

Context and proto-institutions in the emergence of transformative innovation policy: insights from Chile

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In response to the need for exploring transformative innovation policy (TIP) implementation dynamics across sectors and contexts, this paper examines the emergence of TIP in the Chilean agri-food sector. Our findings indicate that TIP has been developing in recent years, primarily in high-level policy discourses, while implementation efforts and the coordination of concrete instrument mixes lag behind. Contextual factors strongly influence TIP development, which include (1) the organization of public administration, (2) national political dynamics, (3) national policy cultures, and (4) geographical contexts. Importantly, our work emphasizes the need for developing policy capabilities and underscores the significant role of proto-institutions in supporting TIP development, through innovation system coordination, science-policy advice, fostering cross-sectoral collaboration, multiactor engagement, and learning and experimentation. Better considering policy contexts as the starting point for developing TIP could advance its implementation and contribute to a broader understanding of TIP dynamics.

Keywords: transformative innovation policy; mission-oriented innovation; challenge-led innovation; food systems transformation; Latin America; innovation systems.

1. Introduction

In recent decades, scholars of sustainability transitions have developed extensive insights and frameworks for understanding and governing long-term processes of large-scale societal transformation across interconnected sectors such as agri-food, energy, mobility, and health (see [Grin, Rotmans and Schot 2010](#); [Köhler et al. 2019](#) for overviews of the field). Governing these transformations is notoriously challenging due to the complexity of the sectors themselves, as well as the scale and cross-sectoral nature of the challenges involved. Considering this complexity, linear and traditional innovation policy efforts face several limitations and challenges, including market failures, directionality failures, demand articulation failures, and policy coordination failures ([Weber and Rohracher 2012](#)). As a result, scholars and practitioners have called for novel, so-called ‘third-generation’ innovation policies that transcend economic growth models and adopt a systemic approach to address sustainability challenges through transformative innovation policies (TIPs) ([Schot and Steinmueller 2018](#); [Ghosh et al. 2021](#)). Relatedly, there are calls for governments to tackle complex sustainability challenges and facilitate transformation by implementing societal missions (e.g. [Mazzucato 2018](#)). These missions set ambitious and clear policy targets, provide direction and coordination for innovation activities, and seek to engage a wide variety of stakeholders in their implementation ([Mazzucato 2018](#); [Diercks 2019](#); [Wanzenböck et al. 2020](#); [Janssen et al. 2021](#); [Haddad et al. 2022](#); [Elzinga et al. 2023](#)).

Hence, TIPs aimed at resolving grand challenges through challenge-led or mission-oriented innovation are emerging globally ([Mazzucato 2018](#); [Haddad et al. 2022](#)). Recent scholarship emphasizes that innovation through missions can be supported by deploying policy mixes that provide direction for innovation activities and coordinate efforts among actors, policy domains, and governance levels. The coherence and consistency of such transformative policy mixes are crucial for effective implementation ([Rogge and Reichardt 2016](#); cf. [Wanzenböck et al. 2020](#)). Implementing TIP is challenging, as noted by several authors ([Diercks 2019](#); [Grillitsch et al. 2019](#); [Bergek, Hellsmark, and Karltorp 2023](#)). It requires developing new capabilities for enacting innovation policies ([Spanó et al. 2024](#)) and a shift in the overall policy system to prevent phenomena like ‘policy layering’ where TIPs are implemented while older policies remain in place ([Diercks 2019](#); [Grillitsch et al. 2019](#); [Klerkx et al. 2025](#)). Without these capabilities and policy changes, the result may be a confusing transformative policy mix characterized by diffuse directionality, incoherence, and inconsistency, with contradictory and counterproductive interactions between policy instruments ([Rodríguez-Barillas, Klerkx and Poortvliet 2024](#)).

While empirical work on TIP is expanding across various sectors, it is predominantly focusing on the Global North, such as the USA, The Netherlands, Sweden, and Norway (see e.g. [Grillitsch et al. 2019](#); [Robinson and Mazzucato 2019](#); [Janssen et al. 2023](#); [Nylén, Johanson, and Vakkuri 2023](#)). These countries have their own specific policy settings and policy cultures within their regional, national, and

