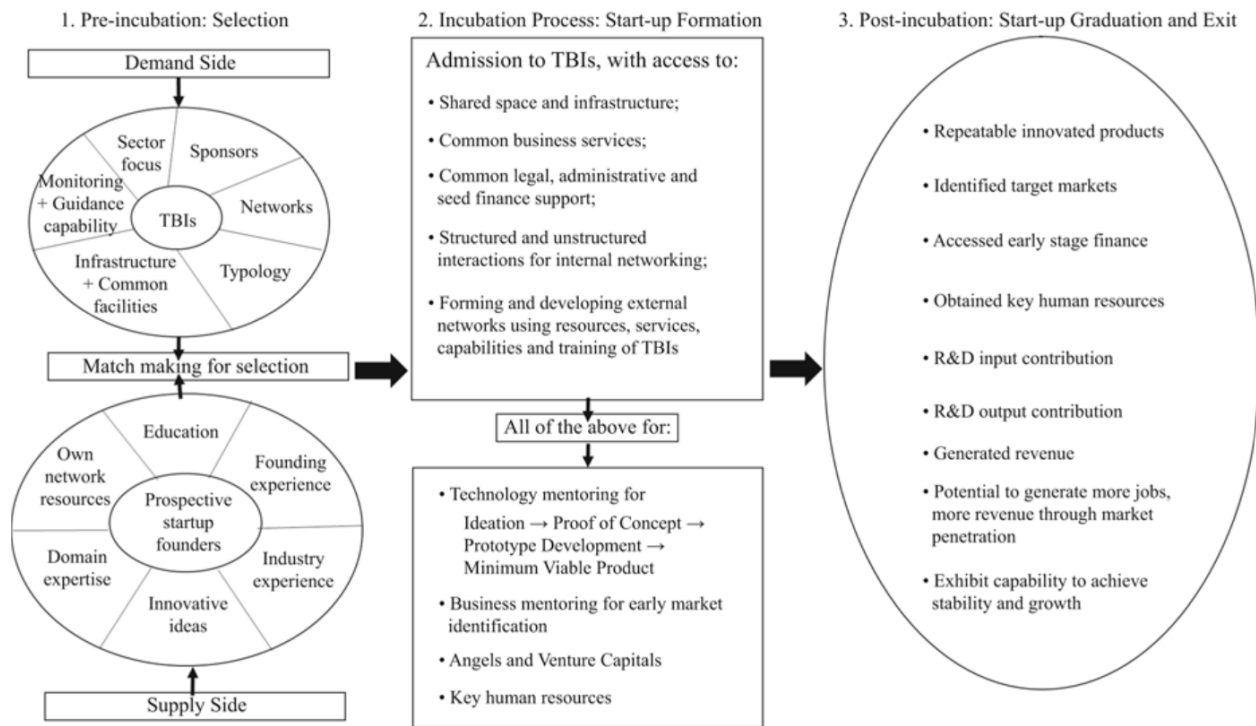


Figure 2: Phases of startups development involving TBIs (Mungila Hillemane et al., 2019)

Pre-incubation phase

TBIs face the critical task of selecting which startup applications to accept for incubation. This involves a detailed matchmaking process with two main aspects: the demand side and the supply side. On the demand side, TBIs look for quality proposals that align with their goals, capabilities, and sector focus. This helps ensure they can offer effective guidance and support to foster successful startups. On the supply side, startups assess which TBI best matches their needs based

on the nature of the TBI's sponsorship (government, university, corporate, or private) and sector specialization (Mungila Hillemane et al., 2019).

During the application review, TBIs evaluate the market potential of the technology, the founders' educational backgrounds, industry experiences, domain expertise, and existing network resources (Mungila Hillemane et al., 2019). The degree of alignment between the TBI's resources and the startup's needs, as well as the TBI's evaluation of the founders' potential to engage successfully in the incubation process, are decisive in selecting startups for incubation.

Incubation phase

The incubation process begins by providing startups with shared spaces, access to common infrastructure and services such as legal, administrative, and financial advice (Mungila Hillemane et al., 2019). It then fosters internal networking among the startups through regular interactive sessions. Ongoing management interactions help startups exploit external networks, enhancing their development from ideation to prototype and eventually to market-ready products. This involves linking with technology mentors, accessing early markets through business mentors, securing early-stage financing from investors, and recruiting essential human resources.

The success of incubation activities depends on the quality of the TBI's infrastructure and services, the effectiveness of both internal and external networking, and how well these elements integrate with the startup's capabilities. The efficiency of the incubation management and the founders' adeptness play crucial roles in the successful convergence and formation of the startup.

Post-incubation phase

Startups ready to graduate typically have well-defined products, established repeatable production processes, clearly identified target markets, sufficient human resources, and initial financing (Mungila Hillemane et al., 2019). These startups have begun generating revenue and contributing to research and development, showing potential for job creation and increased revenue through market expansion. This level of development signifies the end of the new venture development process, at which point the TBI concludes its direct involvement in the venture's formation.

3. Contextual Framework

Food ecosystem transformation is driven by population growth, consumer trends and the advanced technologies that strengthen human connection. Moreover, after the Covid-19 pandemic, it highlighted the importance of making recovery plans to establish new food security systems and decentralized food supply chains (Endeavor, 2023). Fragmented food supply chains and inadequate trading practices impose constraints on the achievable efficiency gains and advancements in food systems, hampering the development of consumer trust and impeding disruptive innovations (EIT Food Strategic Agenda, 2019). According to Ardila (2022) global food production needs to increase by at least 70% by 2050 to feed the projected 9 billion people. However, agriculture already accounts for 90% of the world's freshwater usage and contributes to a quarter of all climate change emissions. Over 820 million people suffer from undernourishment due to lack of access to decent food (Crespo, 2019).

Addressing this challenge necessitates a collaborative effort among the public sector, private industry, and the scientific and technological communities. Therefore, Agrifood technologies coming from startups play a crucial role beyond being simple sources of innovation. These AgriFoodTech technologies can enhance the efficiency of water and energy use in agrifood systems, significantly reduce food waste and promote plant-based diets (Klerkx & Villalobos, 2024). In the following sections, the case study will be discussed in Section 3.1. Subsequently, Section 3.2 will outline the positive aspects of AgriFoodTech startups, while Section 3.3 will explore the challenges and areas of concern within the industry.

3.1. Case study

Agriculture in Chile

Chile's extensive territory spans 4300 km from north to south. As a well-known producer and exporter of a diverse array of high-value crops (see Figure 3), Chile leverages its Southern Hemisphere location to harvest during off-peak seasons, providing fresh supplies to global markets when they are scarce elsewhere (Fernández, 2021; HNRG, 2021). This strategic advantage underscores the importance of its agricultural development and the international acclaim for its agricultural products, ranging from bottled wine to fresh and dried fruits (PolyNatural, 2022;

Guzmán, 2023). Chile's export-oriented economy, supported by free trade agreements with over 90% of the global economy, significantly benefits the agricultural sector (HNRG, 2021).

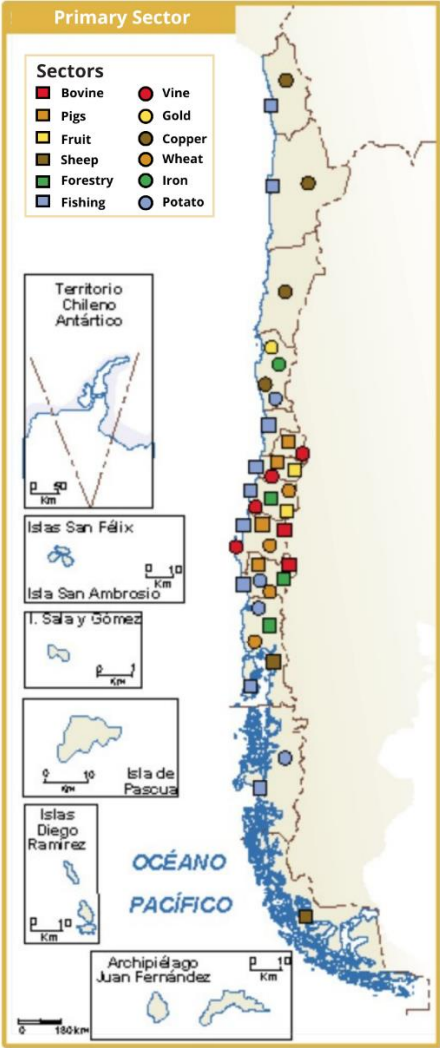


Figure 3: Chile's primary sector² (Netmaps, 2024).

This agricultural prosperity is supported by a dedicated workforce whose demographics are detailed in the latest National Agricultural and Forestry census in the latest version, 2020-2021, as shown in Figure 4. The 2020-2021 census provides crucial insights into the demographic composition of this workforce. The age demographics were divided into the following groups: 18-24, 25-49, 50-64, and 65 and older. The blue section represents men, while the green represents women. Data show that 78.4% of male producers and 74.2% of female producers in Chile are over 50 years old.

² "The primary sector refers to all those activities that are dedicated to the exploitation of natural resources to obtain raw materials." (Caballero, 2024).

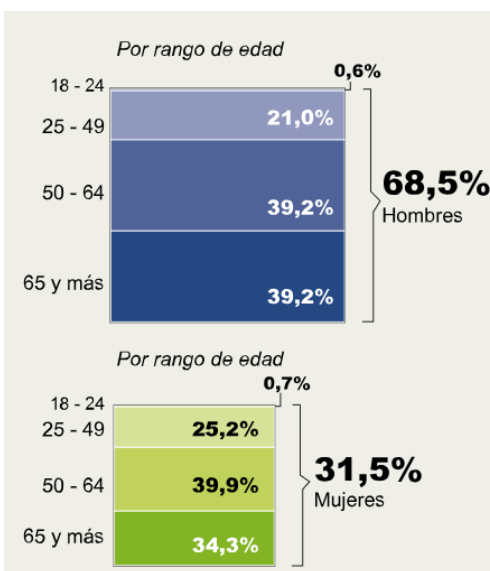


Figure 4: Distribution of producers by sex and age for the 2020-2021 (INE, 2022).

AgriFoodTech in Chile

Over the last decade, recognizing its agricultural capacity and geographic advantages, the Chilean government has seriously considered both public and private investments to spur agricultural innovation within the country. In collaboration with the World Bank, it launched a plan to finance technological innovations in agriculture, thus positioning the sector for future growth (PolyNatural, 2022). In 2017, investment in AgriFoodTech positioned Chile among the top four countries in Latin America as shown in Figure 5. For example, Start-Up Chile, the pioneering government-supported incubator, has assisted nearly 2000 startups, fostering entrepreneurship and digital innovation in the region (Loukos & Arathoon, 2021; Forward Fooding, 2023).

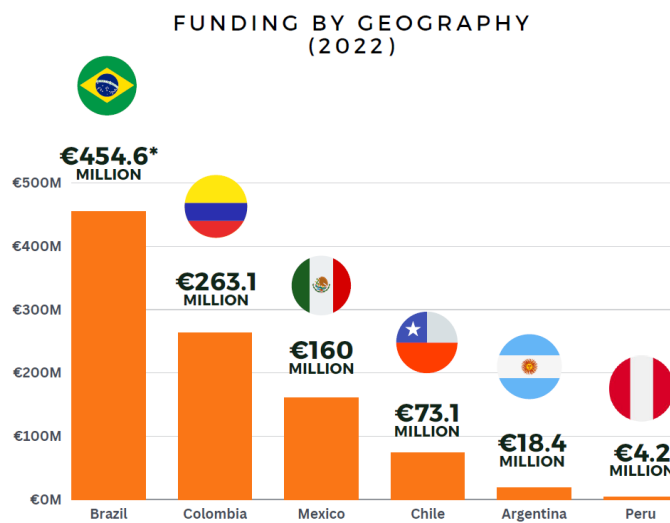


Figure 5: Funding by geography 2022 (Forward Fooding, 2023).

To address the complexity inherent in the Agrifood industry, this research will categorize AgriFoodTech startups into several specific sectors. These include Ag Biotechnology, Agribusiness Marketplaces, Bioenergy & Biomaterials, and more contemporary categories like Cloud Retail Infrastructure, eGrocery, and Novel Farming Systems (Burwood-Taylor, 2017). This detailed categorization aids in understanding and analyzing the diverse technological interventions and their impacts on the agricultural landscape, providing a structured approach to assessing the sector's evolution and innovation dynamics.

Chile has become a fertile environment for partnerships among innovation companies, the government, and venture capital, supported by factors such as the positive reputation of its agricultural products, institutional stability, extensive free trade agreements covering more than 80% of the global GDP, ongoing government support from entities like CORFO (Corporación de Fomento de la Producción/Production Development Corporation), which aims to encourage entrepreneurship and innovation to enhance productivity in Chile, and consistent year-round fruit production to meet the demands of the northern hemisphere (PolyNatural, 2022). Moreover, funding in the AgriFoodTech sector is increasingly seen as a promising and underexplored market (Stephen & Wolf, 2023). In 2021, Chile achieved two unicorns, meaning startups valued at more than \$1 billion dollars: Cornershop and NotCo (Winter, 2024), with other leading startups in the sectors being AgroUrbana, Instacrops, Done Properly, and PolyNatural.

Therefore, this research aims to focus on AgriFoodTech startups already developed like those mentioned above and startups in the early stages with the purpose of understanding the strategies implemented by prominent startups, identifying opportunities, and recognizing limitations that can be addressed to support emerging startups, thereby offering valuable insights for learning.

3.2. Positive challenges

AgriFoodTech is a complex industry that poses challenges for changing its diverse processes, operations, and roles as food travels from farms to forks (Burwood-Taylor, 2017). This complexity offers multiple opportunities for entrepreneurs and technologists to disrupt the industry and introduce new efficiencies using AgriFoodTech across various stages of the supply chain. For instance, AgriFoodTech in Chile is expected to drive the shift towards sustainable agriculture by enabling technology-intensive farming practices. This includes allowing farmers to remotely manage their crops through applications that utilize data from sensors, drones, and satellites, as well as pioneering space-efficient methods known as 'Vertical Farming' to address food scarcity in urban environments (Endeavor, 2023). Successfully implementing these initiatives can often be challenging, highlighting the need for continued research and targeted actions in this area.

As AgriFoodTech startups scale, they often replace older, less sustainable practices at various points in the value chain. These include short-term innovations such as e-mobility, new circular materials, and innovative food marketing strategies. However, understanding the factors that drive

their growth and the connection between these entrepreneurial ventures and the social or environmental impacts they produce remains poorly understood (Horne & Fitcher, 2022). On the other hand, sustainable farmers are increasingly recognized as 'new heroes' by individuals born between 1980 and 2003, and this perception continues to resonate today (Endeavor, 2023). Referred to as 'digital natives,' these generations are pivotal in shaping the future workforce of AgriFoodTech. Research by Silvello et al. (2021) indicates that 94% of this demographic are eager to apply their skills toward meaningful causes. Consequently, AgriFoodTech startups that actively incorporate these younger demographics into their business models are likely to achieve long-term success (Endeavor, 2023).

3.3. Questionable challenges

This research addresses both short-term and long-term impacts, highlighting concerns regarding the social impact of AgriFoodTech startups. There is a noted ambiguity in how these startups approach sustainability; some may use their sustainability claims more as a marketing tool rather than as a genuine strategy for sustainable transformation (Stephens & Wolf, 2023). Therefore, the dialogue surrounding the measurement of social impact in AgriFoodTech has intensified, triggered by various stakeholders who demand greater transparency and accountability in sustainability efforts (Stephens & Wolf, 2023). The concept of social impact is evolving beyond just enhancing operational efficiency and economic viability for farmers and entrepreneurs. It also involves the broader implications of AgriFoodTech initiatives on external actors such as customers and the wider community. This holistic approach emphasizes not only the economic benefits but also the sector's responsibility towards sustainable community integration and startups' ethical engagement (Endeavor, 2023; Lachman, 2018).

Furthermore, according to Endeavor (2023), there are some limitations encountered by AgriFoodTech startups in Chile, one of which is related to the traditional organizational structures within the large industry, which slow the adoption of new practices. For instance, Bravo (2021) points out that although most companies in the Maule region's agricultural sector in Chile, utilize software, only half are using licensed versions. Additionally, technology adoption rates are low, with only 10% of companies using energy-autonomous sensors and a mere 5% deploying aerial robotics. Traceability efforts show that while 65% of companies use sensors, more than half recognize the need for improvements in their processes. Furthermore, GPS-based systems are only used by 20% of these companies, indicating significant room for advancement in technological integration. These statistics indicate that established practices within the agricultural sector are major obstacles to adopting the advanced technologies proposed by AgriFoodTech startups. However, the exact factors driving this resistance remain unclear.

Secondly, while the industrial sector is aware of available technologies and recent scientific advancements, this knowledge is not fully utilized in R&D processes. This disconnect contributes to the slow adoption of advanced technologies and limited involvement of highly skilled personnel in startups (Endeavor, 2023). The challenge extends beyond merely getting, it also involves

effective combination and demonstrating it within the startups. This issue of integration also impacts their strategic market positioning. Initially, many AgriFoodTech startups focus primarily on domestic markets due to their stage of development and limited resources. As AgriFoodTech startups mature and pursue international expansion, they encounter significant obstacles, such as regulatory challenges and inadequate market entry strategies, which impede their growth (Endeavor, 2023).

There is a general lack of understanding about the roles and influence of various actors within the private and public sectors, which adversely affects the competitiveness of AgriFoodTech startups in Chile. This gap manifests as insufficient support for forming strategic partnerships, especially with national and international research centers that could significantly benefit these startups (Endeavor, 2023). Moreover, while AgriFoodTech startups need to stay updated on competitor activities and market trends to remain competitive, this practice is not consistently applied. Effective monitoring of these aspects is crucial as it helps startups to make informed decisions and develop strategies that attract investment and foster growth (Endeavor, 2023).

To effectively reshape the intricate food ecosystem, it is essential to enhance our understanding of various influencing factors, such as social, organizational, economic, technical, and political aspects. Identifying strategic points where entrepreneurship and innovation can drive significant changes is crucial in this process (Gil et al., 2018).

4. Theoretical Framework

Section 4.1 will detail the Multi-Level Perspective (MLP) framework and niche perspective. Section 4.2 will introduce the enabler theory as applied in this research. Finally, Section 4.3 will present a conceptual framework that illustrates the connections between the concepts used in this research.

4.1. Multi-Level Perspective framework and niche perspective

In this study, the Multi-Level Perspective (MLP) is the baseline for measuring AgriFoodTech startups. This theoretical framework examines the prospects and dynamics of extensive transition processes and various innovations, including startups. The MLP is established on three analytical levels: the socio-technical landscape, socio-technical regimes, and niche innovations (Lascialfari et al., 2019). According to Lascialfari et al. (2019), the socio-technical landscape encompasses the socio-political context, environmental problems, demographics, and other global tendencies. The socio-technical regime consists of all the rules and behaviors that ensure the balance and reproduction of the system. Niche space allows external actors to gain new knowledge and assemble skills, fostering new interactions that might support and lead to more radical innovations (Germesheid, 2020).

Following this last level, niches serve as 'breeding spaces' for innovations, insulated from market pressures (Kemp et al., 1998). These innovative socio-technical formations are contemplated as seeds for systemic change, specifically in the Agrifood industry (Wiskerke & Van der Ploeg, 2004). Nevertheless, the timing of niche innovations is critical, "when ongoing processes at the levels of the regime and landscape create a window of opportunity," (Geels, 2002, p. 1262), radical innovations can ascend into the regime. Startups that create technology can be seen as a suitable example of this window. In this research project, the studied niches are startups in the Agrifood sector that have developed disruptive and sustainable innovations they aim to integrate into the food ecosystem (Geels, 2002). Geels (2002) emphasizes the significant role niches play in transitions towards a more sustainable regime. Figure 6 explains how niche innovations like startups can lead to a sustainable transition pathway.

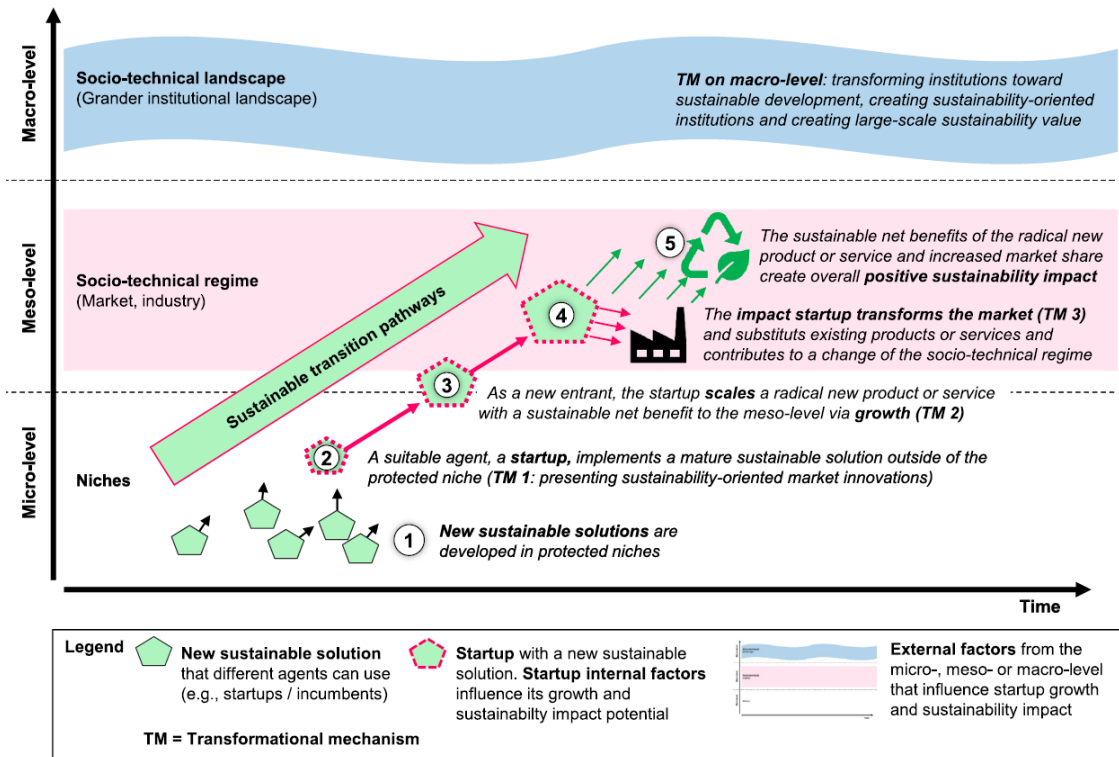


Figure 6: Multi-Level framework for startups in sustainable transition pathways (Horne & Fitcher, 2022)

The local niche level might be viewed as a collection of specific projects in which various actors conduct innovation experiments to address domestic demands and challenges (Germescheid, 2020). Examining these projects through a socio-technical perspective allows for a deeper understanding of the numerous external aspects—social, organizational, economic, technical, political—that have either contributed to their success or led to downfalls (Germescheid, 2020).

Following Germescheid (2020) stated that at this level, the interplay of these factors becomes evident. Political influences may involve regulatory support or resistance and policy frameworks. Economic factors encompass funding availability, cost-effectiveness, and market potential, while organizational elements include the structure and culture of the participating entities (incubators, universities, other businesses, etc.), their readiness to innovate, and their capacity for collaboration. Social factors may relate more to public perception and customer response, while technical aspects involve the feasibility and reliability of new technologies.

Studying local niche projects with this comprehensive approach reveals critical insights into the dynamics that facilitate or hinder innovation. It also highlights the importance of timing, stakeholder alignment, and the broader systemic context in which these projects operate (Germescheid, 2020). Therefore, niches act as incubator rooms for ideas to mature, grow, and develop along a sustainable transition pathway (Horne & Fichter, 2022).

By understanding these factors, stakeholders can better strategize to overcome barriers, leverage enablers, and ultimately foster successful innovations that can be scaled and integrated

into broader regimes. Then, by merging principles from MLP with insights derived from innovative transitions, the experts formulated a set of aspects that enhance the comprehension of the diverse dimensions impacting innovation and, based on Lascialfari et al. (2019) and Lachman & López (2022), adapted to AgriFoodTech startups, the following factors will help to measure the key players and aspects involved in this ecosystem towards a food sustainability pathway:

- (i) **Domestic demand/Market:** Refers to the identification of business opportunities considering the Agrifood consumption choices and assessing whether prototypes/ideas can be potentially scalable. AgriFoodTech startups should integrate societal concerns into their innovations.
- (ii) **Support institutions/Networks:** Relates to the ability of entrepreneurs to receive support either internally or from institutions (private or public) such as incubators, accelerators, venture capital, etc., which play an important role in creating networking relationships to define their value proposition and growth to promote or hinder the sustainable innovation pathway.
- (iii) **Skilled labor force and knowledge:** Highlights the availability of skilled labor that AgriFoodTech entrepreneurs assemble from technology and research institutes, other startups, universities, etc., and assesses whether the environment provides a space for collaboration.
- (iv) **Technology and Infrastructure:** Indicates that the new product/service created by the AgriFoodTech startup may need new technological operations, whether for transforming elements or adjusting the production supply chain. Startups either receive or lack the physical resources to organize their supply chain and the appropriate retail channels to impact the food ecosystem.
- (v) **Policies:** Focuses on the appropriate regulations to promote new food products or services from AgriFoodTech startups as they might seek to shape public policies that foster a supportive institutional environment and impact the food ecosystem.
- (vi) **Players:** Reflects on the actors involved, with the aim of better understanding their role in the food ecosystem.

4.2. Enabler Theory

Based on Horne & Fichter (2022), the enabler theory can help measure the growth and impact of startups on sustainability. This theory is divided into internal and external enablers, and for this research, it serves as a baseline to understand if the factors function as enablers for startups, specifically AgriFoodTech startups.

External enablers

Davidsson (2015) defines external enablers (EE) as "a single, distinct, external circumstance, which has the potential of playing an essential role in eliciting and/or enabling a variety of entrepreneurial endeavors by several (potential) actors" (Davidson, 2015, p.683). This definition provides a general perspective; however, for this research, EE will particularly focus on the factors of Domestic Demand/Market, Technology and Infrastructure and Policies from previous section. Also, EE roles vary depending on the specific startup, examples could include receiving technical support to strengthen their innovative product or service or boosting a sustainable product with supportive policies. Additionally, these factors can be established throughout the analytical levels, such as the socio-technical landscape like COVID-19 that limited face-to-face contact, in the socio-technical regime it could be customers' willingness to adopt new products in the market, and at the niche level, such as receiving technical support from other actors. It is crucial that various mechanisms clarify how EE influences startups. These mechanisms are the cause-and-effect relations that demonstrate the functioning of EEs (Horne & Fichter, 2022).

Internal enablers

According to Horne & Fichter (2022), the maturity of this internal enabler (IE) is still not fully described. However, the definition provided is "A single, distinct, venture-internal circumstance, which has the potential of playing an essential role in eliciting and/or enabling a variety of entrepreneurial endeavors" (Horne & Fichter, 2022, p.6). For this enabler, the factors that this research will focus on are Skilled Labor Force and Knowledge, and Support Institution and Network from previous section. This IE can significantly influence startups; for example, benefiting from diverse backgrounds within their team members, enhancing partnerships between startups and other actors. Identifying different mechanisms on how IEs impact startups is possible, however, IEs are restricted when it comes to the three analytical levels as this is tailored to the specific needs and context of the individual venture (Horne & Fichter, 2022).

Finally, for both EE and IE, understanding the context when analyzing the potential that the enabler can have in a startup is essential. For EE, an example would be considering a disruption in the food supply chain due to a transport strike. While food delivery startups would struggle to access supermarket supplies to continue their operations, other startups might see this as an opportunity to innovate, such as on-site farming solutions that enable people to produce their own food locally, avoiding the disrupted supply chain. In the case of IE, seeking specific knowledge to support internal prototype testing, partnering with universities is ideal. Initially, this connection provides necessary expertise. However, as the startups scale, the knowledge from researchers may become less applicable. Therefore, the context-dependency for both types of enablers must be assessed to determine their existence and effectiveness, and which are not (Horne & Fichter, 2022). Simplified logic suggests that the more effective the enablers are in the context of a startup, the more likely it is to succeed and contribute to a more sustainable pathway (Horne & Fichter, 2022). To illustrate the linkage between the MLP framework and the enabler theory with the selected factors for this thesis, see figure 7.

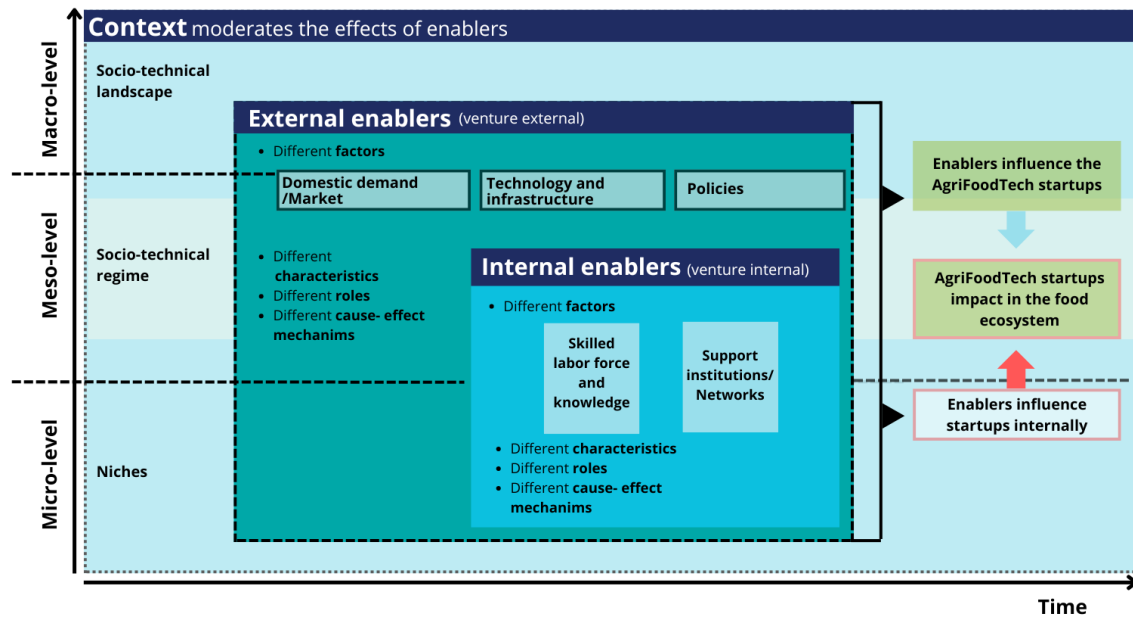


Figure 7: Enablers of AgriFoodTech startups with factors (Adapted from Horne & Fichter, 2022).

4.3. Conceptual framework

Globally, innovation and entrepreneurship have become key drivers for transforming food ecosystems (De Bernardi et al., 2020). However, to date, studies of AgriFoodTech startups have been limited and fragmented across various disciplines (Klerkx & Villalobos, 2024). Following these concepts and enhancing adaptability to the constantly changing environmental background and promoting entire food sustainability are considered achievable goals without compromising the advantages offered by current food production procedures (De Bernardi & Azucar, 2020).

This study aims to illuminate the role of AgriFoodTech startups that with their innovations want to contribute to the food ecosystem in an evolving landscape of sustainable food transformation, as detailed in Figure 8. The framework presents the AgriFoodTech startup and its relationship with key players in Chile, aiming to understand how the AgriFoodTech startup ecosystem operates within the country. This addresses research sub-question 1: *'Who are the key players in AgriFoodTech startups in Chile?'* Furthermore, by examining some existing AgriFoodTech startups using the enabler theory, this research will provide insights into the challenges and limitations they face, focusing on social, organizational, economic, technical, and political aspects. This addresses research sub-question 2: *'What are the key challenges and limitations faced by Chilean AgriFoodTech startups?'* Finally, understanding the potential impact that AgriFoodTech startups can have in the ecosystem by analyzing the enablers is explored in research sub-question

3: 'How do AgriFoodTech startups aim to impact food ecosystems in Chile?'. This exploration helps identify the sustainable transition pathway to reach the concept of Food Sustainability.

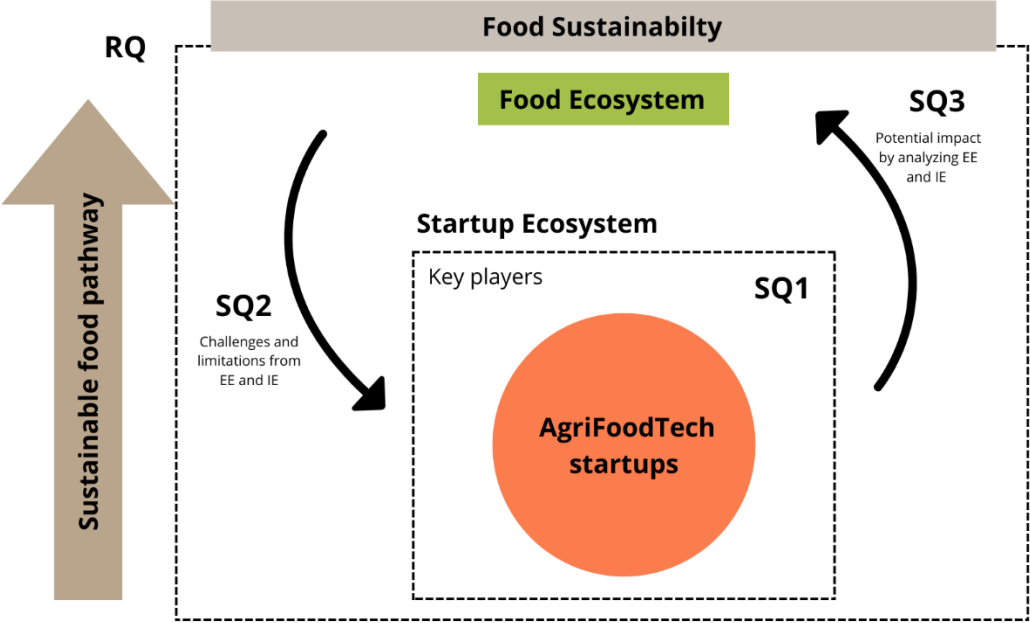


Figure 8: Conceptual Research framework (Author's own).

5. Methodology

This section outlines the structure of the research methodology. Section 5.1 presents the elaboration of the research questions and methods. Section 5.2 details the operationalization of the theoretical framework. Data collection processes are described in Section 5.3, followed by data analysis in Section 5.5. Lastly, ethical considerations and positionality are discussed in Section 5.6.

5.1. Elaboration of Research Questions and methods

In this thesis, the findings are analyzed through the enabler theory, examining its context linked with the Multi-Level Perspective (MLP) framework that supports theories of sustainable transition, specifically for AgriFoodTech startups (see Figure 7).

SQ1 investigates the main stakeholders involved in the AgriFoodTech startup ecosystem in Chile, as identified from the preliminary literature review in Section 2.4. This aims to provide an overview of the AgriFoodTech startups ecosystem in Chile.

SQ2 utilizes the MLP framework and enabler theory to analyze the factors identified in Section 4.1 during interviews. The goal is to comprehend the challenges and limitations AgriFoodTech startups face, and to determine whether these factors are considered enablers or obstacles, depending on their context as elaborated in Section 4.2. This approach aims to provide a deeper understanding of the startup environment within the AgriFoodTech sector.

SQ3 involves analyzing the impact of AgriFoodTech startups on Chile's food ecosystem through a detailed investigation of the same factors identified in Section 4.1 as potential enablers, as shown in Table 2. By meticulously examining insights gathered from interviews, this analysis seeks to uncover the broader influence of startups in the food ecosystem in Chile.

Consequently, as shown in the Research Framework in Figure 9, the research was divided into three main research sub-questions to answer the main research question: *How do AgriFoodTech startups in Chile aim to contribute with their innovations to a more sustainable food system?*

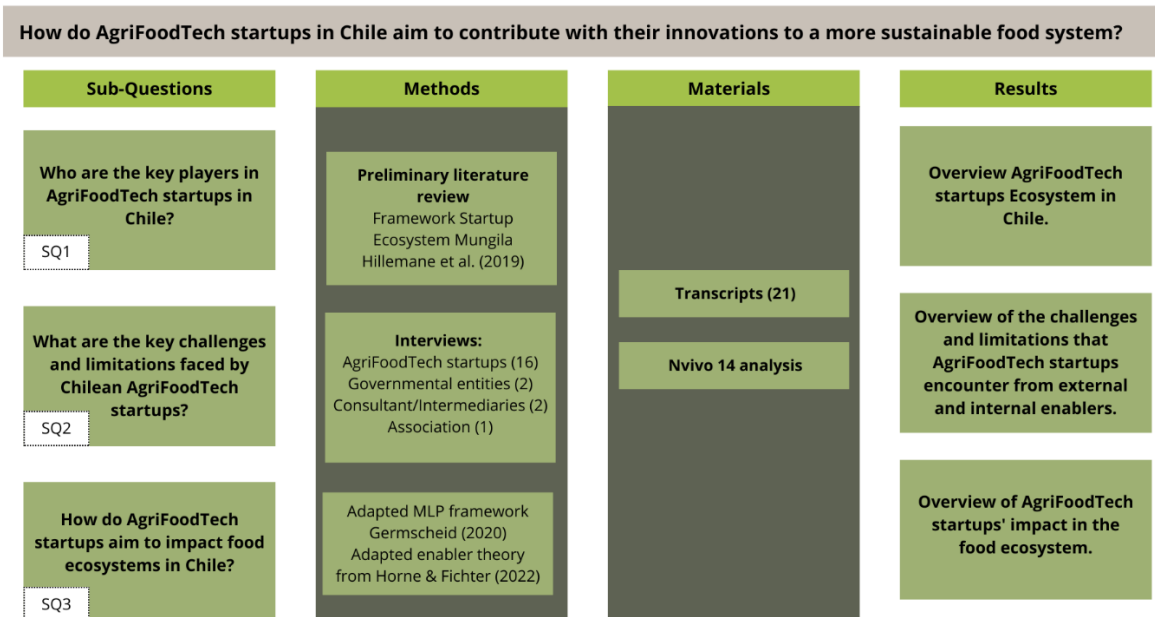


Figure 9: Analytical framework Author's own.

5.2. Operationalization of Theoretical framework

The use of theoretical frameworks serves as essential tools for analysis, allowing researchers to structure and guide their work with data systematically (Gibson & Brown, 2009). The Multi-Level Perspective (MLP) framework, the enabler theory, and the six factors used in this investigation offer a systematic approach to organizing and interpreting complex data sets, ensuring that the research process remains coherent and focused. Then, by examining AgriFoodTech startups through the six main aspects mentioned in Section 4.1 and illustrated in Figure 7, Table 2 helps identify key players, challenges, limitations faced by the startups, and their potential impact to answer the research question.

Aspect from MLP	Factor	Definition	Enabler
Social	Domestic demand/Market	Identify of whether the clients and market facilitate opportunities for the AgriFoodTech startups to develop and scale up in a food sustainable pathway.	EE
Organizational	Support institutions/Networks	Determine support mechanisms that facilitate the establishment of network relationships for AgriFoodTech startups.	IE
Economic	Skilled labor force and knowledge	Availability of AgriFoodTech startups to have skilled labor and bring knowledge collaboration among different actors.	IE

Technical	Technology and infrastructure	Receiving or not the physical resources to transform or adjust the AgriFoodTech business.	EE
Political	Polices	Recognizing if there are or not appropriate regulations to promote the product/services that AgriFoodTech startups provide and impact the food ecosystem.	EE
-	Players	Recognize the actors that are involved in AgriFoodTech ecosystem in Chile.	-

Table 2: Operationalization (Author's own).

5.3. Data Collection

This research employed two primary methods of information gathering. Initially, desk research was conducted, focusing on the AgriFoodTech startup market in Chile and the role of key players to comprehend the dynamics of the industry within the country. Subsequently, semi-structured interviews were conducted in both Spanish and English with 21 experts, including 16 from AgriFoodTech startups, 2 from governmental entities, 2 from Consultants/Intermediaries, and 1 from an association. The distribution of interviewees is detailed in Table 3, with the last column showing the short abbreviation used for citations in the results section.