international innovation systems, which influence the negotiation of policy directions. Although some attention has been given to the policy cultures in which transformative policies are developed and implemented (e.g. [Johnstone, Stirling, and Sovacool 2017](#)), there remains a significant gap in understanding the emergence and implementation of TIP in diverse contexts ([Uyarra et al. 2025](#)). [Haddad et al. \(2022: 25\)](#) emphasize that one of the main challenges in the implementation of TIP lies in the lack of attention to (constraining) influence of cultural contexts, institutional conditions, and the political system (including resistance from political movements). This underscores the need to further empirically investigate the emergence and implementation of mission-oriented TIP in different contexts. This need is particularly relevant in the Global South, where TIP remains largely unexplored ([Köhler et al. 2019](#); [Ghosh et al. 2021](#); [Hebinck et al. 2021](#); [Janssen et al. 2021, 2023](#); [Bergek, Hellsmark and Karltorp 2023](#)). A few studies have been conducted in the context of the Transformative Innovation Policy Consortium in countries such as South Africa and Colombia ([Ghosh et al. 2021](#)), as well as other studies in Costa Rica ([Rodríguez-Barillas, Klerkx and Poortvliet 2024](#)), Brazil ([Penna et al. 2025](#)) and Ghana ([Akon-Yanga et al. 2021](#)). These limited examples highlight the need for more comprehensive research in the Global South. In particular, we observe research gaps in understanding (1) the (political) dynamics of TIP implementation in practice and (2) the ways in which implementation dynamics takes shape across different sectors and contexts ([Haddad et al. 2022](#); [Bergek, Hellsmark and Karltorp 2023](#); [Kok and Klerkx 2023](#)).

Given the limited analysis of TIP in the Latin American context, including Chile, this paper focuses on the emergence of TIP in this country, with an empirical emphasis on one of its main sectors, the agri-food sector. In the agri-food sector, there is increasing adoption of challenge-led, transformative, and mission-oriented innovation in both science and policy domains, emphasizing the importance of TIP ([Pigford, Hickey and Klerkx 2018](#); [Kok et al. 2019](#); [Herrero et al. 2020](#); [Klerkx and Begemann 2020](#); [Conti et al. 2024b](#)). Empirical work on agri-food-related TIPs and their role in agri-food sector transformation (e.g. [Brunori 2023](#)) has also emerged, in countries such as New Zealand, Australia, Finland, and the Netherlands ([Fielke et al. 2023](#); [Magrini 2023](#); [Klerkx, Turner and Percy 2023](#); [Nylén, Johanson and Vakkuri 2023](#); [Wiarda et al. 2023](#); [Klerkx and Villalobos 2024](#)), and there has been critical work arguing for more coherent TIP in the agri-food sector in the European Union ([European Environment Agency 2023](#)). However, apart from a study in Costa Rica zooming in on a particular technology in a subsector (Climate Smart Agriculture in the Coffee Sector) ([Rodríguez-Barillas et al. 2024](#)), there has been limited analysis in Latin America looking at the whole agri-food sector at a country level as a case.

Specifically, in order to address the two research gaps highlighted earlier, the paper empirically explores the question: how have TIPs in the agri-food sector taken shape in Chile?

2. Theoretical background

2.1 Characterizing TIPs

[Haddad et al. \(2022\)](#) identify five key characteristics of TIP based on a literature review. These characteristics are (1) a focus on ‘grand challenges and inclusive growth’, where

TIPs aim to address complex societal challenges rather than solely pursuing economic growth; (2) ‘directionality’, where TIPs coordinate and guide innovation activities toward shared visions and defined goals; (3) ‘multifaceted policy intervention’, where TIPs deploy multiple (different types of) policy instruments such as taxes, regulations, and subsidies within policy mixes; (4) ‘multilevel governance’, implying that successful TIP implementation requires coordination across local, national, and international governance levels; and (5) ‘multiple actors and global networks’, where the development and implementation of TIP rely on collaboration and negotiation among various public and private actors.

First, regarding ‘grand challenges and inclusive growth’, TIPs are third-generation innovation policies designed to address complex societal challenges, often referred to as ‘wicked problems’ (cf. [Haddad et al. 2022](#); [Rittel and Webber 1973](#)). These challenges, such as climate change, inequality, and biodiversity loss, are characterized by high complexity, interdependence, and resistance to straightforward solutions. Addressing wicked problems requires systemic innovation efforts such as those exemplified by TIP, which go beyond a narrow focus on economic growth towards catalysing transitions in socio-technical systems (cf. [Schot and Steinmueller 2018](#)). Being challenge-led, TIPs are closely aligned with frameworks like the sustainable development goals and the planetary boundaries framework, which emphasize the need for sustainable and equitable development within ecological limits ([Schot and Steinmueller 2018](#); [Rockström et al. 2009](#)). TIPs also put an emphasis on inclusive growth, which is fostered through (social) innovation processes that include a wide variety of actors in policy formulation and implementation (cf. [Ghosh et al. 2021](#)) and can contribute to inclusive economies ([Schot and Steinmueller 2018](#)). However, while a focus on inclusivity is laudable, there is a lack of empirical and conceptual clarity regarding how transformative and mission-oriented innovation contributes to dynamics of (in)justice in agri-food systems ([Kok and Klerkx 2023](#)).