	Name	Category	Description	Role interviewee	Short abbreviation
1	Instacrops	Farm Management software, Sensing & IoT	It is a full stack platform that integrates and packages IoT, satellite and drones' technologies for giving real time recommendations for farmers using ML (Machine Learning) and AI (Artificial Intelligence) (Instacrops, n.d.).	Chief Technology/Data Officer (CTO)	S1
2	AgroMatch	Farm Robotics, Mechanization & Equipment	Platform that connects owners of machinery or services with farmers looking to lease these machines or services (AgroMatch, 2022).	Co-Founder and Co-Founder AgroTech Chile	S2

3	Agrapp	Farm Management software, Sensing & IoT	An elemental platform for the correct agricultural management. We will help you make the right decisions through financial reports where you will know every detail of your costs of labor, workers, machinery and inputs (Agrapp, n.d.).	Chief Executive Officer (CEO)	S3
4	AquaPlants	Novel Farming Systems	Urban gardens with high yields (AquaPlants, n.d.).	Chief Executive Officer (CEO)	S4
5	BIONAUTE	Ag Biotechnology	Fungicide that is applied through the irrigation system, using the application of the revolutionary RNA (biochemical compound) interference technology (BIONAUTE, 2023).	Co-Founder / Chief Sustainability Officer (CSO)	S5
6	F4F - Food for the Future	Innovative Food	We transform organic waste into highly nutritional products for poultry, mammal and fish feed (F4F, n.d.).	Chief Technology/Data Officer (CTO)	S6
7	Farmtastica	Novel Farming Systems	Modular vertical farms which allow production of vegetables regardless climate or geographic conditions (Farmtastica, n.d.).	Co-Founder	S7
8	AgroInventario	Farm Management software, Sensing & IoT	First system that allows farmers to know in real time and from any device what and how much product they have in their warehouses. (AgroInventario, n.d.)	Co-Founder	S8
9	INFOOD PROTEIN	Innovative Food	We revalue organic waste, developing products with high nutritional value (INFOOD PROTEIN, 2022).	Co-Founder	S9
10	Arpegio/Tribu	N/A	Venture Capital that works together with founders, industry partners and capital partners as we each contribute to create value in technology startups for Latin America's agrifood industry (Arpegio, n.d.).	Managing Director	P1
11	HoneyPro Spa	Ag Biotechnology	Develops biotechnological tools to increase the quality and yield of sustainably	Chief Executive Officer (CEO)	S11

			pollinated crops (HoneyPro, n.d.).		
12	PolyNatural	Bioenergy & Biomaterials	Chilean based company, offering Shel-Life (r) to extend the life of fruits. Our 100% natural and organic solution extends the life of fruits from the southern hemisphere to the World (PolyNatural, n.d.).	Founder and Co-Founder Agritech Chile	S12
13	Done Properly	Innovative Food	Done Properly is a foodtech company that develops bioprocessed ingredients from fermentation technologies. (Done Properly, n.d.).	Co-Founder	S13
14	AgroUrbana	Novel Farming Systems	We are the first Vertical Farming company in Latin America. We produce incredible food by applying advanced technology and processes responsible with the environment and people (AgroUrbana, n.d.).	Co-Founder	S14
15	CORFO	N/A	Production Development Corporation, promotes entrepreneurship and sustainable growth (CORFO, n.d.).	Entrepreneurship Manager	G1
	START-UP	N/A	Accelerator program by the Chilean government, located in Santiago (START-UP, n.d.).	Manager	
16	Transforma Alimentos	N/A	It is an initiative promoted by CORFO and supported by the Ministry of Agriculture that, through public-private coordination and collaboration, seeks to promote the sustainable growth of the Chilean food industry (ECLAC et al., 2010).	Director	G2
17	AgroTech Chile	N/A	It seeks to be a reference and a meeting point for all actors involved in the convergence between agriculture and technology (AgroTech Chile, n.d.).	CoFounder	A1

18	ComeS	Agrobusiness Marketplaces	It connects food producers with companies through a platform that allows buyers to quote, purchase and optimize their management of local suppliers (ComeS, n.d.).	CoFounder	S18
19	Botanitec	Ag Biotechnology	Design and production of biotechnological solutions for the agricultural industry based on natural active ingredients (Botanitec, n.d.).	Founder	S19
20	Patagonia Biotecnología ("PatBio")	Innovative Food	Uses abundant seaweed to produce bio-stimulants that enhance growth and increase yields and caliber of a wide range of agricultural products (Endeavor, 2023).	Founder	S20
21	Mumulkan	N/A	Consultancy firm with a multidisciplinary team with extensive experience in agribusiness and technology. Our strength lies in our unique combination of skills in digital transformation, innovation, business, engineering, agronomy, lean management and change management (Mumulkan, n.d.).	Founder Mumulkan / Founder Trongkai	P2

16	AgriFoodTech startups
2	Governmental entities
2	Consultants/Intermediaries
1	Association

Table 3: Categorized interviews (Own illustration).

5.4. Interviewing process

The 21 interviewees were contacted primarily through LinkedIn and existing networks of experts. During the interviews, participants were briefed on the scope of the research and asked if they would like to participate in the study. Interviewee selection depended on their availability and was strategically guided by the desire to include a range of experiences within the AgriFoodTech sector, focusing on both established and early-stage startups. Furthermore, the interviewees demonstrated a willingness to provide detailed insights, enhancing the richness of the discussion. Most interviews were conducted online and typically lasted about an hour. However, the in-person interviews, conducted at the interviewees' startup or personal offices (see figure 10), were more extensive, ranging from one and a half to two hours. During these sessions, additional experts

Transcripts were maintained in their original Spanish to preserve linguistic nuances and were only translated into English for displaying findings and within the codebook. For accurate translation, the DeepL translator was employed to ensure fidelity in this process. The interviews with various stakeholders provided valuable insights into the challenges and limitations that AgriFoodTech startups face in the Chilean food ecosystem, as well as the impact of these startups on the industry. By analyzing the factors identified as enablers or potential enablers, we gained a deeper understanding of how these startups navigate their environment. This analysis has been crucial in identifying the key elements that support or hinder their operations.

5.6. Ethics and positionality

Participants were informed of the purpose of this research and gave verbal consent before participating, see the first part of Appendix A,B, and C. While anonymity was maintained to ensure the confidentiality of startups, details that might identify participants were omitted. Nevertheless, it is noted that many startups prefer to be identified to gain visibility, which this research could facilitate.

The researcher's influence might color the perspective of this study, as well as affect participation and evaluation of data collection (Hennink et al., 2020). My background as a Colombian woman, educated in Latin America, a native Spanish speaker and fluent in English, positions me uniquely among the experts interviewed. This shared cultural and linguistic background often made the founders more receptive, with many expressing enthusiasm about contributing to academic research that could enhance their visibility. However, my industry experience as an industrial engineer might also influence my research perspective. Additionally, my work in the innovation sector may sometimes restrict the flow of information, as startups with unreleased projects may hesitate to divulge details or share images from in-person interviews.

6. Results

The results are structured in three main sections, each addressing one of the RQs. Section 6.1 explores the key players in AgriFoodTech in Chile, highlighting the players involved at any stage of the startup development process (SQ1). This is followed by Section 6.2, which analyzes the social, organizational, economic, technical, and political challenges and limitations in the network built by Chilean AgriFoodTech startups (SQ2). Section 6.3 then evaluates the impact of these factors on the food ecosystem in Chile (SQ3). Finally, this section outlines the contributions of AgriFoodTech startups to a more sustainable food pathway. Based on the data collected in Section 5.3, citations of interviewees will follow the abbreviations used in Table 4.

	Name	Short abbreviation
1	Instacrops	S1
2	AgroMatch	S2
3	Agrapp	S3
4	Aquaplants	S4
5	BIONAUTE	S5
6	F4F - Food for the Future	S6
7	Farmtastica	S7
8	AgroInventario	S8
9	Infod Protein	S9
10	Arpegio/Tribu	P1
11	HoneyPro Spa	S10
12	PolyNatural	S11
13	Done Properly	S12
14	AgroUrbana	S13
15	CORFO	G1
	START-UP	
16	Transforma Alimentos	G2
17	AgroTech Chile	A1
18	ComeS	S14
19	Botanitec	S15
20	Patagonia Biotecnología ("PatBio")	S16
21	Mumulkan	P2

Table 4: Interviewee abbreviation (Author's own)

6.1. Results SQ1: Key players in AgriFoodTech startups in Chile

The ecosystem concept is related to this section, in the sense that to understand the key actors who are connected to the AgriFoodTech startups, experts frequently use it to analyze the entrepreneurship world (Bisang et al., 2022). Developing this ecosystem is crucial for fostering entrepreneurship and innovation as well as promoting access to not only physical resources but

also intangible ones like knowledge that is needed for the growth and expansion of the startups (Bisang et al., 2022). However, these startup ecosystems are not limited to the entrepreneurial sector as they also encompass a variety of supportive entities that will be stated in this section based on the players mentioned throughout the interviews. An overview of the players is presented in Appendix E. Experts in Innovation Ecosystems have mentioned that in these networks, there are multiple interactions with various actors including governments, supporting institutions, financial entities, universities, industries in the sector, consumers, entrepreneurs, etc. In Appendix E, the actors involved in the AgriFoodTech ecosystem in Chile are categorized as follows:

5.1.1. Governmental entities

Government actors play an important role in this ecosystem, the ones mentioned in the interviews are shown in table 4.

Governmental entities in Chile	Number of mentions
CORFO (Cooperación de Fomento de la Producción/Production Development Corporation)	19
FIA (Fundación del Ministerio de Agricultura para la Innovación Agraria/Foundation of the Ministry of Agriculture for Agricultural Innovation)	8
Pro Chile (Intitución del Ministerio de Relaciones Exteriores que promueve la oferta de bienes y servicios chilenos en el mundo/An institution of the Ministry of Foreign Affairs that promotes the offer of Chilean goods and services in the world.)	6
Transforma Alimento	4
Government	4
Semilla Expande (supported by CORFO)	3
ANID (Agencia Nacional de Investigación y Desarrollo/National Research and Development Agency)	3
Ministry of Agriculture	2
State entities	2
OpenLab (Universidad de Chile, supported by CORFO)	1
INDAP (Instituto de Desarrollo Agropecuario/Agricultural Development Institute)	1
SSAF Desafíos (Subsidio Semilla de Asignación Flexible para Desafíos / Flexible Allocation Seed Grant supported by CORFO)	1
Fortalece PYME (supported by CORFO)	1

Table 5: Governmental entities in Chile (Author's own).

First and foremost, government actors play a pivotal role in shaping the business environment and influencing both national and international investment, as mentioned in section

2. This influence is evident in Chile, when findings show how was CORFO created “..this president inspired by OECD insights on innovation and productivity, proposed using specific taxes, such as the mining tax on copper companies, to fund innovation. This led to the creation of the Fund for Innovation and Competitiveness (FIC), which subsequently established the innovation sector within CORFO...” (G1) Thus, this governmental entity is a key player in the startup ecosystem.

Moreover, regulatory frameworks determine how easily new businesses, such as startups, can be established by influencing everything from the availability of funding to market accessibility, both national and international. Findings illustrate this with G1's statement: “We focus on how the policy helps develop new technologies, diversify the economy, and create employment. Additionally, we evaluate how much private capital has been raised, the overall portfolio impact, tax contributions, and the policy's rate of return.” By implementing supportive regulations, the government can foster a climate conducive to entrepreneurial ventures and technological advancements.

The findings also highlight that the next two institutions mentioned most frequently were FIA and Pro Chile, demonstrating the involvement of the Ministry of Agriculture and Foreign Affairs as key supporters of AgriFoodTech startups. One participant noted, “We have an alliance with ProChile, so the business rounds that are registered in calls, tours to other countries that showcase innovations, take them as speakers to events in Spain, Switzerland, the United States, Canada...” (S16). Conversely, FIA's role was not seen as positive when S19 stated, “With FIA, I don't have a particularly good experience because I have never won any of the funds I applied for, but I get everything from CORFO...” Government institutions can thus influence AgriFoodTech startups in both beneficial and challenging ways.

5.1.2. Governmental and Private entities

Public and private entities mentioned in the interviews are shown in table 5, recognizing their important role in the AgriFoodTech startups ecosystem.

Governmental and Private entities in Chile	Number of mentions
SERCOTEC (Servicio de Cooperación Técnica/Technical Cooperation Service)	3
Capital Abeja Emprende (supported by SERCOTEC)	1
Fundación Chile	1
Fondo CLIN (supported by Fundación Chile)	1
Scalex	1

Public-private consortium	1
Hubtec Chile	1

Table 6: Governmental and Private entities in Chile (Author's own).

Findings show that public-private partnerships are often formalized through collaborations that leverage the strengths of both sectors, creating a supportive ecosystem for AgriFoodTech startups. S4 explained, "... we are also a partner of an institution in Chile called SERCOTEC, which is basically the business center of a private entity directed by CORFO and the University of Chile. The advantage of this institution is that it provides business management advice, and through it, we have engaged with incubators and more...". These actors significantly influence startups. Additionally, according to Table 5, this public-private entity was the most frequently mentioned in the interviews.

These entities encourage AgriFoodTech startups to grow and gather intellectual capital aimed at developing innovative solutions that can enhance productivity, sustainability, and competitiveness in agriculture and food production. S14 noted, "...Scalex aims to be a stock exchange tailored for medium-sized companies, with more feasible information requirements than traditional exchanges, intended for companies already profitable and with a growth plan...". Additionally, entities like Hubtec are crucial, as G2 mentioned, "...we have an alliance with Hubtec because it is the only hub in Chile that declares food as a pillar, so it's vital for finding allies and generating a critical mass so that we can all be in tune to define great initiatives...". Then these entities are key players in this startup ecosystem.

5.1.3. Knowledge and Research centers

This key player is essential in the AgriFoodTech sector, providing the ongoing knowledge necessary for startups to continue growing. Table 6 below lists the centers mentioned in the interviews.

Knowledge and Research entities in Chile	Number of mentions
Universities and Academia	21
INIA (Centro Nacional de Investigación Agropecuaria National Agricultural Research Center)	4
Research institutes	2
THINKAGRO UTalca	1
Schools	1

Fundación Fraunhofer	1
Technical Centers	1
CEAP (Centro de Estudios en Alimentos Procesados/Center for Processed Food Studies)	1
CETA (Centro Tecnológico de Innovación en Alimentos/Food Innovation Technology Center)	1
Observatorio de sostenibilidad de la Universidad de Chile	1
INACAP (Centro de Innovación Gastronómica/Gastronomic Innovation Center)	1
CeBiB (Centro de Biotecnología y Bioingeniería/Biotechnology and Bioengineering Center)	1
CBT (Centro de Biotecnología Traslacional supported by Sofofa)	1

Table 7: Knowledge and Research entities in Chile (Author's own).

Findings indicate that universities are the actors most involved with AgriFoodTech startups. S13 suggested, "... Chilean universities are very good, always fighting within the rankings, in the top, but doing research, when it has to do with the connection with the private system, there is still much to be done..." S5 concurred this sentiment, stating, "... we started this at university, when we were students, and in order to be able to, let's say, form and sell the company, we participated in different projects or contests, of which we won, for example, the Grand Chile, which is a very large university performance contest in Latin America...". Thus, universities play a crucial role for AgriFoodTech startups.

Additionally, institutions like INIA, the National Agricultural Research Center, strive to enhance the sustainability of the agri-food sector, promoting greater food security and sovereignty. Its mission is to create valuable and innovative solutions for farmers, strategic partners, and society through research and development, innovation, environmental engagement, and technology transfer. S11 noted, "... we collaborate with INIA, which has provided significant support in analysis. This year, we are participating in INIA's SmartField program, which supports small agricultural startups by optimizing services and technology within the agricultural sector..." S3 added, "... we have also worked with INIA to carry out agricultural management research on controlled cultivation, so this research also serves as a validator...". Therefore, this entity significantly promotes the development of startups.

5.1.4. Incubators and Accelerators

These actors are essential for AgriFoodTech startups as they are agents offering entrepreneurs essential resources to foster development and growth, the ones indicated in the interviews are shown in table 7.

Incubators and Accelerators entities in Chile	Category	Number of mentions
Start-Up Chile (supported by CORFO)	Accelerator	11
Accelerators	Accelerator	6
Ganesha Lab	Accelerator	3
Imagine Lab (Microsoft Chile)	Incubator	2
Incubadora Chrysalis (Universidad Católica)	Incubator	2
Incubators	Incubator	2
IncubatecUFRO	Incubator	2
Startup BioBio (supported by Endeavor, IncubaUdeC, Casa W and CORFO)	Accelerator	1
FABLAB	Incubator	1
Jump Chile	Accelerator	1
Village Capital	Accelerator	1
100+ aceleradora AB InBev	Accelerator	1
IncubaUdeC (Universidad de Concepción)	Incubator	1
Ketrawa Lab	Accelerator	1
Patagonia Biotech Hub	Accelerator	1
G100 nada te detiene	Accelerator	1

Table 8: Incubators and Accelerators entities in Chile (Author's own).

Incubators and accelerators serve as crucial bridges for early-stage businesses, facilitating the transition from promising ideas to market-ready enterprises. Findings show that this support is vital for startups as they navigate the challenging phases of market entry and scaling. S5 stated, “For us, not just any incubator will work, but generally, incubators are good options for starting a project, especially if you lack experience. Since we started as students, they were beneficial...” G1 concurred with S5, stating, “We run an acceleration program that pairs each startup with one or more mentors, depending on their stage. Additionally, a technical executive oversees their progress and provides continuous feedback...” Therefore, these entities are key players among startups.

On the other hand, this support from incubators and accelerators has potential drawbacks, such as pressure to scale rapidly, equity requirements, short program duration, and standardized programs. Specifically, when it comes to capital raising, as S9 stated, “Incubators and accelerators provide project frameworks and methodologies for raising capital, but they don't guarantee funding by the end of their programs. This has been a point of criticism...” Key players can also impose constraints on the startups.

It is worth mentioning that, based on table 7, Start-Up Chile was pointed out 11 times. Start-Up Chile is a public business accelerator, supported by CORFO and the Government of Chile, that empowers technological ventures from any origin or industry to use Chile as a platform for global scaling, as S8 mentioned, “...the one that has helped us the most has been Start-Up Chile, which is CORFO and is financed by CORFO, but it has given us a very large network, which is not seen in any other fund...” S7 concurred with S8, stating, “We applied to Start-Up Chile and won...and with that,

we were able to create the first laboratory and the first version of the technology just to be able to validate...” Through this comprehensive support, incubators and accelerators play an indispensable role in transforming nascent ideas into successful, scalable businesses.

5.1.5. Private entities

Private entities play an important role in the ecosystem, the players mentioned in this category are the following, see table 8.

Private entities in Chile	Number of mentions
Other startups	10
Venture Capitals	8
3F (Family, Friends and Fools)	6
Companies in the sector	5
Consulting groups	4
Angels investors	3
Mujeres empresarias / Women entrepreneurs	3
500 startups	2
Tecla 7 Caja de los Andes	2
Suppliers	2
Endeavor	2
Innova funds	2
Banks	1
Foreign investors	1
Kayak Venture	1
Sudamerik	1
Broota (crowdfundig)	1
WSA (World Summit Awards)	1

Table 9: Private entities in Chile (Author's own).

As discussed in Section 2, companies from the sector are often very important for startups. Our interviewees also indicated this, and in the Chilean case, this is evident through S7's statement: "...we tested it for Walmart Chile, which was the first full production container exclusively for Walmart worldwide and we opened it here in Chile and it was parked in the parking lot of a supermarket where we deliver vegetables every day..." This integration allows startups to innovate and improve their products more effectively. Also, suppliers can become investors in the business, as S6 mentioned: "...in Chile, some of the suppliers of our waste are also investors, so it's all local." This shows new relations between AgriFoodTech startups and private stakeholders.

Findings show that collaborating with other startups fosters innovation and support. Other startups were mentioned 10 times during the interviews; this can be illustrated by S6's comment: "...we do have regular meetings with other startups in Brazil and for me in Ecuador where we share, that's kind of on a voluntary basis." S12 added: "...But what is true is that there is a virtuous ecosystem here, let's say, that the startups come together and the founders talk to each other." Then collaboration in this field is recognized.

Furthermore, consulting groups provide strategic guidance, market insights, and technical skills that encourage AgriFoodTech startups to develop their business. S11 stated: "...we began developing projects through a small biotechnology consulting firm, focusing on zero waste by revalorizing agro-industrial waste streams. This work led us to engage with CORFO and FIA formats for innovative agro-industry projects..." Therefore, this player serves as guidance to the startups.

Also, findings suggest that entities like Endeavor play an important role in Chile. S20 stated: "...Endeavor, a global organization, was first founded in Chile 25 years ago. Chile uniquely has four Endeavor offices—in the north, Santiago, the south, and Concepción—making it a powerful network. The organization is highly committed to supporting emerging entrepreneurs with strong ethics and energy..." Such an entity boosts AgriFoodTech startups in the ecosystem.

The different options and approaches that an AgriFoodTech startup can have to access a diverse range of financial resources facilitate their development and expansion in the sector. A common trend is that financial entities are looking for investment in growing industries, as S17 mentioned: "...in the end, venture capital seeks a solution in Chile but is going to apply it in Mexico, Brazil, the United States..." Moreover, findings show that venture capitals are the most used by startups for growth, as S18 stated: "...we were fortunate to initially secure private financing from Deplas, a Venture Capital firm from Silicon Valley active in southern Chile. They share our vision of making an impact..."

Findings show that startups can raise capital from various investors, including angels, 3F (Family, friends, and fools), and private equity companies' funds, university contributions, personal investors, and insurance companies, and subsequently invest these funds into startups on behalf of their investors. The 3F investors were described by S14: "...we started first with Family, Friends, and Fools, the first round, or Family, Friends, and Fans, with that we started with the pilot plant..." Then, families play a huge role in the development of AgriFoodTech startups as expanded in the next section.

Among the players already mentioned, it is worth specifying Mujeres Empresarias, an organization focusing on entrepreneurship support for women in Chile, by providing training programs, personalized consulting, acceleration methodologies, and visibility through awards to women entrepreneurs, businesswomen, and senior executives. We foster networking and the exchange of experiences, promoting a collaborative, productive, and dedicated environment for our country's development (Mujeres Empresarias, 2022). This entity was involved with S7, who noted: "...we were also with Mujeres Empresarias; here there is a very good network of people and

institutions that are there to accelerate a company, to ask questions, to show the way..." Therefore, this player might influence AgriFoodTech startups led by women.

5.1.6. Producers and/or Consumers

This player is a vital component of the ecosystem, engaging in continuous collaboration with startups to develop their innovations. Refer to Table 9 below for details.

Producers and/or Consumers in Chile	Number of mentions
Customers	18
Farmers	14
Producers	12
Aquaculturists	3
Beekeepers	1

Table 10: Producers and/or Consumers in Chile (Author's own).