Second, the ‘directionality’ of TIP pertains to how policy mixes drive innovations to contribute to desired future systems. Although various conceptualizations of directionality have been proposed in the literature (cf. [Haddad et al. 2022](#)), it involves prioritizing specific innovation activities and associated transformation pathways ([Weber and Rohrer 2012](#); cf. [Schot and Steinmueller 2018](#)). This prioritization is essential for ‘translating broad societal goals into actionable policy’ and providing clear guidance for these processes ([Bergek, Hellsmark and Karltorp 2023: 1113](#)). Directionality, therefore, implies that TIPs support innovations that ‘contribute to a particular direction of transformative change’ ([Weber and Rohrer 2012: 1042](#)), rather than ‘promoting all innovations as inherently desirable’ ([Parks 2022](#)). However, implementing a strong and coherent directionality for TIP has proven to be challenging in practice ([Parks 2022](#)). Mission-led innovation has emerged as a way to addressing these challenges, with scholars differentiating between diverse types of missions emerging in both theoretical and empirical contexts ([Wittmann et al. 2021](#)). For instance, recent studies distinguish between accelerator and transformer missions ([Wittmann et al. 2021](#)). Accelerator missions tend to be R&D-focused or technology-driven, aiming to provide (technological) solutions while addressing market and institutional failures. Conversely, transformer missions emphasize social

innovation and behavioural change, requiring more extensive governance coordination due to the complexity and multi-layered nature of the issues involved. In addition to guiding innovation, TIP can also support the emergence of new innovation pathways while facilitating the phase out of incumbent systems and technologies, a process known as exnovation (David 2017; Kivimaa and Kern 2016; Rogge and Johnstone 2017; Ghosh et al. 2021; Hebinck et al. 2022). For example, Ghosh et al. (2021) identify twelve ‘transformative outcomes’ of TIP, which focus on either supporting and scaling up innovative niches or destabilizing and dealigning existing socio-technical regimes. Similarly, Elzinga et al. (2023) outline six ‘performance functions’ of mission-oriented innovation systems, which encompass both the creation of innovations and the destabilization of established systems. Exnovation, such as phasing out excessive pesticide use in industrial agriculture, is an example of how TIP can contribute to the destabilization of outdated and unsustainable practices. The emphasis on exnovation within TIP represents a relatively novel governance strategy, equally important as fostering innovation (Hebinck et al. 2022; Stegmaier 2023; Sommer and Frank 2024).

Third, the development and implementation of TIP require a shift individual policy instruments or sectoral approaches (Schot and Steinmueller 2018; Wanzenböck et al. 2020; Hadad et al. 2022) to ‘multifaceted policy intervention’. Consequently, considerable attention has been directed to the role of policy mixes, wherein a combination of policy instruments is employed to foster transformation (Rogge and Reichardt 2016; Kern, Rogge and Howlett 2019). Rogge and Reichardt’s (2016) seminal work on transformative policy mixes emphasizes that these mixes encompass combinations of various policy processes, elements, and characteristics. Policy mixes incorporate different policy elements, including policy strategies and instruments. Policy strategies refer to ‘a combination of policy objectives and the principal plans for achieving them’ (Rogge and Reichardt 2016: 1623), while policy instruments represent ‘the concrete tools to achieve overarching objectives’ (ibid). These instruments may include regulations, economic instruments, or information resources, serving various purposes such as technology push, demand pull, or more systemic interventions (Smits and Kuhlmann 2004). To assess the transformative potential of policy mixes, the interplay between their processes and elements can be characterized by the consistency of elements, coherence of processes, and the credibility and comprehensiveness of the policy mix. However, achieving these characteristics in practice is challenging, as trade-offs, conflicts, or coordination failures often arise within and between the diverse processes and elements involved (Edmondson, Kern and Rogge 2019; Wilts and O’Brien 2019; Rodríguez-Barillas, Klerkx and Poortvliet 2024).¹