Producers, customers, and farmers are integral to the success of AgriFoodTech startups, which focus on solving specific problems faced by their target customers. Identifying and engaging potential customers who are willing to adopt new technologies is crucial, as stated by S1: "...be able to understand potential customers and ensure that what you are doing solves a real problem...that whatever you are doing, the customer is willing to pay for it because it solves a problem." S3 concurred this statement: "We focus on understanding the user's needs and prioritize features that address the most important problems they face with our solution." Therefore, keeping the customer at the center of product/service development is essential for creating value, as mentioned by S8: "...keeping the client at the center 100% of the time is essential for creating value. While it's easy to theorize and develop tools in the office, only the client can determine if they are willing to pay for the solution."

In AgriFoodTech, producers such as farmers, aquaculturists, and beekeepers often become the clients. As S11 noted, "...we developed a beekeeping input that doesn't require chemical preservatives, which is significant because most liquid beekeeping inputs use chemicals to prevent fermentation. These chemicals also harm the bee's microbiota, we validated this concept with beekeepers..." Therefore, for AgriFoodTech startups, having producers as customers is essential to develop a suitable product.

5.1.7. Associations and Social guilds

Finally, Associations and Social guilds are recognized in the AgriFoodTech environment, see below in table 10, the ones mentioned during the interviews.

Social entities in Chile	Number of mentions
SNA (Sociedad Nacional de Agricultura/National Agricultural Society)	3
Agrotech Chile	2
Sofofa (Sociedad de Fomento Fabril/ Industrial Development Society)	2
Apical (Asociación de productores de insectos comestibles/Association of edible insect producers)	1
Grupo en Puerto Varas	1
Frutas de Chile (ASOEX Asociación de Exportadores de Chile)	1
Chiletec (Asociación de Empresas Chilenas de Tecnología)	1
Climatech Chile	1
REDMAD	1

Table 11: Social entities in Chile (Author's own).

Associations and Organizational guilds are the main actors who were involved in this environment that can create a self-reinforcing cycle of entrepreneurial activity, as A1 stated “... our goal is to build alliances with various organizations involved in agricultural technology, including Transforma Alimentos, Start-Up Chile, SNA, Frutas de Chile, and universities, we aim to advance connections with these actors to promote technology in agriculture, driving economic development and enhancing productivity, efficiency, and sustainability. Our tool helps map, monitor, and measure data to improve decision-making and optimize resource use...”. Findings show that associations often emerge focused on specific geographic areas or sectors S19 stated “... I have another one in Biotribu, ... which is already a very open group of Chilean biotech startups, we collaborate and hire each other, we also provide services, we support each other all the time, and we send each other data...” These associations forge network among different players in AgriFoodTech startups.

Furthermore, in Chile SNA National Agricultural Society and Sofofa Industrial Development Society play a crucial role as the first one, it is considered the oldest trade association in the country (Avendaño & Escudero, 2016), this association aims to foster the growth and advancement of the agri-food sector by bringing together and representing the entire production chain through leadership, encouragement, and support of initiatives that enhance innovation, competitiveness, and social responsibility in education and environmental stewardship (SNA, 2021) findings show this when “...SNA also represents the sector, lobbies for certain policies... they are seeking to promote an eco-food powerhouse...” (A1).

And the second “It is a guild that unites 22 business associations and over 160 companies, representing key sectors of Chile's economy and over 4,000 businesses. We aim to foster a society where businesses are valued and operate in freedom and prosperity. We do this by developing inclusive public policies, fostering dialogue, and promoting sustainable economic growth, to improve people's quality of life” (Sofofa, 2023) findings show it when P2 stated “... Sofofa is like a

guild, if one could call it, that brings together different companies from different industries, which is focused on promoting different types of business and industry...” S19 concurred with P2 in that “... Sofofa is like a guild, if one could call it that, bringing together different companies from various industries, focused on promoting different types of businesses and industries...” Therefore, these two institutions directly influence AgriFoodTech startups in various aspects.

6.2. Results SQ2: Challenges and Limitations faced by AgriFoodTech startups in Chile regarding the enabling factors.

It is important to note that the factors adapted from Section 4 to AgriFoodTech startups, with the relevant questions, help to understand the multiple dimensions and connections influencing the food ecosystem. Therefore, the analytical a priori codes based on MLP are: Social, Organizational, Economic, Technical, Political, and Players. These categories are then divided into domestic/demand market, support institutions/networks, skilled labor force and knowledge, technology and infrastructure, policies, and actors. Afterwards, these a priori codes are enhanced by empirical codes that emerge from analyzing the data collection (Germscheid, 2020) (see Appendix D).

6.2.1. Market overview and generational clients

The market overview should be presented from a broad perspective to specific details. Firstly, findings show the current situation in the market. P2 mentioned, “... the Agtech sector is currently experiencing a 'financing winter,' marked by a significant decline in capital availability. This reduction is the lowest in six years, even when excluding the pandemic-affected years of 2021 and 2022, according to the latest AgFunder report...” S14 concurred with P2, noting that “... as the economy contracts, Agtech startups face frequent closures. This shift from a period of low capital costs and abundant liquidity has led to many startups struggling as they adjust to the new financial constraints...”

Secondly, findings reveal that the dynamics of Chile’s economy significantly influence the market conditions that startups like Done Properly must navigate. For instance, Done Properly needed to develop a bioreactor for their innovative food—typically used in the pharmaceutical industry—but faced obstacles due to the local industry structure. As S13 noted, “... here there are commercial pools, there are no pharmaceutical companies, medicines are not produced here; they are imported and distributed...” This highlights a critical barrier for AgriFoodTech startups that want to engage in specific industries, as external factors impact them from the start.

Regarding specific market details, findings show that there are two markets in Chile: the horeca market, which covers restaurants, catering, and food service, and the retail market, which includes supermarkets. Retail can be challenging for AgriFoodTech startups, as S14 stated: “... competing for shelf space is challenging, especially for single-product companies that lack the scale and

resources to maintain a constant presence and organization. These smaller companies struggle to ensure their product is well-represented and not displaced by larger competitors...” This indicates that external factors are already impacting AgriFoodTech startups.

Clients play a crucial role in shaping the opportunities and challenges faced by AgriFoodTech startups entering the Chilean market. The attitudes and perceptions of customers, farmers, and producers significantly influence the success of these startups. Most interviews show that “... convincing individual producers to try something new is very difficult because it is a very traditional industry, very conventional, and very much about learning by doing, and inheritance...” (S19). While convincing potential clients, as S12 stated, “... the adoption of technological innovation in the agricultural sector is challenging and slow, requiring patience, long sales cycles, significant effort, and constant customer engagement, leading to resource depletion...” Therefore, resistance to technology adoption or skepticism from these groups can create substantial barriers.

However, a common trend behind this resistance is generational. As S8 noted, “... the younger generation adopts technology more easily; even though we end up closing contracts with older people, they often find it more challenging to do so...” Understanding and engaging with these producers and/or consumer actors is essential for startups to navigate the market effectively and foster a supportive environment for technological advancements in the AgriFood sector. As S1 stated, “... in technology, the market fit issue is being able to find a solution that solves a market problem and that the market is willing to pay for. That is the biggest problem...” This dynamic interaction can either empower emerging startups by providing a ready market for their innovations or hinder their progress if societal stakeholders are not aligned with the technological developments being introduced.

Findings also show that customer misinformation is a challenge for the industry. As S11 stated, “... another factor is cultural, because our technology also reaches the rural world. Beekeepers in Chile, for instance, are mostly from rural areas, so this means that, besides being traditional, they handle very little information in a broad sense...” G2 concurred with S11, noting that “... the acceptability of clients and society in general is also an issue, as there is a lot of misinformation about synthetic products. People are often unaware of what they are consuming, and there is a lot of misinformation...” Thus, these aspects affect the perception of innovative products offered by AgriFoodTech startups.

6.2.2. Socio-cultural factors

In Chile, a social outbreak occurred in 2019. Findings show that this event impacted not only startups but also the Agrifood industry. As S4 stated, “... We were also in a very important social context, the famous social outbreak that occurred here in Chile, which put us in a situation of great food insecurity. This was compounded by the increase in the price of fourth-range foods...” S12 concurred with S4, noting, “... in 2018, I began to enter the market, and then in 2019, there was

a social outbreak in Chile. Everything was on stand-by; you could not go out to the street. It was chaotic...”

Additionally, the Covid-19 pandemic, which began in 2020, affected everyone. Findings indicate that this was also challenging for startups. As S12 stated, “... The pandemic severely impacted my business because it relies on in-person demonstrations and testing of physical products, which became challenging without face-to-face interactions...” S13 agreed with S12, saying, “... Imagine the pandemic for a company like ours, which makes products that need to go to the laboratory, and then we could no longer go...” Therefore, these events directly affected AgriFoodTech startups.

Another relevant challenge that emerged from the interviews is gender-related. A common trend among AgriFoodTech startups led by women is that “... women in entrepreneurship often face greater scrutiny than their male counterparts. They encounter more doubt and questioning, which impacts their interactions and opportunities. Sometimes, deals are harder to close without male team members, highlighting the gender bias that persists. Despite these challenges, women continue to persevere, but the disparity is evident and supported by statistics...” (S18). However, this is not always the case; sometimes, female entrepreneurs receive a positive response from the market. As S19 stated, “... I do not come from the Agro sector; I am a doctor in biotechnology from the University of Chile. Those credentials provide a certain level of assurance. Once people get involved and see what we do, they recognize the seriousness with which we approach our work, the science behind it...” Therefore, gender presents a dual perspective when it comes to supporting AgriFoodTech startups led by women.

6.2.3. Interaction of support institutions

It is important to recognize the external support that AgriFoodTech startups receive. In Chile, institutions such as CORFO provide support through their Entrepreneurship Division and Start-Up Chile. Details on how each of these programs provides support are shown in Table 11.

Entrepreneurship Division in CORFO	Start-Up Chile
Started in 2012.	Started in 2010.
Gives subsidies to innovative entrepreneurs not necessarily in technology for the different stages	Gives subsidies to innovative entrepreneurs in technology or science-based startup for the different stages
Create incubators, accelerators, mentors and investors networks.	Investors network, connect angel investors, VC and international accelerators with startups their thesis of investment.
Around 300 up to 400 startups being funded each year in the different stages	Around 150 not more than 200 startups being funded each year.

Support a lot of technological centers	Mentor networks to pair startups with corporative mentors.
Portfolio focused more on IT.	Diverse portfolio.
Funds are limited and focused more the business model and how startups reach the markets and pricing strategy	Did not mention.
Ask startups for compulsory activities regarding sustainability and start using indicator to measure the sustainable impact	Do not ask startups for obligatory measures, it just offer academies with sustainability formation.

Table 12: Characteristics of the two main programs that offer CORFO to support startups in Chile (Own table from interview G1).

Most of the interviewees recognized the work done by CORFO. For example, S12 said, “... CORFO is really a great partner for all the startups that are beginning because it gives you the support you need if your idea is good...” Similarly, S2 stated, “... CORFO, for example, is world-class in terms of entrepreneurial support. They understand very well what the needs are, they are fast, and the money is available and reaches many startups. It helped us a lot, so in that sense, it was very good...” Recognizing that these institutions are well-structured and backed by the government, their support extends beyond financial assistance.

They also play a crucial role in facilitating connections among various stakeholders within the ecosystem. This comprehensive backing ensures that startups not only receive the necessary funding but also benefit from a network of collaborators and resources, fostering a more integrated and supportive environment for innovation and growth. This can be seen in the case of HoneyPro, which noted, “... through our services, we can access alliances with producers, which allow us to obtain small funds and connect with investors. This year, we are working hard to approach them through Start-Up Chile and CORFO linkage. For example, we have been participating in some events, ProChile is also supporting us strongly, and the Transforma Alimento project has provided additional support through the innovation catalog...” (S11). Another example is S8, who said, “... The most help has come from Start-Up Chile, funded by CORFO. It offered an extensive network not available with other CORFO funds. Although we didn’t receive immediate funding, Start-Up Chile's incubator and accelerator provided valuable visibility and access to key contacts, significantly accelerating our progress...” Then, this support entity is essential in developing AgriFoodTech startups in Chile.

Entities like Start-Up Chile play a crucial role in fostering a supportive environment. They recognize that the challenge lies not only in creating an ideal sustainable product but also in developing a sustainable business model. G1 stated, “... we are strongly promoting the idea that sustainability is about how you do things rather than just what you are doing. It involves social, economic, and environmental sustainability, and we need to change that mindset...” They understand the importance of building a robust and viable business foundation to ensure long-term success and sustainability.

Despite their strengths, governmental institutions like CORFO also have weaknesses in understanding the development and growth in the agricultural sector. This was highlighted by S2, who mentioned, “... CORFO knows a lot about startups and innovation, but it does not know much about agriculture. As a result, it doesn’t understand how to provide appropriate funding and expects you to grow as a Fintech or retail tech company, while agribusiness evolves more slowly and has different implications...” Additionally, some startups see gaps in the programs offered. As S11 pointed out, “... Some funds have rigid structures despite their focus. It is crucial to have an evaluation matrix that considers the broader impact of projects, not just their immediate goals, to better assess their environmental impact and overall significance...” Therefore, these programs can also be limited in some aspects.

Moreover, programs like those of CORFO can sometimes be counterproductive for AgriFoodTech startups. S12 mentioned, “... It may even create a perverse incentive in some cases, where companies rely solely on CORFO support and find it very difficult to market their solutions or sell directly...” Therefore, while CORFO provides support, it also imposes limitations on AgriFoodTech startups' ability to evolve.

Although participation in SNA programs does not always result in financial awards for AgriFoodTech startups, involvement can still lead to valuable connections. For example, Farmtastica mentioned, “We didn’t win the contest organized by the National Society of Agriculture in Chile, but we made a valuable connection with the Fraunhofer Foundation. This partnership led to collaborative projects that produced modules for both Walmart and the Municipality of Quinta Normal...” (S7). Thus, these institutions not only provide direct support but also open doors to other types of assistance.

6.2.4. Financial entities support

One of the most significant challenges AgriFoodTech startups face is securing funding. As G2 noted, “... Scaling up disruptive innovations is a major challenge because it requires significantly more financing to validate and bring these developments to market compared to traditional innovations...”

Firstly, while public funds are available, securing them is not always easy or suitable for all startups. AgroUrbana experienced this firsthand, stating, “... We applied for several funds but received harsh and unfounded rejections, leading us to reconsider applying for public funding...” (S14). Even though public funds depend on government decisions, S14 noted, “... despite applying through various government channels, we consistently receive negative and poorly evaluated responses...” Then this case was a clear barrier for the startup.

Secondly, public funding can be contradictory. AgrolInventario mentioned, “... some public funding applications are contradictory because they require you to cover expenses upfront before receiving the funds, forcing you to find alternative financing...” (S8). S5 agreed, saying, “... obtaining funds requires demonstrating results, but producing results needs funds, creating a complex situation where developing innovations and seeking capital simultaneously becomes difficult.” Then, sometimes this support is not feasible for some startups.

Understanding that not everyone wins a public fund, entrepreneurs turned to other ways for securing financial support, it is through venture capital, angels or 3F funds (Family, friends and fools). However, as S2 pointed out, “... reaching out to funds is challenging due to a lack of accessible information and assurance of a response. Without a clear contact process, standing out among numerous requests is difficult, and finding investor data is also problematic...” Fundraising is time-consuming, as S13 described, “... raising money is like a sales process. To secure funding from a few investors, you often need to approach hundreds, with a conversion rate of 1%...” S12 concurred, stating, “... it involves scouting for investment funds that fit your core business, making calls or sending emails to explore possibilities...” Therefore, raising funds is always a challenge to startups.

It is worth noting that actors like 3F provide more than just financial support. For AgrolInventario, family investors offer valuable guidance: “... Our family investors, who are older and experienced, provide a mature perspective that helps us make more measured decisions. Their guidance and calm behavior are invaluable...” (S8). Then, these financial actors not only provide financial support but also guidance in their development.

In Chile, the landscape for AgriFoodTech startups is evolving. S12 observed, “... Venture Capital in Chile has matured significantly. Initially, investments were based on general interest, but now the industry has become more specialized, with boutique funds focusing on specific categories...”

However, a significant gap remains. Many venture capitalists and angel investors misunderstand agriculture, setting unrealistic expectations. S2 noted, “... many VCs set unrealistic demands, making it difficult for agricultural startups to secure funding, as VCs often expect quick returns that aren’t feasible in this sector...” Similarly, P1 highlighted, “... Venture capital may not always fit Agtech and Foodtech companies due to their longer development timelines and unique challenges...” Therefore, providing some knowledge behind the sector can make the difference.

Selecting the right funding approach depends on the startup’s stage and needs. S12 stated, “... While seeking 'smart money' that offers both capital and expertise is ideal, sometimes securing any funding becomes critical, especially if facing significant debt...” S18 agreed, emphasizing, “... smart money is crucial because a poor investor can add more pressure than value. It’s important to choose investors who align with your goals and can offer additional skills and capabilities...” Then, entrepreneurs want to not just receive the funding but also align with their business values.

Additionally, the geographical location of startups can be a barrier. CORFO acknowledged this, saying, "... investors often prefer to be physically close to monitor daily operations. A one-hour flight distance can still be a barrier, so bridging this gap is a key challenge..." External challenges may limit investors' ability to engage with these startups.

6.2.5. Gaps in building a collaborative network

Having a network with the right contacts is crucial for AgriFoodTech startups, as it significantly enhances visibility. In Chile, institutions like INDAP pose challenges for AgriFoodTech startups due to their rigid work plans and lack of incentives for engaging with new innovations. As S2 noted, "... INDAP presents challenges due to its resistance to change and extra workload, limiting startups' access to farmers and opportunities..." Then, this network holds significant potential for exploration.

Transforma Alimento plays a key role in networking by fostering public-private consortia and connecting startups with academia and businesses. G2 mentioned, "... Initially, we focused on building connections. As companies sought to showcase their innovations, we created an innovation catalog highlighting the top 50 innovations annually..." They connect different actors that AgriFoodTech startups need to thrive.

However, geographic distribution adds complexity. G1 highlighted, "... Acceleration programs are centralized in Santiago, making it difficult to reach startups outside this area..." This geographical barrier poses additional challenges for startups.

Networking with academia has been beneficial for some startups, providing valuable insights and opportunities, as noted by S7: "... Partnerships with universities have helped us gain insights and support academic projects..." Conversely, some startups find this connection less useful. S8 observed, "... Early-stage programs often blur the lines between startups and SMEs, lacking clear differentiation..." Therefore, universities collaboration can be beneficial for some startups but may be less effective for others.

On the other hand, the findings indicate that The status quo also hinders networking. S12 stated, "... In Latin America, those of higher social status often have better networking opportunities, affecting investment sectors..." Centralization of contacts in metropolitan areas impacts network-building, as S18 experienced: "... It was challenging to connect with companies outside the capital, requiring us to expand our networks...". Building a network involves navigating various challenges and obstacles along the way.

However, this collaboration is not only aimed for the AgriFoodTech startups but also for the farmers in Chile. This is a finding in Agrapp as he stated that "... Universities are crucial in the agricultural ecosystem as they provide essential knowledge to farmers, particularly in regional areas where agricultural technicians are trained. Their role in technology and knowledge transfer is significant and often more important than entrepreneurs might realize..." (S3). But also, this

collaboration with farmers could have a different approach as the market also influences this “...collaboration tends to be limited when producers are focused on local markets, as they often compete directly with each other. This contrasts with producers who supply global markets, where collaboration is more common.....” (S14). Therefore, while there is potential for collaboration with farmers, challenges remain in addressing all aspects comprehensively.

Private entity partnerships offer valuable resources. S13 noted, “... 100+ by AB InBev provides extensive support, including resources and expertise...” S3 agreed, emphasizing the professional development provided by programs like 500 Startups. However, collaboration between large companies and startups remains a challenge, with significant gaps between large and small producers. G2 pointed out ...the issue of articulation and collaboration between large companies and startups, and vice versa, remains an unresolved issue...” Then the need for tailored plans to address these gaps is acknowledged.

When it comes to collaboration among startups, findings reveal mixed perceptions. AgriFoodTech startups, being unconventional businesses, exhibit unique behaviors and thought processes that distinguish them from traditional enterprises, this is seen when S8 stated that “...entrepreneurship is unique because it relies heavily on collaboration and support from others. Unlike traditional companies, where work can be more isolated, startups thrive on collective help from friends, meetings, and networking, with founders contributing a small fraction of the overall effort...”. However, in a new and innovative sector can be insecure to share technical information among AgriFoodTech startups, most interviews show that “...Forming alliances has been challenging, requiring numerous meetings. Many are protective of their knowledge and data, often preferring to keep their information and collaborations secret, which complicates the process...” To foster a collaborative network, significant effort is required behind AgriFoodTech startups.

6.2.6. Internal support

AgriFoodTech startups require not only external support to develop and create value but also strong internal support from their team. Developing a successful business demands internal collaboration across various areas, including commercial, technological, and financial departments. Recognizing the importance of diverse internal expertise ensures that the startup can effectively address challenges and leverage opportunities in each aspect of the business. Findings show this when S1 stated, “...to help from technology to the delivery of products so that the commercial team could sell them, then to accompany the commercial teams to be able to sell the products...” However, this collaboration should come from the background of the founders, as the trend in the findings shows, “...I stress the value of diverse competencies alongside shared values. Our team blends 30 years of agricultural expertise with 20 years in computer engineering, featuring a PhD in agronomy for R&D and a focus on technology and automation, enabling us to push

scientific and technological boundaries effectively...” Thus, working towards the same goal requires different disciplines and internal effort.