Fourth, scholars have stressed that achieving coherence and consistency within innovation policy mixes requires effective coordination (cf. Weber and Rohracher 2012; Wittmann et al. 2021). Such coordination is particularly important, as failures in aligning innovation policy mixes can result in ineffective or undesirable policy intervention outcomes (cf. Weber and Rohracher 2012). Recent studies, including those by Zepa and Hoffmann (2023) and Wittmann et al. (2021), further articulate that this ‘coordination’ can occur both ‘vertically’ (across governance levels, such as national and regional

and ‘horizontally’ (across governmental institutions or sectors). A nuanced understanding of how emerging TIP instruments and processes are coordinated across these dimensions may provide insights into addressing coordination failures in incumbent innovation systems.

Finally, implementing TIP requires ‘multiple actors and global networks’. Understanding the directionality of missions requires addressing questions about ‘who’ provides direction and ‘in which ways’. This involves identifying the actors, interests, and (government) organizations involved in setting innovation policy agendas (Kok and Klerkx 2023; Klerkx and Villalobos 2024). Scholars highlight the importance of creating shared visions among stakeholders to ensure effective and inclusive directionality for future innovation pathways (e.g. Grin, Rotmans and Schot 2010; Oomen et al. 2022). While multiactor approaches are considered crucial for implementation, scholars increasingly seek to understand the ‘how’ of multiactor processes, particularly given the high stakes involved in coordinating transformative change (Turnhout et al. 2020; Kok et al. 2021). Key considerations include balancing public and private actors’ interests, as dominant incumbent interests may undermine the transformative potential of TIP (Smink, Hekkert and Negro 2015; Diercks 2019; Grillitsch et al. 2019; Nylén, Johanson and Vakkuri 2023). For example, in the empirical agri-food context addressed by this paper, studies have shown that private sector interests frequently dominate the setting and directions of innovation agendas, focusing on optimizing rather than transforming incumbent systems, for example, through high-tech solutions (Clapp 2021; Conti, Zanello and Hall 2021; Béné 2022).

2.2 Implementing TIPs: the role of policy context

The challenges of implementing coherent, consistent, and comprehensive policy mixes highlight the context-specific and political nature of TIP and the innovation missions they promote. As noted by scholars, TIPs are often contested, particularly in terms of their directionality and the practical challenges associated with defining and executing them (Wanzenböck et al. 2020; Bergek, Hellmark and Karltorp 2023). This calls for exploration of the ‘politics of missions’ (Janssen et al. 2021; cf. Kok and Klerkx 2023). Although the significance of mission directionality and the associated challenges have been widely discussed in the literature (Bergek, Hellmark and Karltorp 2023; Klerkx and Villalobos 2024), strategies for its operationalization seem to remain highly contingent on the local dynamics of specific policy contexts (see e.g. Parks 2022; Bulah et al. 2024; Rodríguez-Barillas, Klerkx and Poortvliet 2024). Moreover, as the shaping of policy processes is inherently political, scholars have examined the relationships between policy mix processes, changes within socio-technical systems (Edmondson, Kern and Rogge 2019), and institutions (Kivimaa and Rogge 2022). Consequently, understanding the complexities of TIP implementation requires acknowledging the diversity of stakeholders and perspectives involved, the power dynamics shaping their (non) inclusion, and the historical policy and political cultures shaping and influencing policy practices (Janssen et al. 2023; Kok and Klerkx 2023; Rodríguez-Barillas, Klerkx and Poortvliet 2024).

Table 1. Analytical framework for analysing the emergence of mission-oriented and TIPs (elaborated from Haddad et al. 2022).

Key characteristic	Specification	Guiding question/operationalization
Grand challenges and inclusive growth	Societal challenge	Are societal challenges addressed through innovation policies? Which ones?
Directionality	Vision on transformation	Is there an overall vision on the direction of transformation?
	Mission type	Are there broad or very specific missions?
	Innovation and exnovation pathways	How does policy support different innovation and exnovation pathways?
Multifaceted policy intervention	Policy instrument mixes	Are (coherent) mixes of innovation policy instruments deployed to address societal challenges?
Multiactor approach	Stakeholder inclusion	Which stakeholders are included in which ways?
Multilevel governance	Horizontal coordination	How is TIP coordinated horizontally, between ministries or departments, as well as executive agencies?
	Vertical coordination	How is TIP coordinated vertically, between national and regional government levels?
Policy context	Political context	How do (historically evolved) policy and political cultures give shape to TIP?
	Policy cultures	