Moreover, findings show that having a strong team that works towards the same goal is crucial. As stated, “...The team has shown remarkable resilience. The name ‘Done Properly’ reflects their commitment to high standards and has driven them to persist and succeed. The entire team has been crucial in advancing the company...” (S13). S14 concurred with S13, noting, “...When faced with a problem, the team focuses on finding solutions rather than dismissing the issue. They adapt and experiment with various approaches, such as adjusting temperature or using a fan, which contributes to the company's dynamic and proactive nature...” Hence, having a strong support system is crucial for startups to effectively tackle challenges.

Internal conflicts are not only seen in startups but also in governmental institutions. This is evident when G2 stated, “...we face limitations with the institutional framework of Transforma Alimentos, as we are currently evaluating the best legal structure—such as a foundation or corporation—to support our growth. We are dealing with 'growing pains' and need a more robust legal foundation to effectively manage our activities and challenges...” Therefore, organizations aiming to support AgriFoodTech startups are also struggling with their own internal challenges.

6.2.7. Mentorship from external entities

Entrepreneurs see mentorship as vital in their process, as it provides industry-specific guidance. This is the case for Transforma Alimento, as mentioned by G2: “...prepare them for pitching in financing rounds so that they can present themselves before a corporate or a large company and show what their innovation is. Yes, we do direct mentoring as well as what our capacity allows...” Moreover, private institutions like Mumulkan contribute to this matter, as they are perceived as a bridge for creating solutions: “...we act as brokers or, let’s say, advisors, serving as a bridge that allows us to generate customized solutions by understanding very well the problem of the client company or end user...” (P2). Another tool available in Chile is the acceleration program offered by Start-Up Chile, which consists of: “...During the acceleration program, we pair startups with one or more mentors based on their stage and provide ongoing feedback from a technical executive. We facilitate learning from peers and offer opportunities for startups to interact with executives and CEOs from large corporations, enabling them to present their ideas and receive early feedback on their products and market positioning...” (G1).

Findings show some examples of this mentorship from Transforma Alimento. For instance, “...Our vision initially focused on using technology to feed bees, but we were advised to shift our perspective. We redefined our goal to optimize crops, which in turn improves crop quality, reduces food waste, and supports pollinators. This broader objective significantly changed our approach and messaging...” S3 concurred with S11, noting how mentorship helped lower monthly revenue: “...We realized the onboarding process was too demanding, requiring significant training and integration effort from our team. To address this, we streamlined the onboarding process to reduce

friction and resource expenditure, which helped improve the sales process and customer retention...” Mentorship is essential for startups to gain support and overcome challenges.

Nevertheless, to capitalize on these mentorship opportunities, founders highlighted that “...Intensive mentorships with frequent sessions, such as once or twice a week, are more effective than infrequent ones. They provide deeper insights and more actionable recommendations, unlike more superficial advice from less frequent meetings...” (A2).

6.2.8. Competition

Findings indicate that the competitive landscape in Chile's AgriFoodTech sector follows different paths. First, healthy competition among players drives businesses to enhance their products and innovate continuously. This is the case for S11: “...A company has adjusted due to our involvement. Originally focused on liquid products, they now offer powder forms and have also shifted to providing more informative brochures...” On the other hand, some competitors remain highly resistant to sharing information and engaging with AgriFoodTech startups, as S8 mentioned: “...Some have been harsher, closing the doors a bit on receiving such data...” S12 also stated that: “...It is a super-concentrated market, where players are even willing to put up barriers to entry, sell at low margins or low cost, in order to prey on competitors...” Some competitors view these innovative products as an opportunity to enhance their own offerings, while others remain hesitant to collaborate closely with AgriFoodTech startups.

Secondly, since many AgriFoodTech startups offer innovative products and services, competition is often minimal or nonexistent. ComeS startup stated that: “...I think we do not have many competitors in Chile. There are a couple of companies; some have tried, and some are no longer there...” (S18). S19 also mentioned: “...I have not yet come across any company that feels like a 100% competitor...” S13 concurred with S19: “...we have no competitors in Latin America or the southern hemisphere because the big competitors are not serving this market...”

Thirdly, findings show that competitors can be seen from a different perspective: “...In an incipient market, there is room for all players to offer their solutions as there are many solutions that address different needs for farmers. Even other competitors can become your potential clients...” (S3; S19). Most interviews show that: “...I think it is more a matter of learning and effort to innovate and do things better. I see it more as an incentive than a competition...” (S18). Therefore, competition has both pros and cons for startups.

6.2.9. Technology and infrastructure

Most interviews show that AgriFoodTech startups are well-equipped with technological knowledge, but other technical areas, such as commercial skills, are highly lacking: “...The startups here in Chile, in general, have a great technical component. They are technically robust because people are highly trained here in Chile from a technical perspective. However, I think we are lacking

a lot in the commercial part; these are the challenges faced by, I would say, most companies here in Chile...” (S12). This technical issue hinders the development of the startup.

Additionally, findings indicate that to effectively support AgriFoodTech startups, various stakeholders—including government bodies, private firms, and financial institutions—should recognize that not all technologies within the innovation sector require the same foundational resources. For example, biotechnology often demands specialized tools and equipment. As S11 stated: “...Also in the development of new projects, the machinery or instrumentation needed for characterization, which is our part, is somewhat expensive for a normal startup...” S14 concurred: “...The same applies to vertical farming. Understanding the setting needed for vegetables to grow effectively, considering multiple factors such as the rack system, the hydroponic system, illumination, humidity, etc., is a matter of trial and error...” Therefore, challenges related to building technology are still present, and one reason most interviewees agree on is due to the novelty of the industry: “...In our case, it is a new industry, not more than 10 years old. The big producers are in Europe, where they produce to satisfy their demand. In Latam, there are just a few that are taking off...” (S13).

On the other hand, there are cases where a disconnection is evident between AgriFoodTech startups and knowledge and research centers when it comes to developing the technology itself. For example, S13 mentioned: “...When academics run tests and fail, nothing happens, but for a startup, if you fail, you risk your work...” This disconnection is not only about the method of testing but also the time frame. AgriFoodTech startups often have shorter time limits, while research projects have longer timelines. As S13 noted: “...What happens with Chilean academia is that when you seek solutions, something you want to solve in three weeks, they propose it in an 18-month project, so it doesn’t work for me...” This is a clear evidence that academia can be an obstacle for startups to develop.

Findings also highlight other technical challenges faced by entrepreneurs from CORFO and Transforma Alimentos perspectives. P1 stated: “...Some startups overly focus on a single product rather than developing a technological platform. To foster more systemic growth, it's crucial for these companies to evolve from a single-product focus to creating multiproduct platforms or platforms that are products themselves. This shift enables broader development and scalability...” Startups are again not seeing the commercial opportunities. Moreover, P2 noted: “...What we are lacking is how these companies prepare themselves to attract investment funds for financing rounds, both in Chile and globally. I think that is still lacking...” Thus, limitations from both academic and public or private entities are directly impacting the infrastructure development of AgriFoodTech startups.

It is worth mentioning that a specific technical challenge arises from the AgroTech Chile Association interview when it comes to data management: “...When a company that handles valuable data goes bankrupt, the primary concern is determining the ownership and fate of the data—whether it belongs to the defunct company or the client that hired them...” (A1). There are, therefore, several technical issues affecting startups.

6.2.10. Regulatory game changers

In Chile, findings show that policies do play a crucial role in boosting AgriFoodTech startups. This is the case for S4, who stated that “...a new law on corporate responsibility will introduce stricter regulations on consumption and traceability, emphasizing the need for comprehensive tracking of materials used in products. This law will require businesses to adopt traceability policies...” Moreover, laws related to the salmon industry also affect AgriFoodTech startups that provide innovative food, as seen with S9 and S6: “...Chile’s new law mandates that major salmon farmers and feed producers begin replacing a portion of their fishmeal with alternative protein sources...” (S6). Therefore, startups that are already implementing traceability or providing alternative food are one step ahead in the future market.

Another example of policies that encourage businesses to be involved in R&D or sustainability is when P2 stated that “...to promote R&D, apply for programs like CORFO’s Create Value but also utilize Chile’s R&D law, which offers tax incentives to companies, encouraging enthusiasm, such as from fruit exporters...” Moreover, the two public policies mentioned by S4: “...The first is the policy towards sustainable agriculture, and the second is the food security and sovereignty programs. These initiatives are promoting a lot of open resources...” Policies like these should support AgriFoodTech startups.

On the other hand, protectionist policies, overly strict regulations, or limited budgets can suppress innovation by limiting access to necessary resources and markets. This can sometimes be influenced by political power, as G1 mentioned: “...It’s difficult because it always has had this connotation of focusing on sectors as a left-wing policy, while right-wing policies are more neutral, letting the market decide which areas are competitive or not...” G2 concurred with G1: “...We would like more specialization and encourage more specialization of these initiatives because, in general, it is quite broad, and that has to do a bit with the policies and governments in power...” This creates some limitations for AgriFoodTech startups.

Therefore, challenges in persuading political stakeholders to make an overall impact on national productivity have been limited. G1 stated that “...it’s hard to convince all political areas that innovation is important. Despite long-term policies and successful programs that have fostered new, productive companies, the overall impact on national productivity has been limited, leading to ongoing frustration about the slow progress...” G2 agreed with G1: “...Efforts to create a food ministry in Chile failed, underscoring the need for private sector involvement, academic input, and strong leadership in food policy, innovation, and sustainability to address challenges in food, waste, and agriculture...” Thus, changes in policies require time and effort.

Furthermore, effort for specific regulations is also challenging. As G2 mentioned: “...In Chile, the regulatory framework for food labeling currently mandates that all food must meet basic health standards. However, this does not extend to functional foods, which offer additional health benefits beyond basic nourishment...” Also, S5 stated that “...developing innovative products in

Chile is challenging due to stringent regulations by the Agricultural and Livestock Service (SAG). Compliance with both domestic and international regulations is time-consuming and resource-intensive...” S9 concurred with S5: “...Chile has a certification and monitoring system for introducing species, so understanding and navigating the regulatory requirements was challenging...” Lastly, when regulation is not in place, it is also challenging. S14 stated: “...Inspecting all farms producing fresh vegetables is impractical due to their large number and the lack of inspector capacity. Food safety reports often highlight issues with pesticide use and water quality, which consumers face daily...” Hence, AgriFoodTech startups encounter significant constraints when navigating these regulations.

6.3. Results SQ3: The potential impact that AgriFoodTech startups have in Chile

Following the same factors from Section 4, and with the relevant questions posed in the interview and shown in Appendix D, we can better understand the enablers through which AgriFoodTech startups potentially impact the food ecosystem.

6.3.1. Enablers of innovative solutions for the market.

The social outbreak and the pandemic led to the extinction of some startups, but “...just as some died during the pandemic, others were born and remodeled...” (G2). This is the case for S11, who stated that “...the pandemic came, and we reinvented ourselves, leading us to collaborate with beekeeping experts. This resulted in identifying beekeepers' needs, developing food formulations, and ultimately creating an emergency nutritional supplement for bees...” This was also the case for S4, who mentioned that “...the company was formed after the pandemic, taking advantage of water and food security issues...”. Thus, entrepreneurs overcame external factors that occurred nationally or globally.

Furthermore, findings indicate that startups provide solutions that impact the market directly. For example, S14 stated, “...the farmer, suddenly, faces a frost, and I don't have the product. The people failed, and it didn't arrive. For the food service world, this is a headache. With greenhouses and vertical farming, they offer a more resilient solution to the food service industry...” S5 added that “...we aim to generate innovation that is sustainable, effective, and efficient, not only in the market but also in the application of science or production, in this case, agricultural crops...”

On the other hand, recognizing the challenges in reaching farmers and the market with new technologies, startups have had to adopt alternative marketing strategies. As S4 stated, “...otherwise, we had to show people that this existed. We attended many fairs, events, and physical instances, gave school talks, and presented on hydroponics. We used digital marketing strategies...” Thus, startups are finding ways to reach the market despite the challenges.

Lastly, innovative solutions in Chile are attracting international attention. As P1 stated, “...There are people from Israel who see Latin America as their main market. Although it has been a

small market, there is significant interest in technology entering this large agro-export market or the consumer market in Latin America...”. Therefore, AgriFoodTech startups are creating opportunities not only for Chile but also for the regional market.

6.3.2. Resilience, resourcefulness and DNA change

Findings show that the entrepreneur’s attitude and proactiveness are important throughout the development of the startup. Acknowledging the ups and downs this path brings, resilience is the key to the business thriving, as S2 stated: “...To secure investment, leverage your network by asking known VCs for referrals to other interested investors. This approach of obtaining warm introductions is far more effective than sending cold outreach emails...” Furthermore, recognizing the fundraising challenges for startups, Done Properly developed a capital-raising blog³ due to their experience: “...I have a blog where I write about raising private capital for biotech companies. Although it’s very specific, many people read it and find it valuable because you can measure the maturity of an ecosystem by seeing how many companies raise private capital from other ecosystems...” (S13). This proactiveness creates value among AgriFoodTech startups.

Also, a common trend among successful entrepreneurs is that “...successful founders share the characteristic of resilience, persisting despite challenges. They adapt by acquiring necessary skills or partnering with knowledgeable individuals, emphasizing the importance of determination and smart networking over having all expertise from the start...” (S8). This point can be summarized when G2 stated: “...startups possess a unique vision and sense of purpose beyond typical business goals. Their resilience and risk-taking are notable, often reflecting a different DNA in them...”

Finally, entrepreneurs who are already familiar with the challenges faced by AgriFoodTech startups want to impact the ecosystem from a different perspective. This is the case with Mumulkan, which develops consulting projects for agribusiness companies, drawing on their experience with Notco and Concha y Toro: “...we focus on selecting suitable digital technologies to solve real agribusiness challenges and collaborate with startups to validate their technologies through pilot projects and success stories. Our support includes R&D, co-development, and offering education and training programs to enhance digital competencies among agribusiness professionals...” (P2). Therefore, all of this has a huge impact on the future of the AgriFood industry.

6.3.3. Proactive networking and tailoring their own path

Understanding how hard it is to find investors, entrepreneurs need to have different approaches to reach them. One approach is the pitch they establish to attract investors; however, it changes depending on the alignment they have. For example, S2 mentioned: “...we tailor our project highlights to align with specific venture capital themes, such as focusing on electric tractors

³ Capital raising blog link from the startup Done Properly <https://sidepathway.substack.com/>

for an electromobility fund or emphasizing small farmer sustainability for impact funds. Despite these adjustments, the core content of the presentation remains consistent...” Also, when it comes to finding accelerators and VCs, values, vision, and purpose are essential, as S11 stated: “...we are engaging with Ganesha Lab to strengthen our connections with venture capital while staying true to our mission. We seek investors who share our values and long-term goals, particularly those familiar with or involved in the agricultural sector...”. Therefore, startups are adjusting their paths to find support.

Moreover, findings show that financial support could come through debt if the startup has a well-built plan with secure cash flow. Banks can provide loans to start the business, as S2 mentioned: “...Suddenly, startups do not see it as an option because getting into debt is always complex, but if one manages to build a very secure flow and show the bank that I have the customers, I only need the capital to start it up, it is a very good alternative to the issue of debt...”. Different ways of tackling their challenges generate new opportunities for startups.

The creation of AgroTech Chile by members from startups brings a network to the table. A1 stated: “...the partners are very active, all with backgrounds in startups or small companies, allowing them to handle multiple tasks. Leveraging their networks and driven by a shared desire to help others, they quickly pooled their knowledge and moved forward swiftly. Decision-making has been easy and aligned, resulting in a rapid and dynamic formation process...”. These founders understand the importance of collaborating with key entities like SNA. Findings show that “...we implemented this first co-work at SNA in the center, with the objective of promoting innovation and getting young people excited about the use of technology...” (A1). This is an attempt to start building collaboration and networking with traditional institutions. G2 concurred with A1: “...positive developments are occurring, such as startups sharing office space with the 100-year-old SNA guild. This proximity fosters optimism and collaboration, showing that business connections and exciting interactions are taking place...”. However, this association is not just about opening spaces but also about addressing challenges like data management. Findings show that “...we could act as a pseudo-data authority, serving as a private data bank beneficial for academic and other purposes. Instead, the data would be managed, preserved, and made accessible for use by other entities, ensuring its continued utility and connectivity with other solutions...” (A1). All of these actions are impacting the industry in different ways.

Despite AgroTech Chile's vision, findings indicate a lack of involvement with farmers. As S14 pointed out: “...I think Agrotech, if you look at who is in it, they are mainly agricultural solution providers. They don't have farmers...” Recognizing that the creation was initiated by founders of AgriFoodTech startups, the main actors—farmers—are left out, which is a fair point to acknowledge.

Another notable development revealed by the findings is the progress of establishing the Patagonia Biotech Hub. As S20 stated: “...a group is working to establish the Patagonia Biotech Hub, a collaborative space in Patagonia involving governments, entrepreneurs, and universities. The hub will feature coworking offices and a laboratory for small entrepreneurs with innovative

biotechnology ideas but limited resources. It will also include angel and venture capital presence to support these initiatives...”. However, findings show that the same problem persists with the two associations mentioned earlier, as S12 stated: “...the disadvantage I would say has to do with the scarcity of resources we have to be able to carry out the initiatives we have in mind...”. Some work has been done to create networking opportunities, but there is still work to be done.

Findings indicate that CORFO understands the value of these associations and AgriFoodTech startups. They are also creating networking and visibility. As G1 stated: “...Currently, we are collaborating with major agricultural guilds, international embassies, and universities in Chile. Last year, we focused on raising awareness about our initiative. We are now advancing with in-person meetings and using social networks for outreach, including WhatsApp groups and email campaigns, leading to steady growth...”. G2 agreed with G1: “...we involve large companies in leading committees to recognize and engage with the broader emerging ecosystem. By connecting diverse sectors—such as wine exporters, food processors, and seafood producers—we want these companies to see themselves as part of a larger, integrated network. This task is challenging but essential for expanding their perspective and involvement...”. As a result, the impact of AgriFoodTech startups is gaining significant attention at higher levels.

6.3.4. Driving collaborative alliances

Findings show that for AgriFoodTech to thrive, collaborations with various actors are essential. For instance, with suppliers, as S14 stated: “...the supplier that was working specifically on seeds for vertical farming was not developing specific genetics. They were evaluating what they had in other company banks for their own gain...” In this way, the innovation of AgroUrbana not only helps the supplier assess the performance of different seed genotypes but also helps find the most suitable seed for their hydroponic system.

Another example is collaborations with farmers in their commercial, management, and financial areas. As S18 mentioned: “...to support small producers seeking market expansion, we began offering financial assistance by advancing funds against future sales. This initiative helps them grow their business, and we also developed an integrated platform to support smaller food producers...” Not only can this type of collaboration help farmers, but thinking of creating collaborations with vegetable producers specifically, as S14 suggested: “...imagine a guild association of vegetable producers visiting farmers in the 7th region to integrate hydroponic and organic vegetable producers. This can gradually advance the industry...” This can be some examples to overcome these obstacles.

Moreover, findings indicate that using platforms facilitates these connections. As S18 mentioned: “...we made the platform as user-friendly as possible in terms of technology, trying to connect it, for example, through WhatsApp, so that they did not have to go to another interface. Something familiar worked very well; there is good communication there...” S11 concurred with S18, stating: “...our primary communication tool is WhatsApp, which allows for direct and personal

interactions. We have integrated WhatsApp into our website to facilitate this communication, making it more immediate and helping users feel closer to us...” LinkedIn is also a useful tool for connections. S19 indicated: “...I use LinkedIn extensively as a crucial platform for visibility and networking. It has been instrumental in publishing content, maintaining a strong presence, and easily contacting companies or individuals. The response rate to my outreach efforts on LinkedIn has generally been quite high...” This is not only from the entrepreneurs' perspective but also from the private sector.

Findings show that collaboration with other startups helps their commercial areas. As S3 stated: “...we aim to leverage existing customer relationships by connecting them with relevant solutions, such as water solutions, and sharing commercial insights to see how these opportunities develop...” However, G2 concurred with S3, noting that new ways of collaboration among competitors are emerging: “...we are talking with companies that may be competitors in alternative protein issues, and they are working together. It’s impressive to see, and I wish we had that everywhere...” Also, the presence of private businesses like Mumulkan is already impacting the food ecosystem. As P2 mentioned: “...Drone Dynamics, which provides image analysis services, is also linked to a Spanish software company. We have a triangulation between a Spanish company, a Chilean startup, and us as brokers or advisors, acting as a bridge to generate a customized solution, understanding very well the problem of the client company, such as fruit exporters...” Therefore, strengthening collaborations toward a larger goal is crucial in this field.

6.3.5. Future scholars and farmers

Findings show that it is also a challenge for academia to train new generations of farmers. As A1 stated: “...we can provide tailored training courses on topics like fruit growing and horticulture, using our database to match specific needs. Our focus is on equipping agronomists with skills to interpret and use data effectively, ensuring they can make informed decisions based on real data and navigate complex datasets...” S14 concurred with A1, stating: “...To drive long-term change, we must train the next generation of farmers to understand industrial processes and embrace technology. Despite being in the early stages, aligning with trends in climate, water, and consumer preferences requires a focus on education and innovation...” This suggests that changes in the education curriculum could impact the development of AgriFoodTech startups.

Hence, findings show that adopting concepts like Agripreneurs would positively impact this sector. As A1 stated: “...FAO has this concept of Agripreneurs, who are basically agronomists or similar professionals trained in sales. They know more than one solution and several solutions, and they have the tools to sell and channel them much better than a single company. It’s a very good model for selling a larger portfolio of solutions...”

Findings also show that Mumulkan, as a consulting firm, acknowledges the needs entrepreneurs have at different stages of startups. With experience in the startup field, they offer: “...a diploma course online in collaboration with UCES University, targeting mid-level agricultural

professionals. It covers emerging digital technologies like AI and blockchain and methods for managing digital transformation in agriculture. The course is taught by both academics and industry experts...” P2 noted that courses like this aim to positively impact the agricultural ecosystem.

Considering the labor force, findings indicate that AgriFoodTech startups are having an impact. As S14 mentioned: “...young people who are not traditional farm workers are crucial for addressing agricultural labor shortages. They live in cities but work in agriculture, returning home each evening and spending weekends with their families. This approach provides a forward-looking solution that integrates with the needs of current agricultural workers...” However, a similar trend is occurring in the construction sector, where: “...many young people from the construction industry are shifting to agriculture due to its more predictable schedules, fewer risks, and year-round stability compared to the seasonal and high-risk nature of construction work...” (S14). This represents a significant impact on the workforce in Chile.

6.3.6. From policies to innovation

Findings show that startups in Chile are already impacting the state due to their policies for innovation. As G1 stated: “...Since 2018, the government has seen a return on investment from startup programs, with IVA (Value Added Tax) revenues exceeding the accumulated costs of the entrepreneurship policy...” Additionally, when governmental organizations need to make decisions regarding AgriFoodTech startups, they seek some guidance. As A1 stated: “...we assist organizations like ProChile, FIA, and Sofofa by providing crucial insights into the ecosystem, including company locations, activities, and development levels, helping them make informed decisions...” Thus, startups are being referenced at the state level.

Furthermore, findings indicate that implementing global indicators for AgriFoodTech startups can have an impact, as Arpegio is doing: “...in the initial stage, we require startups to identify key indicators they should measure, align these with their theory of change, and match them to the SDGs. For those progressing, especially those already selling, we expect them to measure these indicators for the first time...” (P1). S20 concurred with P1, noting: “...being part of B corporations gains strong commitment from customers and suppliers by demonstrating dedication beyond legal requirements. They focus on doing things right, considering not just financial results but also environmental and social impacts. This is assessed based on both financial and broader impacts on the community, environment, and internal governance...” Therefore, global indicators can be a useful tool that AgriFoodTech startups can implement.

7. Discussion

The aim of this thesis was to gain insights into the challenges, limitations, and impact of AgriFoodTech startups in Chile as they work towards a more sustainable food system. This discussion will analyze the results for the sub-questions to address the overall research question: How do AgriFoodTech startups in Chile aim to contribute with their innovations to a more sustainable food system? The analysis will start by discussing the key players and their connections with AgriFoodTech startups in Chile (Section 7.1). It will then review the challenges, limitations, and impact using the MLP framework and the enabler theory approach (Section 7.2). Policy recommendations will follow (Section 7.3), with a focus on how AgriFoodTech startups act as niches for food ecosystem transformations (Section 7.4). Finally, limitations and future research directions will be addressed (Section 7.5).

The MLP framework (Germescheid, 2020), the enabler theory (Horne & Fitcher, 2022), and the startup ecosystem framework (Munglile Hillemane et al., 2019) provide robust models for understanding and addressing the key players and the multifaceted challenges faced by startups. These theoretical models are particularly effective for AgriFoodTech startups, offering a structured approach to analyze barriers and opportunities in Chile. The enabler theory emphasizes the role of both external and internal factors that can facilitate or hinder startups depending on the context. In contrast, the MLP framework provides a broader view by examining niche-regime interactions across social, technical, economic, political, and organizational aspects. Integrating both approaches allows stakeholders to better understand the obstacles faced by AgriFoodTech startups and to develop tailored strategies for contributing to a sustainable food ecosystem transition pathway.

7.1. AgriFoodTech startup ecosystem in Chile

The AgriFoodTech startup ecosystem in Chile involves constant interaction among the various actors. The connections between these seven key players facilitate the validation and testing of the technologies developed by AgriFoodTech startups, as well as the identification of improvements and new business opportunities. Thus, Figure 11 summarizes the principal actors in the AgriFoodTech startup ecosystem in Chile.

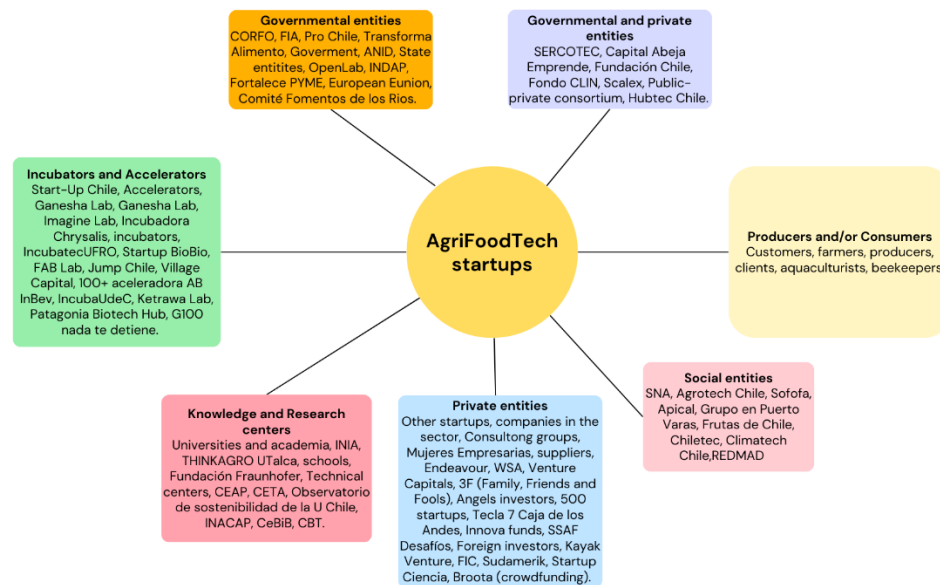


Figure 11: Overview AgriFoodTech startup Ecosystem in Chile (Own illustration).

Firstly, incubators and accelerators are involved in the early stages (pre-seed, seed, and early-stage). They provide support in critical areas such as value proposition development and business plan design. They also offer or contribute to training and courses on specific topics to complement entrepreneurs' knowledge. In some cases, they help with providing or finding financial

resources. Moreover, these entities have networks that facilitate connections with other actors, such as financial institutions and research centers, which can significantly enhance a startup's ability to innovate, grow, and compete in the marketplace. Despite their important role, incubators and accelerators have faced criticism for sometimes failing to secure final investment deals for startups. Entities like Transforma Alimentos have acknowledged this gap, noting that investment funds from ANID or CORFO are insufficient for initial funding and full market entry.

Secondly, given that AgriFoodTech startups are based on transformative technologies like farm management software and biotechnology, universities and research centers play a dominant role in this ecosystem. They provide talent, technology, and connections in the field. Chilean universities, for instance, are highly ranked according to Quacquarelli Symonds (QS) ⁴. Student clubs, academic knowledge, and practical opportunities such as research, prototyping, and testing ensure that students and entrepreneurs gain not only theoretical knowledge but also valuable assets for starting a business or supporting a startup.

Thirdly, the participation of private entities, such as venture capital firms, is evident in Chile. Many AgriFoodTech startups carefully evaluate the feasibility of their vision in terms of growth and revenue within a realistic timeframe. This assessment is crucial for evolving innovative concepts into sustainable and profitable business models in the agrifood sector. Partnerships with businesses like Walmart also support the development of innovative products from startups like Farmstastica.

Next, by leveraging the combined efforts of the public and private sectors, Chile has established a robust ecosystem that nurtures AgriFoodTech startups, enabling them to thrive and contribute to the country's agricultural innovation and economic growth. Key governmental initiatives, such as those led by CORFO, Start-Up Chile, provide essential funding, mentorship, and infrastructure support. The private sector, through investments and strategic partnerships, offers additional resources and market access, exemplified by entities like Arpegio and Mumulkan.

Additionally, Transforma and CORFO collaborate extensively with other incubators, investors, and academic institutions. These partnerships expand their network and enhance their capacity to identify and support promising early-stage enterprises and entrepreneurs. By fostering these connections, Chile ensures a continuous flow of innovative ideas and technologies, further strengthening the AgriFoodTech sector. This collaborative environment not only accelerates the development and commercialization of cutting-edge agricultural technologies but also drives substantial economic growth and sustainability in the agrifood sector.

Associations and social guilds are key actors in this research. They provide connections between AgriFoodTech startups and other actors and facilitate technical support and knowledge. Associations like AgroTech Chile, for example, are particularly valuable because they are managed

⁴ *Ranking where some of the factors evaluated are academic reputation, quality of students, international research network, among others, Chile is situated in the top 5 with 2 universities in the Latin region and recognized the work of 25 Chilean universities, one more from last year's analysis (Bas, 2023; Latercera, 2023)*

by entrepreneurs from the sector. These founders bring firsthand experience and insights, enhancing the support network for startups.

Lastly, it is strategically essential for farmers, aquaculturists, and beekeepers to evolve from being mere producers to becoming active clients. This shift amplifies the relevance and effectiveness of technological innovations and drives the overall growth and sustainability of AgriFoodTech startups. This inclusive approach ensures that technological advancements are practical, user-friendly, and directly beneficial to end-users, thereby driving widespread adoption and long-term success.

Consequently, the startup ecosystem overview provided in section 2.4 highlights TBIs as integral components within Chile's AgriFoodTech landscape. However, the analysis reveals a gap in understanding the specific roles of TBIs, particularly how associations and private entities like consultants leverage external networks to facilitate growth. The general overview by Mungile Hillemane et al. (2019) does not delve deeply into these specific functions, underscoring the need for further research on how TBIs support startups' sustainability and success.

7.2. Challenges, limitations and impacts

7.2.1. External Enablers

Policies from the government are external enablers for AgriFoodTech startups. A supportive political framework and well-thought-out policy environment are essential for nurturing innovation and entrepreneurship. This is the case of 'Ley Rep,'⁵ once the policy is implemented, businesses like AquaPlants that are one step ahead will have more opportunities to grow in the market. Another case is the certifications under the Aquaculture Stewardship Council (ASC)⁶. This measure seeks to reduce the environmental impact of the country's salmon industry and promote greener practices in fish feed production, such as Food4Future and INFOOD PROTEIN. Other policy

⁵ *The primary tool of this law is the Extended Producer Responsibility (EPR) system. Mechanism requires producers of priority products to organize and fund the management of waste generated from their products' marketing within the country (Gobierno de Chile, 2020).*

⁶ *"The Aquaculture Stewardship Council (ASC), fisheries and ASC Chain of Custody (CoC) standards help companies and organizations to promote and identify farm grown fish as having been responsibly produced" (ControlUnion, 2023). Legislation requires large salmon farmers and feed producers to begin replacing a certain percentage of ingredients in salmon feed with more sustainable components.*

examples include the policy towards sustainable agriculture from the Office of Agricultural Studies and Policies (ODEPA)⁷ and the National Strategy for Food Security Sovereignty⁸.

Moreover, international trade policies and bilateral agreements can open new markets for entrepreneurs. For example, the R&D Law in Chile aims to enhance the competitiveness of Chilean companies by offering a tax incentive for R&D investments, allowing them to reduce the first category tax by up to 52.55% of their R&D expenditures (CORFO, 2022). Therefore, some policies are in place to promote AgriFoodTech startups that are aligned with these programs. Following Bisang et al. (2019), public policies in Uruguay have a similar approach in promoting Agtech startups, with some initiatives where alternatives are being defined to offer entrepreneurs greater opportunities to grow and develop in the ecosystem.

On the contrary, regulations in Chile are often designed to support traditional food products, making it difficult for AgriFoodTech startups to navigate. The following regulations are limitations for AgriFoodTech startups:

- Agricultural and Livestock Service (SAG)⁹, the regulatory approval process for new products can be not only lengthy but also demanding in terms of administrative effort with documentation, testing, and other requirements
- The strict labeling requirements in the regulatory framework are not tailored for the innovative foods and ingredients these startups create. As a result, the 18 labels¹⁰ mandated create significant limitations to market entry and competition, as they do not accommodate the unique benefits of these products.

Therefore, these regulations are enablers that create significant barriers for startups, which often operate with limited budgets, staff, and guidance.

A similar scenario is described in Bisang et al. (2019) regarding Argentina, where public policies for Agtech lack alignment and do not provide a clear roadmap or defined objectives necessary for supporting the development of the sector and its technologies. The government should continuously adapt and refine its policies to respond to the dynamic needs of the

⁷ Centralized public service, reporting to the President of the Republic through the Ministry of Agriculture, it carries out various initiatives to promote more sustainable agricultural systems, which are Energy, Agrifood heritage, Food loss and waste, Genetic resources, SIRSD-S) and Sustainability in production systems (Minagri, 2022)

⁸ The strategy aims to enhance current and future food security by valuing food producers and promoting sustainable food systems. Developed collaboratively by public and private sectors, it reflects the government's commitment to ensuring the right to food through a comprehensive and inclusive approach (Minagri, 2023)

⁹ This aims to protect livestock with 3 complementary regulations: Protection of livestock during transport, on Protection of animals that provide meat, skins, feathers and other products at the time of processing in industrial establishments and on Protection of animals during industrial production, marketing and in other animal holding areas (Minagri, 2014),

¹⁰ 1. Low in saturated fat, 2. Low in total fat, 3. High in calcium, 4. Low in sodium, 5. High in dietary fiber, 6. Low in cholesterol, 7. High in vitamin A and/or C, 8. High in folic acid, 10. Contains other bacilli, 11. Free of trans fatty acids, 12. Free of sugars, 13. Low in saturated fats, 14. Prebiotics, 15. High in potassium, 16. High in DHA/EPA, 17. Lactose free, 18. High in DHA (Minsalud, 2004)

entrepreneurial ecosystem, ensuring that both domestic and international investors are motivated to invest in new and innovative AgriFoodTech startups. By doing so, they can create a powerful foundation for sustainable economic growth and technological development. Moreover, increasing regulatory demands on farmers could lead to reduced supply, making it essential to find a technological solution that ensures food safety without raising costs.

Next, there are some external factors, as Horne & Fitcher (2022) mentioned, that can act as disablers or enablers depending on the context; geography and social crises are examples. Firstly, Chile's landscape limits the enabler in the technical and financial support factor. Technical and financial resources are primarily concentrated in the metropolitan area, where the capital is located, and key actors such as CORFO, Start-Up Chile, and Transforma Alimentos are based. Therefore, the technical assistance that these entities provide through incubators, accelerators, or mentorship programs is limited for startups that are located far away, such as ComeS or PatBio. Also, unlike other fields like Fintech, scalability for AgriFoodTech startups is influenced by unique challenges such as production processes, supply chain logistics, and technological infrastructure. Therefore, CORFO and Start-Up Chile, which generally understand the innovation dynamics of startups, often fail to grasp the unique development processes of AgriFoodTech startups. These institutions tend to apply a one-size-fits-all approach and framework, not recognizing the distinct challenges and requirements of the agricultural sector.

Now, when it comes to funding, startups have experienced that investors are often reluctant to commit if they are not geographically close to where the development of the new technology is happening, reducing the options for startups to find investment. Additionally, venture capitalists often misunderstand how the agricultural sector operates. It is heavily impacted by external factors beyond their control, such as climate change, droughts, rainy seasons, and harvest cycles. Venture capitalists should tailor their terms and expectations when investing in AgriFoodTech startups. While investors are experts at supporting startups in various industries, agriculture operates differently, and this can hinder the growth and support of AgriFoodTech ventures if not properly understood.

Consequently, AgriFoodTech startups view these external challenges as opportunities to innovate and seek the necessary support. This can be seen with the creation of associations like AgroTech Chile and Patagonia Biotech Hub, founded by local startup entrepreneurs. These associations understand the unique needs of the sector and work to provide the resources and specific support necessary for these startups to thrive. For example, AgroTech Chile's collaboration with the National Society of Agriculture (SNA) in the coworking space and with INDAP, which has offices throughout rural areas in the country, enables the association to access regions that are normally centralized institutions cannot. Additionally, the Patagonia Biotech Hub located in the south also provides collaboration spaces to offer support not only in the technical area but also by including venture capitalists and angel investors for that specific sector and region.

These associations can serve as examples for the cases studied in Bisang et al. (2019), where the lack of strong and formalized associations or collaborative platforms is evident in

Argentina and Uruguay. While individual startups are making progress in building networks, there may be a gap in the ecosystem in terms of a cohesive strategy or unified platforms that bring together various players in the Agtech field as effectively as AgroTech Chile. This is evident as a missed possibility for enhancing collaborative innovation and scaling the impact of Agtech solutions in those countries.

Moreover, for financial support, AgriFoodTech startups often seek the 3Fs (Family, Friends, and Fools)—family and friends who are willing to invest in their business due to their emotional connection with the founders. During the early stages of a startup, an injection of capital is essential to invest in resources (Ahorro, 2020) such as the creation of pilot plants and/or software. This was the approach used by AgroUrbana, AgrolInventario, among others.

Secondly, social crises such as the social outbreak¹¹ and the Covid-19 pandemic¹² are worth mentioning. These events caused significant economic disruption, business losses, a decline in investments, and supply chain interruptions, particularly impacting food accessibility. For AgriFoodTech startups, this hindered their ability to reach clients, as many needed to visit fields to demonstrate new products to farmers. Consequently, numerous startups were forced to either close or remain on standby with some processes. This was a disabler for startups, not only in reaching the market and offering innovative products or services to customers but also in keeping their businesses growing.

Thus, AgriFoodTech startups saw this as an opportunity to remodel and adapt their business models to address food accessibility issues. This was the case for HoneyPro, which created new products, and Farmtastica, which offered fresh vegetables. These startups, among others, pivoted their strategies to meet the evolving needs of the market and ensure their survival during these challenging times, turning the external disabler into an enabler.

Producers and customers have a direct influence as external enablers for AgriFoodTech startups. In this investigation, startups acknowledge the importance of market fit, meaning that the solution solves a problem and identifies potential clients who are willing to pay for the technology. Instacrops is a suitable example. When the solutions fit the market, they act as enablers for the startups.

These last two enablers—contextual factors related to Covid-19 and market fit—are similar to those found in Bisang et al. (2022) case studies in Argentina and Uruguay. These startups had to pivot to digital platforms due to restrictions on face-to-face interactions, leveraging virtual tools to maintain operations. This highlights the sector's resilience and capacity for rapid adaptation in

¹¹ In 2019 social outbreak occurred where millions of people throughout the country took to the streets to express their disagreement with the treatment that, for decades, the governments of the Concertación (was a coalition of left, center-left and center-right political parties (BCN, 2017)) and the right wing, through their policies and programs, have violated the economically weaker social classes (Jiménez-Yañez, 2020).

¹² The Covid-19 pandemic struck, leading to global lockdowns aimed at preventing the virus's spread, which affected everyone worldwide (UNESCO, 2020).

business models. Additionally, Bisang et al. (2022) emphasized the importance of customer networking, which proved essential for validating and refining products, further highlighting the adaptability and innovation within the Agrifood sector.

Farmers, especially those from older generations, often pose challenges for AgriFoodTech startups due to limited exposure or skepticism towards new technologies and digital solutions. Changing their attitude toward adopting disruptive services, such as Agrapp's agricultural management software or PatBio's innovative food products, requires more effort and time. In contrast, younger generations, already familiar with technology, are quicker to understand and embrace these new products and services, though they remain a demographic minority in the sector. This generational divide in technology adoption highlights a broader issue from those already identified by Bisang et al. (2019), which includes a misalignment between the entrepreneur's proposal and the actual needs and priorities of the market and its clients.

Lastly, the agricultural sector in Chile is still in its early stages of moving toward technology and digitalization. Linking the usage statistics from Bravo (2021) to the statement about market differentiation highlights a critical insight: while many agricultural companies in the Maule region are adopting innovative technologies, the market is saturated with similar solutions. To stand out and achieve greater success, a startup must offer a unique differentiating feature. For example, the fact that only 50% of companies use licensed software and 65% require improvements in sensor-based traceability suggests a gap in the market. A startup that can provide a more efficient, user-friendly, and legally compliant software solution or a more advanced traceability sensor system could potentially dominate the market due to its distinct advantages over competitors.