To develop implementation strategies sensitive to specific policy contexts, recent research emphasizes the need for governmental organizations to develop transformative capacities to direct socio-technical system change and highlights the importance of aligning and strengthening abilities, resources, and different roles within these organizations (e.g. Borrás et al. 2024). Hence, building capacities in governmental institutions, innovation agencies, and individual policymakers is a central element in overcoming the challenges in TIP implementation (e.g., Wolfram 2016; Hölscher 2020; Ghosh et al. 2021; Spanó et al. 2024). Institutional conditions, which are highly context-dependent (cf. Fuenfschilling and Truffer 2014), can either foster or hinder the transformative potential of policymaking. As Ghosh et al. (2021: 743) note, the realization of transformative outcomes is ‘contextual and contingent on different capacities and constraints’. Recent studies by Parks (2022) and Bulah et al. (2024) highlight the importance of developing both institutional and individual capacities for ensuring the directionality in TIP, aligning with identification of three dynamic capabilities by Spanó et al. (2024): sensing (the ability to scan the environment for trends and opportunities), seizing (the ability to capitalize on identified opportunities), and transforming (the ability to change internal resources to respond and adapt to changes in the environment).

These capabilities not only support policy implementation but also facilitate the gradual evolution of new institutional arrangements. Following Howells and Edler (2011), the introduction of new innovation policy approaches, such as TIP, requires structural changes across all stages of the innovation policy process, from policy formulation to execution and evaluation. This transformation typically involves the gradual development of new institutional arrangements. To understand these dynamics and emerging structures, scholars have drawn on insights from institutional theory, particularly the concept of proto-institutions or ‘institutions in the making’. According to Lawrence, Hardy and Phillips (2002: 283) proto-institutions are ‘new practices, technologies, and rules are institutions in the making: they have the potential to become full-fledged institutions if social processes develop that entrench them and they are diffused throughout an institutional field’.

Hence, we believe focusing on the context-specific (institutional) conditions that might advance or hinder the capacity to implement (different characteristics of) TIP is important for understanding how the implementation of TIP plays out in practice.

2.3 Analytical framework

Building on the aforementioned theoretical exploration, we have developed an analytical framework for examining the emergence of TIPs in the Chilean agri-food sector. This framework is informed by the five main characteristics of TIP identified by Haddad et al. (2022) and integrates the need to consider policy contexts to implement TIP. To operationalize these elements in our empirical research and data analysis, we have formulated guiding questions that correspond to each characteristic, as detailed in Table 1. As our approach to understanding the policy context was explorative, we do not operationalize policy contexts in the framework, but rather reflect upon our findings and their conceptual implications in the discussion.

3. Case and methodology

3.1 Innovation in the Chilean agri-food sector and the challenge of sustainable food systems

Chile’s geographic and climatic diversity supports a wide array of agroecosystems and agricultural products. Since the return to democracy in 1990, successive governments have continued the neoliberal policies established during the military dictatorship, supporting an export-oriented agri-food sector. These policies have facilitated the conversion of traditional agriculture into a technology-driven sector that rapidly adopts and adapts foreign technologies to secure significant market positions in products such as wines, fruits, and salmon (Pérez-Alemán 2005; Gwynne 2006; Barton and Murray 2009; Iizuka 2009). Despite a prevailing free market discourse, this shift from a domestically oriented and traditional agri-food sector to a modernized export-oriented one has been heavily supported by state investments in the form of public agricultural and food R&D, public advisory services, innovation funding, and network support from various innovation