7.2.2. Internal Enablers

For AgriFoodTech startups, there are connections that work as enablers to enhance their development internally, as Horne & Fitcher (2022) stated. One connection is recognizing how actors like knowledge and research centers are linked with startups, offering valuable opportunities to pilot test and validate their products and business models. There are multiple examples where startups work hand in hand with universities in Chile to create prototypes and validate their products. However, in some cases, this partnership is not fully effective as an enabler. For instance, universities that provide incubator or accelerator programs to help startups do not differentiate between startups and SMEs, lacking technical and knowledge support specifically for AgriFoodTech startups.

Moreover, universities' support can also facilitate connections with farmers, serving as an internal enabler, especially in regional areas where agricultural technicians seek training. This setting presents an ideal opportunity for AgriFoodTech startups to engage with potential clients. However, it appears that entrepreneurs have not fully explored this connection, making this internal enabler less effective than it could be. Additionally, an internal enabler that should be more effective is the collaboration between startups. In this research, there are cases where startups in

vertical farming, biotech, innovative food, and farm robotics & mechanization are narrow-minded in sharing information among them, making it challenging to cooperate in the food ecosystem.

The study by Bisang et al. (2019) highlights that Agtech startups in Argentina strategically allocate over 50% of their revenue to research and development activities. This significant investment in R&D underscores their commitment to enhancing their technological capabilities and supporting the growth and innovation of their startups.

Furthermore, mentorship and guidance from Arpegio and Mumulkan, specifically for this research, can be considered internal enablers. Their understanding of the areas where AgriFoodTech startups are lacking, when they ask for indicators to measure their impact and act as advisors in generating customized solutions, plays a crucial role in the startups' success. Guidance from experienced entrepreneurs is also an internal enabler for new founders, helping them learn from their mistakes and receive direction on how to proceed in the path of entrepreneurship. It is worth mentioning that the creation of AgroTech Chile provides significant guidance for startups, fostering internal learning as the association's founders, who have extensive experience in the industry, offer valuable insights that startups are eager to receive. Accordingly, this enabler functions both as an external and internal support mechanism.

In the research on Bisang et al. (2019), it is indicated that while accelerators are key to providing initial support and financing for Agtech startups in Argentina and Uruguay, they often fall short in fostering long-term sustainable growth. This suggests a need for expanding the focus of accelerators to address the specific challenges faced by Agtech startups more effectively. In contrast, organizations like Arpegio and Mumulkan in Chile offer a more comprehensive support model that provides holistic assistance across various developmental stages, aligning more closely with the long-term needs of startups in this complex and innovative sector.

On the other hand, although recognizing the depth of scientific knowledge and support from entrepreneurs in Chile is important, building a successful startup requires a multidisciplinary approach. While expertise in specific scientific or technological fields forms the backbone of these AgriFoodTech startups, integrating diverse skills from various disciplines is essential to transform innovative ideas into sustainable businesses. A multidisciplinary approach involves assembling individuals with diverse backgrounds, skill sets, and areas of expertise to collaborate on a shared project or goal, enabling AgriFoodTech startups to succeed.

Nevertheless, this internal enabler is not fully effective as there is often a notable gap in commercialization expertise among entrepreneurs in Chile. Many startup founders possess strong technical skills but struggle with the challenges of effectively marketing their products and reaching their target customers. This difficulty arises from a lack of knowledge in areas such as sales strategies, advertising, and market penetration. According to a report by CORFO, many Chilean entrepreneurs excel in developing innovative technologies but face significant hurdles when it comes to translating these innovations into commercially viable products (Aoe, 2019).

Moreover, the skilled labor enabler indicates tentatively that novel farming methods, such as vertical farming, present a viable solution to ensure food security across Chile's extensive territory. As these AgriFoodTech startups achieve scalability, positioning such technologies in remote regions can unlock significant growth opportunities. This not only expands market reach but also stimulates local economies by providing new employment opportunities and boosting agricultural productivity. Such advancements tie directly into the discussions by Klerkx & Villalobos (2024) regarding the long-term impacts of disruptive agricultural startups. In particular, the scalability of vertical farming could redistribute benefits similarly to advancements seen in protein production and digital agriculture, demonstrating a practical application of theoretical research into startup-driven agricultural transformation.

This research suggests that AgriFoodTech startups contribute to a more sustainable food ecosystem pathway despite encountering numerous internal and external challenges. While existing key stakeholders play a significant role in their development, it is crucial for these entities to continuously evolve and enhance their support mechanisms to further reinforce this development. Ongoing adaptation is essential for generating the growth and success of AgriFoodTech startups as they navigate the complexities of the food ecosystem.

7.3. Policy recommendation

This research highlights the crucial role of policies and collaborative efforts among diverse stakeholders in supporting AgriFoodTech startups. Various changes are necessary to address the challenges and limitations these startups face.

The crucial connection between entrepreneurs and academia is immense, yet there is a critical need to provide agronomists with the right tools, skills, and opportunities to foster startup creation. Introducing specialized technical courses into university curriculums for agronomists and related fields, such as the program offered by FAO (2023), can facilitate the development of these professionals into Agripreneurs. These data science courses would equip individuals with essential skills for launching AgriFoodTech startups and enhance the competencies of current team members, thereby supporting and strengthening the startups. Expanding such educational initiatives will be instrumental in nurturing a new generation of Agripreneurs¹³ who can drive innovation and growth in the agricultural sector.

Given the framework provided by governmental institutions like CORFO and Start-Up Chile, while valuable, it does not fully address the unique needs of some AgriFoodTech startups. The one-size-fits-all approach they currently apply fails to tackle some of the specific challenges and

¹³ "Agripreneurs is an individual who starts, organizes and manages a business venture focusing on the agricultural sector" (Mukhopadhyay & Mukhopadhyay, 2020).

requirements faced by the agricultural sector. Therefore, it is essential to adapt these frameworks to better support these types of startups. Tailoring policies and support mechanisms can enhance the effectiveness of these institutions, ensuring that they foster innovation and growth in a way that is more aligned with the particularities of the agricultural industry. This adjustment would enable AgriFoodTech startups to more effectively navigate the complexities of the sector, leading to more sustainable and impactful outcomes.

Furthermore, findings suggest a significant lack of understanding among VCs regarding how the agricultural sector works. To address this, implementing educational programs or workshops could be an effective solution. Given the crucial role that CORFO plays in the startup sector and its strong partnership with universities, research centers, and startups, it can collaborate to design these programs, which would culminate in a certification. The program could cover topics such as crop cycles, technological innovations in farming, climate impact on agriculture, and case studies of successful AgriFoodTech startups. This certification could be a prerequisite for VCs to access certain government incentives or funding pools. By doing so, CORFO would ensure that VCs are better prepared to support AgriFoodTech startups successfully.

Most of the respondents indicate that misinformation among consumers is a critical concern. Visibility and understanding of how new technologies in the agrifood sector work are necessary. Therefore, creating public awareness and educational campaigns can inform consumers about the existence of AgriFoodTech products or services and their benefits and safety. An example guide is The Farm to Fork strategy from the European Green Deal ¹⁴. By increasing the visibility of AgriFoodTech startups and changing consumers' mindsets, the adoption of these technologies becomes more likely, facilitating business success in the ecosystem.

7.4. AgriFoodTech startups acting as a niche for food ecosystem transformation

On the niche level, collaboration among entrepreneurs often exists to help each other, typically on a general basis. However, some remain hesitant, highlighting a more individualistic approach. In the entrepreneurial area, networking is essential for fostering innovation and sharing resources. Similarly, collaboration with competitors is mixed; while some see potential benefits in alliances, others are reluctant to work with these startups.

The results tentatively suggest that associations bridge the gap between various stakeholders and AgriFoodTech startups by offering necessary support and expertise. This connection is particularly effective when startups and governmental institutions recognize and leverage the efforts of these associations. However, pure collaboration through associations alone will not drive

¹⁴ *It aims to make food system fair, healthy and environmentally – friendly, then advances in technology and scientific breakthroughs, joint with rising public awareness and demand for sustainable food, stand to benefit all stakeholders involved (EU, 2022).*

transformative change. While a unified voice through these associations is admirable, it must be accompanied by concrete actions and progress to drive meaningful change in the industry.

According to Klerkx & Villalobos (2024), the use of sustainability discourse in startups may lead to greenwashing and increased financial support. This is relevant to the resilience observed among entrepreneurs in Chile's AgriFoodTech sector. Resilience is vital as it allows startups to navigate and adapt within a landscape where sustainability claims might not always align with actual environmental improvements. The drive to stand out and create meaningful change challenges startups to go beyond mere discourse and substantiate their sustainability claims with genuine actions and results. This is crucial in Chile's evolving regulatory environment, where standards for measuring sustainability impacts are still under development. Demonstrating real progress towards SDGs becomes a marker of resilience and a differentiator in the marketplace, pushing startups to ensure their innovations offer verifiable benefits rather than contributing to greenwashing trends. This alignment—or misalignment—between claimed and actual impacts highlights the importance of integrating robust, transparent sustainability practices into the core operations of AgriFoodTech startups.

7.5. Limitations and future research

This research encountered certain limitations. The three-month period allocated for fieldwork only allowed for a brief view of changes, making it difficult to capture the long-term development of the Agrifood sector and the AgriFoodTech startups interviewed. Consequently, the thesis provides limited evidence of transition pathways and food ecosystem transformation, as these are long-term processes.

Moreover, during data collection, many startups were eager to participate in interviews. Nevertheless, the limited three-month timeframe did not allow for all the desired interviews to be conducted. Although the research principally focused on AgriFoodTech startups, it did not fully consider all perspectives from the different actors involved in Chile. By interviewing only startups, government entities, consultants/intermediaries, and associations, other critical players, especially farmers and major companies within the sector, were excluded. This omission restricts the understanding of the full food ecosystem and the dynamic interactions among stakeholders. Expanding the scope to include insights from farmers and these enterprises would provide a more comprehensive view of the challenges, limitations, and impact that AgriFoodTech startups have in the sector.

Furthermore, Horne & Fichte (2022) stressed the shortage of empirical research behind external enablers (EE) and the underdeveloped concept for internal enablers (IE). This research expands the comprehension of EE in their impact on the growth of startups and offers support for the emerging concept of IE. By considering how external and internal enablers affect AgriFoodTech startups, this thesis provides the first empirical insights using this theory.

Integrating the MLP framework with enabler theory offers a deeper understanding of how various factors influence startups and their impact. Germscheid (2020) suggested that applying enabler theory would have generated more detailed and extensive results. Additionally, the framework of Mungila Hillemane et al. (2019) for TBIs provides a basis for understanding the startup ecosystem but could benefit from a more detailed exploration of TBIs, such as industry leaders, technology experts, and academic institutions, to more effectively enable external networks. Therefore, this thesis provides researchers with richer insights into the dynamics that drive the impact of AgriFoodTech startups, opening doors for future research.

For this research it is vital to mark that the factors used in the enabler theory differ from those in the Horne & Fichter (2020) study, but they still support the theory. However, since the enabler theory relies on the specific context in which the startup operates, it can limit the theory's applicability across different regions and industries, making it difficult to standardize the enablers. Additionally, the theory might occasionally place excessive emphasis on contextual factors, potentially overlooking the interconnection between internal and external enablers within a specific context. This oversight can result in a failure to recognize that some factors are dynamic, transitioning from EE to IE or vice versa. Thus, these considerations are reserved for future research agendas.

Furthermore, in this study, the concept of "food ecosystem" was used rather than "food systems." For future recommendations, it is essential to embrace the concept of the food ecosystem among researchers to ensure food sustainability, emphasizing the enduring viability and responsibility of food systems.

Outside this study, exploring the concept of AgriFoodTech startups as a network of innovators could be valuable. This research recognized them as a collective group. Conducting more studies that acknowledge different types of startups as individual niches, despite their technology, and analyzing the factors that influence them could clarify the niche concept in this field. Additionally, strengthening collaboration and fostering a shared vision among startups, with the understanding that they are part of a larger ecosystem, would lead to a more cohesive niche. This collective effort would enable all startups to work towards the same goal, enhancing the overall impact and success of the Agrifood sector.

8. Conclusion

In conclusion, this research addresses the question: *How do AgriFoodTech startups in Chile aim to contribute to a more sustainable food system with their innovations?* It highlights the role of individual startups in driving the sustainable food transition in Chile and offers valuable insights for both theory and policy. By understanding these contributions, different stakeholders can adapt their support mechanisms to better align with the needs of AgriFoodTech startups, thereby promoting a cohesive and sustainable food ecosystem.

The research indicates that mature AgriFoodTech startups are increasingly benefiting from improved support systems in technical, knowledge, and financial aspects, along with expanding market opportunities. Despite contextual influences, this environment has generally enhanced their ability to grow and innovate more effectively. In Chile, we observe a dynamic ecosystem with various actors and their interactions contributing to the transformation of the food ecosystem. However, collaboration among startups still has significant room for improvement.

Programs from governmental institutions have been instrumental in fostering numerous startups. However, there is still significant room for improvement in governmental policies, regulations, and frameworks to better support these startups. Enhancing policy measures and

regulatory adjustments could further streamline their growth, addressing specific challenges and fostering a more supportive and effective environment in the food ecosystem in Chile.

In Chile, older generations of farmers often resist adopting new technologies from AgriFoodTech startups, indicating a need for increased efforts to shift traditional attitudes. In contrast, younger generations, already adept with technology, tend to quickly understand and adopt these new innovations.

Associations founded by AgriFoodTech entrepreneurs hold great potential to meet the specific needs of startups within the sector, leveraging their experience and networks to promote collaboration. However, continuous effort is required to drive transformation effectively. Additionally, support from consultants and intermediaries experienced in the sector serves as a crucial enabler, strengthening the business operations and innovations of AgriFoodTech startups in Chile.

Finally, fostering a collective vision among AgriFoodTech startups and acknowledging their integral role within a broader ecosystem can solidify a unified niche. By integrating SDGs into their strategic discourse to measure sustainable impact, startups can better coordinate their initiatives and align them with the transformation of the food ecosystem.

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Appendices

Appendix A: Interview Guide startups with informed consent

(English version)

INTERVIEW GUIDE AGRIFOODTECH STARTUPS

This research is being conducted to investigate AgriFoodTech startups in Chile and their impact towards a sustainable pathway. Me Natalia Rodríguez, I am conducting this research for my master's thesis at Utrecht University in the Netherlands. The questions I would like to ask you relate to the factors that have affected your business along the way, since its foundation until now. The purpose is to get insights into how you have navigated challenges and opportunities that have influenced how your business is now. Everything you tell me will only be used for this research project and will not be shared with anyone outside the research team, which includes me and two supervisors. Also, the information collected will be anonymised. I would also like to record the interview so that I can focus on our conversation rather than on taking notes. Is that okay? After

transcribing the interview, the recording will be deleted. With this knowledge, are you willing to be interviewed, and do I have your consent?

GENERAL QUESTIONS

1. Can you tell me a bit about yourself?
 - a. Could you please describe your educational background?
Probe: Bachelor and/or Master in what?
2. Can you tell me a bit about your work here?
 - a. What is your job title in the company?
3. What is the size of the business you work in?
4. Do you know when was the startup founded?
5. Have you ever worked in an Agrifoodtech startup before? *if needed
Probe: If yes please describe it.

KEY QUESTIONS

6. What is the aim/goal of your start-up?
Probe: Short and long term?
7. What kind of product/service do you aim to provide?
Probe: Why?
8. How do you aim to contribute to the food system?
Probe: In nutritional, ethical, or environmental level?
9. What is your aim to change the food system?
Probe: Why?
10. Can you tell me about the development of your start-up? What were the important moments?
Probe: Why?
11. From your perspective what do you think are the opportunities or limitations encountered in the startup development process?
Probe: How do you tackle them?

Now I want to go a bit deeper into the different important factors you mentioned.

12. In terms of support network, how has the interaction been with other actors such as government institutions, incubators, consumers, etc.?
Probe: Explain the relationships between them.

13. Who else operates and how in your area of business?

Probe: Give examples.

14. In terms of knowledge, what is the scientific knowledge needs your startup face?
how do you see the startups ´ size influence accessing scientific knowledge among others?

Probe: Based on your experience do you see cooperation with (other startups) in sharing?

In the competitive landscape of AgriFoodTech, securing funding is crucial for growth and expansion.

15. Could you please walk me through your experience in accessing investors for your startup?

Probe: What strategies did you use to attract investors?

16. What are some of the key challenges you faced during the fundraising process?

Probe: Give me examples.

17. Can you describe the type of investors you targeted and the criteria you choose when selecting potential investors for your startup?

Probe: How do you tailor your pitch to attract them?

Many AgriFoodTech startups benefit from support programs such as incubators and accelerators.

18. Could you please share with me your experience with support programs like incubators, mentoring, or accelerators for your startup?

19. From those programs what specific resources or guidance did you find the most valuable during your participation?

Probe: Where was it and at what stage of the startups were you? Why?

20. Based on these experiences how did they help you overcome challenges, improve y business model, or access new networks and resources?

Probe: Give me some examples.

Now I want to discuss your market, in terms of customers and competitors.

21. How do customers accept your AgriFoodTech startup’s products?

Probe: If not, what could be the reason?

22. How have incumbent startups in your area reacted?

Probe: What is your relationship with them?

In the AgriFoodTech industry there are various niches such as precision agriculture, food delivery platforms, vertical farming, among others.

23. How was the creation of this AgriTech group (nicho) to gather different startups?

Probe: What was your role and contribution?

24. How building this group (nicho), has helped AgriFoodTech startups?

Probe: What are the advantages or disadvantages you have encountered?

25. What trends or developments do you foresee shaping this group (niche) in the future?

CLOSING QUESTIONS

26. Understanding the tools, actors and connections mentioned during the interview, how would you describe how you navigate this stakeholder field to create sustainable value?

Probe: Who would you say was the key actor or factor to your startup's trajectory? What tensions/difficulties have you faced in maintaining your sustainability position?

27. Are there any important topics that have not been addressed and you would like to mention?

(versión en español)

GUIA DE ENTREVISTA STARTUPS AGRIFOODTECH

Esta investigación se está llevando a cabo para explorar los startups en AgriFoodTech en Chile y su impacto hacia un camino sostenible. Yo Natalia Rodríguez, estoy realizando esta investigación para mi tesis de maestría en la Universidad de Utrecht en Países Bajos. Las preguntas que me gustaría hacerte se refieren a los factores que han afectado a tu negocio a lo largo del camino, desde su fundación hasta ahora. El objetivo es saber cómo se han afrontado los retos y las oportunidades que han influido en la situación actual del startup. Todo lo que me cuentes sólo se utilizará para este proyecto de investigación y no se compartirá con nadie ajeno al equipo de investigación, que incluye a dos supervisores y a mí. Además, la información recopilada será anónima. También me gustaría grabar la entrevista para poder centrarme en nuestra conversación y no en tomar notas. ¿Te parece bien? Después de transcribir la entrevista, se borrará la grabación. Sabiendo esto, ¿estás dispuesto a ser entrevistado y tengo tu consentimiento?

PREGUNTAS GENERALES

1. ¿Puedes hablarme un poco de ti?

- a. ¿Podría describir su formación académica?
Probe: Pregrado y/o Máster ¿en qué?
2. ¿Puede hablarme un poco de tu trabajo aquí?
 - a. ¿Cuál es su cargo en la empresa?
3. ¿Cuál es el tamaño de la empresa en la que trabajas?
4. ¿Sabes cuándo se fundó la empresa?
5. ¿Has trabajado antes en un startup Agrifoodtech? *si es necesario
Probe: Si la respuesta es sí, por favor descríbalo.

PREGUNTAS CLAVE

6. ¿Cuál es el objetivo del startup?
Probe: ¿A corto y largo plazo?
7. ¿Qué tipo de producto/servicio pretende ofrecer?
Probe: ¿Por qué?
8. ¿Cómo pretende el startup contribuir al sistema alimentario?
Probe: ¿A nivel nutricional, ético o medioambiental?
9. ¿Qué pretende el startup cambiar en el sistema alimentario?
Probe: ¿Por qué?
10. ¿Puedes hablarme del desarrollo de tu startup? ¿Cuáles fueron los momentos importantes?
Probe: ¿Por qué?
11. Desde tu punto de vista, ¿cuáles crees que son las oportunidades o limitaciones encontradas en el proceso de desarrollo de un startup?
Probe: ¿Cómo las afrontas?

Ahora quiero profundizar un poco más en los diferentes factores importantes que has mencionado.

12. En términos de red de apoyo, ¿cómo ha sido la interacción con otros actores como instituciones gubernamentales, incubadoras, consumidores, etc.?
Probe: Explica las relaciones entre ellos.
13. ¿Cuáles otros actores operan y cómo en tu área de negocio?
Probe: Dame ejemplos.
14. En términos de conocimiento, ¿cuáles son las necesidades de conocimiento científico a las que se enfrenta tu startup?

Probe: Basándose en tu experiencia, ¿consideras que la cooperación con (otros startups) permite compartir?

En el competitivo panorama de AgriFoodTech, asegurar la financiación es crucial para el crecimiento y la expansión.

15. ¿Podrías explicarme tu experiencia a la hora de acceder a inversores para tu startup?

Probe: ¿Qué estrategias utilizaste para atraer inversores?

16. ¿Cuáles son algunos de los principales retos a los que te enfrentaste durante el proceso de captación de fondos?

Probe: Dame ejemplos.

17. ¿Puedes describir el tipo de inversores a los que te dirigiste y los criterios que elegiste a la hora de seleccionar posibles inversores para tu startup?

Probe: ¿Cómo adaptaste tu discurso para atraerlos?

Muchos startups de AgriFoodTech se benefician de programas de apoyo como incubadoras y aceleradoras.

18. ¿Podría compartir conmigo tu experiencia con programas de apoyo como incubadoras, mentores o aceleradoras para tu startup?

19. ¿Qué recursos u orientaciones específicas de esos programas te resultaron más valiosos durante tu participación?

Probe: ¿Por qué? ¿Dónde estabas y en qué fase del startup te encontrabas?

20. A partir de estas experiencias, ¿cómo te ayudaron a superar retos, mejorar tu modelo de negocio o acceder a nuevas redes y recursos?

Probe: Dame algunos ejemplos.

Ahora quiero hablar del mercado, en términos de clientes y competidores.

21. ¿Cómo aceptan los clientes los productos de tu startup?

Probe: ¿Cuál podría ser la razón si sí o sino no?

22. ¿Cómo han reaccionado las empresas existentes de tu área?

Probe: ¿Cuál es tu relación con ellas?

En la industria AgriFoodTech existen diversos nichos como la agricultura de precisión, las plataformas de reparto de alimentos, la agricultura vertical, entre otros.

23. ¿Cómo fue la creación de este grupo AgroTech (nicho) para reunir a diferentes startups?

Probe: ¿Cuál fue tu papel y contribución?

24. ¿Cómo ha ayudado la creación de este grupo (nicho) a los startups en AgriFoodTech?
Probe: ¿Cuáles son las ventajas o desventajas que has encontrado?

25. ¿Qué tendencias o desarrollos prevé que darán forma a este grupo (nicho) en el futuro?

PREGUNTAS DE CIERRE

26. Teniendo en cuenta las herramientas, los actores y las conexiones mencionados durante la entrevista, ¿cómo describirías la forma de navegar por este campo de actores para crear valor sostenible?

Probe: ¿Quién dirías que ha sido el actor o factor clave en la trayectoria de tu startup? A qué tensiones/dificultades se ha enfrentado para mantener su posición de sostenibilidad?

27. ¿Hay algún tema importante que no se haya tratado y que te gustaría mencionar?

Appendix B: Interview Guide Governmental entities and Association with informed consent

(en español solamente)

GUIA DE ENTREVISTA ENTIDADES PUBLICAS Y ASOCIACION

Esta investigación se está llevando a cabo para explorar los startups en AgriFoodTech en Chile y su impacto hacia un camino sostenible. Yo Natalia Rodríguez, estoy realizando esta investigación para mi tesis de maestría en la Universidad de Utrecht en Países Bajos. Las preguntas que me gustaría hacerte se refieren a los factores que han intervenido la creación y apoyo de AgriFoodTech startups. El objetivo es saber cómo se han afrontado los retos y las oportunidades que han influido en la situación actual de diferentes startups. Todo lo que me cuentes sólo se utilizará para este proyecto de investigación y no se compartirá con nadie ajeno al equipo de investigación, que incluye a dos supervisores y a mí. Además, la información recopilada será anónima. También me gustaría grabar la entrevista para poder centrarme en nuestra conversación y no en tomar notas. ¿Te parece bien? Después de transcribir la entrevista, se borrará la grabación. Sabiendo esto, ¿estás dispuesto a ser entrevistado y tengo tu consentimiento?

PREGUNTAS CORFO y TRANSFORMA ALIMENTOS

- ¿Qué programas o iniciativas específicas ofrece la entidad para apoyar a las nuevas empresas de tecnología en sus primeras etapas de desarrollo?
Probe: ¿Cuál es el programa que más apoya?
- ¿Cómo evalúa y selecciona CORFO las AgriFoodTech startups para participar en sus programas de emprendimiento u oportunidades de financiación?
- ¿Qué tipo de recursos y servicios de apoyo ofrece la entidad a las nuevas empresas de tecnología agroalimentaria?
Probe: Como mentoría, formación o acceso a redes...
- ¿Puede compartir ejemplos de startups que se hayan beneficiado del apoyo de su apoyo y destacar sus contribuciones al sector?
Probe: ¿Por qué crees estos startups se destacaron más que otras?
- ¿Cómo colabora la entidad con otras partes interesadas, como asociaciones industriales, instituciones de investigación u organismos públicos, para fomentar la innovación y el crecimiento en el sector agroalimentario?
- ¿Qué papel desempeña la entidad a la hora de facilitar el acceso a la financiación y las oportunidades de inversión para las AgriFoodTech startups, tanto a escala nacional como internacional?
- ¿Cuál es la experiencia con el sector agroalimentario es diferente que otros sectores?
Probe: ¿Por qué si o no?
- ¿Cuáles son las principales barreras que has visto desde tu rol para el desarrollo de los startups?
Probe: ¿Cómo ayuda la entidad a superarlos?
- ¿Existen áreas específicas de enfoque o áreas prioritarias que CORFO esté particularmente interesada en apoyar a través de sus programas de emprendimiento?
Probe: ¿Por qué?
- ¿Y cómo complementa específicamente, Transforma Alimentos al instrumento Start-Up Chile?
Probe: ¿Y también con AgroTech Chile?
- ¿Cuáles son las prioridades y objetivos que quieren atacar ahorita de todas estas problemáticas que hay?

- De cara al futuro, ¿cuáles son las metas y objetivos de CORFO para seguir apoyando el crecimiento y el éxito de las nuevas AgriFoodTech startups en Chile?

Probe: ¿Qué estrategias se están implementando para lograrlos?

PREGUNTAS ASOCIACION AGROTECH CHILE

En la industria AgriFoodTech existen diversos nichos como la agricultura de precisión, las plataformas de reparto de alimentos, la agricultura vertical, entre otros.

- ¿Cómo fue la creación de esta asociación AgroTech Chile para reunir a diferentes startups?
Probe: ¿Cuál fue tu papel y contribución?
- ¿Por qué se creó la asociación?
- ¿Qué quieren realizar con la creación de AgroTech Chile?
Probe: A corto y a largo plazo
- ¿Cómo ha ayudado la creación de este grupo a los startups en AgriFoodTech?
Probe: ¿Cuáles son las ventajas o desventajas en el ecosistema de AgriTech startups que has encontrado? ¿Qué temas comunes pretende resolver Agrotech Chile?
- ¿Cómo ves que las políticas o instituciones públicas en Chile ayudan o no a navegar a los startups?
Probe: ¿Por qué?
- ¿Qué tendencias o desarrollos prevé que darán forma a esta asociación en el futuro?
- Como ves a los start-ups en conexión con la industria establecida, también dado su conexión con SNA (co-work etc.)

PREGUNTAS DE CIERRE PARA AMBAS

- ¿Qué consejo daría a los startups que buscan establecer asociaciones con organizaciones de los sectores público y privado para acelerar su crecimiento e impacto?
- Pensando en el futuro, ¿qué tendencias prevé en cuanto a la colaboración entre los startups y organizaciones públicas/privadas, y cómo piensa adaptar sus estrategias en consecuencia?

- ¿Hay algún tema importante que no se haya tratado y que te gustaría mencionar?

Appendix C: Interview Guide Consultants/Intermediaries with informed consent

GUIA DE ENTREVISTA CONSULTORA/INTERMEDIARIOS

Esta investigación se está llevando a cabo para explorar los startups en AgriFoodTech en Chile y su impacto hacia un camino sostenible. Yo Natalia Rodríguez, estoy realizando esta investigación para mi tesis de maestría en la Universidad de Utrecht en Países Bajos. Las preguntas que me gustaría hacerte se refieren a los factores que han intervenido la creación y apoyo de AgriFoodTech startups. El objetivo es saber cómo se han afrontado los retos y las oportunidades que han influido en la situación actual de diferentes startups. Todo lo que me cuentes sólo se utilizará para este proyecto de investigación y no se compartirá con nadie ajeno al equipo de investigación, que incluye a dos supervisores y a mí. Además, la información recopilada será anónima. También me gustaría grabar la entrevista para poder centrarme en nuestra conversación y no en tomar notas. ¿Te parece bien? Después de transcribir la entrevista, se borrará la grabación. Sabiendo esto, ¿estás dispuesto a ser entrevistado y tengo tu consentimiento?

PREGUNTAS GENERALES

- ❖ ¿Puedes hablarme un poco de ti?
- ❖ ¿Podría describir su formación académica?

Probe: Pregrado y/o Máster ¿en qué?

- ❖ ¿Puede hablarme un poco de tu trabajo aquí?
Probe: ¿Cuál es su cargo en la organización?
- ❖ ¿Cuál es el tamaño de la organización en la que trabajas?
- ❖ ¿Sabes cuándo se fundó la organización?
- ❖ ¿Has trabajado antes en el área de AgriFoodtech o startups?
Probe: Si la respuesta es sí, describir.

PREGUNTAS ARPEGIO/MUMULKAN

- ❖ ¿Cuál es el objetivo de consultora/intermediario?
Probe: ¿A corto y largo plazo?
- ❖ ¿Cómo pretende la empresa contribuir o cambiar al sistema alimentario?
Probe: ¿A nivel nutricional, ético o medioambiental?
- ❖ ¿Puedes hablarme del desarrollo de la empresa? ¿Cuáles fueron los momentos importantes?
Probe: ¿Por qué?
- ❖ ¿Qué estrategias empleas para garantizar una comunicación y colaboración eficaces entre los miembros del equipo y las partes interesadas externas en la industria agroalimentaria?
- ❖ ¿Cómo te mantienes al día de las últimas tendencias e innovaciones en tecnología agroalimentaria para orientar los esfuerzos y estrategias de tu equipo?
Probe: Dar ejemplos

Sabiendo el portafolio de startups que tienen hoy en día

- ❖ ¿Qué tipos de apoyo y recursos proporcionan a los startups más allá de la inversión financiera?
Probe: Como mentoría, orientación estratégica o acceso a redes...
- ❖ ¿Qué criterios específicos utilizan para evaluar y seleccionar las AgriFoodTech startups para las oportunidades de inversión?
Probe: ¿Se han mantenido estos criterios siempre igual o han variado durante el tiempo?
- ❖ ¿Puede compartir ejemplos de startups exitosas en las que Arpegio haya invertido y destacar su impacto en el sector?

Probe: ¿Por qué crees que fueron exitosas?

- ❖ ¿Cuáles son algunos de los retos o barreras comunes a los que se enfrentan las AgriFoodTech startups en Chile, y cómo trabaja consultora/intermediario con ellas para superar estos retos?
- ❖ ¿Cómo evalúa el potencial de expansión internacional y entrada en el mercado de los startups en su cartera de inversiones?
- ❖ ¿Existen áreas específicas dentro del sector agroalimentario en las que consultora/intermediario esté especialmente interesados en invertir?
Probe Por qué?

Muchos startups de AgriFoodTech se benefician de conexiones y crear contactos

- ❖ ¿Puedes compartir algunos ejemplos de cómo tu equipo colabora con fundadores, socios industriales y socios de capital para crear valor en startups de AgriFoodTech?
- ❖ ¿Cómo se garantiza la coincidencia de metas y objetivos entre startups y los socios de los sectores público y privado para maximizar el impacto de las colaboraciones?
- ❖ ¿Puedes hablar del rol de confianza y transparencia a la hora de crear asociaciones de éxito entre startups y agentes de los sectores público y privado?

PREGUNTAS DE CIERRE PARA AMBAS

- ❖ ¿Qué consejo daría a los startups que buscan establecer asociaciones con organizaciones de los sectores público y privado para acelerar su crecimiento e impacto?
- ❖ De cara al futuro, ¿cuáles son las tendencias y oportunidades clave que consultora/intermediario ven en el sector de la tecnología agroalimentaria, y cómo piensan capitalizarlas a través de su estrategia de inversión?
- ❖ ¿Hay algún tema importante que no se haya tratado y que te gustaría mencionar?

Appendix D: Code Book

Enabler aspects apriori code	Enabler apriori factor	Empirical Code name	Strategy Used	Description	Example from data
Social	Domestic demand / Market	Customer/clients/market	Inductive	Use this code to identify of whether the clients and market facilitate opportunities for the AgriFoodTech startups to develop and scale up in a food sustainable pathway.	<i>"...to be able to understand potential customers and that what you are doing is something that solves a real problem. ..."</i> S1
		Social events	Inductive	Use this code to identify the social events that affect or not the development of the AgriFoodTech startup	<i>"...I started to go out to the market and here in Chile there was a social outbreak, in 2019 there was a social outbreak, and everything was on stand-by, everything that was happening, you could not go out to the street, it was crazy. The social outbreak happened and the pandemic came. And then the pandemic finished me off, basically..."</i> S12

Organizational	Support institutions / Network	External support	Inductive	Use this code for indicating the possibility for entrepreneurs to have spaces to get or not support from external institutions such as incubators, accelerators, venture capitals, etc.	<i>"...in some cases, international accelerators that also provide some money through equities, and so when they are looking for deal flow, sometimes they contact us asking for, hey, do you have any kind of startups recently that fits with our thesis of investment? And we then go to our database..." G1</i>
		Internal support	Deductive	Use this code for indicating the support that AgriFoodTech startups have internally or not.	<i>"...but we are always open to generate strategic alliances or knowledge so that others can massify this at the same level as it is being massified in Europe, which is clearly leading the way..." S9</i>
Economic	Skilled labor force and knowledge	Collaboration	Deductive	Use this code for any collaboration the entrepreneurs in AgriFoodTech startups might or might not receive to build their own network towards a food sustainable pathway.	<i>"...I think you will find that Chilean universities are very good, always fighting within the rankings, in the top, but doing research, when it has to do with the connection with the private system, there is still much to be done..." S13</i>

		Competence	Inductive	Use this code for matters of positive and negative competence the AgriFoodTech startups perceive in their environment.	<i>"...It's difficult, it's like that, competition, obviously competition, because in the end the substitute products are mainly seaweed extracts, some others are focused on stress, but the truth is that they are also my potential customers..." S19</i>
		Experience	Deductive	Use this code for matters of knowing if entrepreneurs had or not experience before in a startup environment as this might impact the development of the startup in the food sustainable pathway.	<i>"...I had a period of two years at Notco, where I had the role of manager of applied artificial intelligence, there my role and that of my team was more than, in short, was to see to it that the implementation of Notco's proprietary artificial intelligence..." P2</i>
Technical	Technology and infrastructure	Tech-infrastructure support	Inductive	Use this code for matters of receiving or not the physical resources to transform or adjust the AgriFoodTech business.	<i>"...we can help with training on topics associated with the startup itself, such as finance, marketing, etc. We are working hard with strategic alliances with other companies that are not Agrotech but are service providers in these areas..." A1</i>

<i>Political</i>	<i>Policies</i>	<i>Laws/Policies</i>	Deductive	Use this code for matters knowing if there are or not appropriate regulations to promote the product/service s that AgriFoodTech startups provide and impact the food ecosystem.	<i>"...The other thing is the regulatory aspect, that is, definitely in Chile we start by saying healthy food and the Ministry of Health says but in the Food Sanitary Regulation all food has to be healthy. Yes, but we are talking about healthy that has something beyond that, that incorporates something that benefits beyond nourishing you. No, functional foods do not exist here in Chile, there are 18 healthy messages that you can put on the label. ..."</i> G2
<i>Players</i>	<i>Actors</i>	<i>Actors</i>	Deductive	Use this code for matters knowing the actors that are involved in AgriFoodTech ecosystem in Chile.	<i>"...INDAP is an association that has an infinite number of offices spread throughout rural Chile..."</i> S2

Appendix E: List of key players from interviews

Key players	Category	Number of mentions
Universities and Academia	Knowledge and Research centers	21
CORFO (Cooperación de Fomento de la Producción/Production Development Corporation)	Governmental entity	19
Start-Up Chile (supported by CORFO)	Accelerator	11
Other startups	Private entity	10
Venture Capitals	Private entity	8
FIA (Fundación del Ministerio de Agricultura para la Innovación Agraria/Foundation of the Ministry of Agriculture for Agricultural Innovation)	Governmental entity	8
3F (Family, Friends and Fools)	Private entity	6
Pro Chile (Intitución del Ministerio de Relaciones Exteriores que promueve la oferta de bienes y servicios chilenos en el mundo/An institution of the Ministry of Foreign Affairs that promotes the offer of Chilean goods and services in the world.)	Governmental entity	6
Companies in the sector	Private entity	5
Aceleradoras	Accelerator	6
INIA (Centro Nacional de Investigación Agropecuaria National Agricultural Research Center)	Knowledge and Research centers	4
Transforma Alimento	Governmental entity	4
Consulting groups	Private entity	4
Government	Governmental entity	4
SERCOTEC (Servicio de Cooperación Técnica/Technical Cooperation Service)	Governmental and private entity	3
SNA (Sociedad Nacional de Agricultura/National Agricultural Society)	Social entity	3
Angels investors	Private entity	3
Semilla Expande (supported by CORFO)	Governmental entity	3
Ganesha Lab	Accelerator	3
Mujeres empresarias / Women entrepreneurs	Private entity	3
ANID (Agencia Nacional de Investigación y Desarrollo/National Research and Development Agency)	Governmental entity	3
Imagine Lab (Microsoft Chile)	Incubator	2
Incubadora Chrysalis (Universidad Católica)	Incubator	2
500 startups	Private entity	2
Tecla 7 Caja de los Andes	Private entity	2

Incubators	Incubator	2
Research institutes	Knowledge and Research centers	2
Ministry of Agriculture	Governmental entity	2
State entities	Governmental entity	2
Suppliers	Private entity	2
IncubatecUFRO	Incubator	2
Endeavor	Private entity	2
Innova funds	Private entity	2
Agrotech Chile	Social entity	2
Sofofa (Sociedad de Fomento Fabril)	Social entity	2
OpenLab (Universidad de Chile, supported by CORFO)	Governmental entity	1
Capital Abeja Emprende (supported by SERCOTEC)	Governmental and private entity	1
INDAP (Instituto de Desarrollo Agropecuario/Agricultural Development Institute)	Governmental entity	1
Banks	Private entity	1
SSAF Desafíos (Subsidio Semilla de Asignación Flexible para Desafíos, supported by CORFO)	Governmental entity	1
Fortalece PYME (supported by CORFO)	Governmental entity	1
THINKAGRO UTalca	Knowledge and Research centers	1
Startup BioBio (supported by Endeavor, IncubaUdeC, Casa W and CORFO)	Accelerator	1
Fundación Chile	Governmental and private entity	1
FABLAB	Incubator	1
Schools	Knowledge and Research centers	1
Jump Chile	Accelerator	1
Fundación Fraunhofer	Knowledge and Research centers	1
Village Capital	Accelerator	1
European Union	Governmental entity	1
Comité Fomento de los Ríos (supported by CORFO)	Governmental entity	1
Apical (Asociación de productores de insectos comestibles/Association of edible insect producers)	Social entity	1
Foreign investors	Private entity	1

100+ aceleradora AB InBev	Accelerator	1
Fondo CLIN (supported by Fundación Chile)	Governmental and private entity	1
Kayak Venture	Private entity	1
Scalex	Governmental and private entity	1
Technical Centers	Knowledge and Research centers	1
Grupo en Puerto Varas	Social entity	1
FIC (Fondo de Innovación para la Competitividad/Fund of Innovation and Competitiveness)	Governmental entity	1
CEAP (Centro de Estudios en Alimentos Procesados/Center for Processed Food Studies)	Knowledge and Research centers	1
Public-private consortium	Governmental and private entity	1
CETA (Centro Tecnológico de Innovación en Alimentos/Food Innovation Technology Center)	Knowledge and Research centers	1
Observatorio de sostenibilidad de la Universidad de Chile	Knowledge and Research centers	1
INACAP (Centro de Innovación Gastronómica/Gastronomic Innovation Center)	Knowledge and Research centers	1
Sudamerik	Private entity	1
Hubtec Chile	Governmental and private entity	1
Frutas de Chile (ASOEX Asociación de Exportadores de Chile)	Social entity	1
Chiletec (Asociación de Empresas Chilenas de Tecnología)	Social entity	1
Climatech Chile	Social entity	1
IncubaUdeC (Universidad de Concepción)	Incubator	1
CeBiB (Centro de Biotecnología y Bioingeniería/Biotechnology and Bioengineering Center)	Knowledge and Research centers	1
Startup Ciencia	Governmental entity	1
CBT (Centro de Biotecnología Traslacional supported by Sofofa)	Knowledge and Research centers	1
Broota (crowdfundig)	Private entity	1
REDMAD	Social entity	1
Ketrawa Lab	Accelerator	1
WSA (World Summit Awards)	Private entity	1
Patagonia Biotech Hub	Accelerator	1
G100 nada te detiene	Accelerator	1
Customers	Producers and/or consumers	18

Farmers	Producers and/or consumers	14
Producers	Producers and/or consumers	12
Aquaculturists	Producers and/or consumers	3
Beekeepers	Producers and/or consumers	1