support organizations. Key players in this ecosystem include the Economic Development Agency (Corporación de Fomento de la Producción—CORFO), the Agricultural Development Institute (Instituto Nacional de Desarrollo Agropecuario—INDAP), the Foundation for Agricultural Innovation (Fundación para la Innovación Agraria—FIA), and the Chile Foundation (Fundación Chile). Additionally, favourable investment policies and support for building foreign markets, as well as attracting investment and human capital, have further bolstered this shift towards an export-oriented sector (Bell, Juma and Juma 2007; Nelson 2007; Namdar-Irani and Sotomayor 2011; Negoita and Block 2012; Klerkx, Álvarez and Campusano 2015; Klerkx and Guimón 2017; Barton et al. 2023). While the Chilean agri-food innovation system has successfully supported this export-oriented sector, it has also generated problems, including environmental degradation, overexploitation of resources such as soil and water, and excessive use of chemical fertilizers and pesticides. Furthermore, other countries in the region have begun producing similar products at lower costs, further impacting the competitive position of the Chilean agri-food sector. In response to these challenges, there has been a growing emphasis on promoting the transformation of the agri-food sector towards more sustainable practices, in line with global trends. These efforts include very diverse pathways such as agroecology (regenerative farming without external chemical inputs) and digital agriculture (enhancing production by using precision technologies) that each have different underpinning values, assumptions, and interests (Gaitán-Cremaschi et al. 2020; Boisier et al. 2021; Barton et al. 2023; Kok and Klerkx 2023). The aforementioned innovation support organizations have also begun to incorporate sustainability criteria (such as those outlined in the sustainable development goals) into their programmes. Additionally, more stringent environmental and social well-being regulations have emerged through both government action and private standards (García Martínez and Bañados 2004; Klerkx, Villalobos and Engler 2012; Hand-schuch, Wollni and Villalobos 2013). However, as Barton et al. (2023: 9) argue in a study on directionality in Chilean agri-food innovation, due to decades of neoliberal development, the Chilean ‘state’ ‘has an active role in financing the innovation system, but [a] passive role in directing it’. This means that the Chilean state could adopt a more proactive stance by exerting stronger influence and providing clearer directionality to achieving public goals through innovation.

3.2 Approach and methods

This paper presents an illustrative qualitative case study to investigate the emergence of TIP in the Chilean agri-food sector. Our case serves as a paradigmatic example (cf. Yin 2009), enabling us to explore the specific empirical dynamics of the case itself, including the ‘how and why’, while also allowing us to use insights from the case to develop a broader generalization about the dynamics of TIP implementation.

Data collection involved 22 semistructured interviews conducted (both in-person and online) between March and May 2023 with key stakeholders from the Chilean agri-food innovation sector. Participants were selected through purposive and snowball sampling. These included high-level policymakers and representatives from innovation agencies (hereafter both as public authorities), scientific/academic experts, private

Table 2. Anonymized overview of respondents.

Respondent number	Function	Organization
A1	Director research centre	Academia
A2	Professor/researcher	Ministry
A3	Professor/researcher	Academia
A4	Professor/researcher	Academia
A5	Strategic director	Academia
P1	Director of company	Private sector
P2	Director of company	Private sector
P3	Manager innovation	Private sector
P4	Manager innovation	Private sector
P5	Manager innovation	Private sector
G1	Director of department	Regional government
G2	Director	Regional innovation agency
G3	Director of department	Ministry/academia
G4	Director of department	Ministry
G5	Director of department	Ministry
G6	Director of council	Ministry
G7	Director programme/department	National innovation agency
G8	Director programme/department	National innovation agency
G9	Director programme/department	National innovation agency
G10	Consultant and ex-director	National innovation agency
O1	Policy analyst	International organization
O2	Director	NGO

(industry) sector actors, and a Non-Governmental Organization (NGO). An overview of participants is provided in Table 2. Interviews typically lasted 1 h and were recorded with participants’ (written) informed consent. The interviews explored five areas: (1) respondents’ perspectives of key developments and challenges in the Chilean agri-food sector, (2) the role of current innovation policies, (3) the transformative nature and potential of these policies, (4) the challenges associated with designing and implementing TIP, and (5) perspectives on the broader governance dynamics in Chile.

Interviews were conducted in English or Spanish and transcribed verbatim. The transcriptions were analysed using a manual coding approach, using the developed analytical framework as a guiding principle. Our approach to data analysis was abductive (cf. Dubois and Gadde 2002). This means that we sought to engage with empirical data to contribute to theory building. Abductive reasoning relies on theoretical concepts to inform our empirical analysis, rather than generating theory from data without theoretical guidance or ‘testing’ theories through analysis. Therefore, in our analysis, we engaged in ‘systematic combining’ (ibid), which involved iterating between theoretical concepts and empirical findings, enabling us to utilize theory as sensitizing concepts (cf. Bowen 2006) and refine our framework based on the empirical findings.

To address potential limitations related to the timeline of the interviewee data, secondary data sources were reviewed to complement insights and incorporate more recent developments. These sources included the National Strategy for Science, Technology, Knowledge, and Innovation (in Spanish ‘Ciencia, Tecnología, Conocimiento e Innovación’, abbreviated as CTCI) for the Development of Chile (CTCI 2022), an

analysis of the CTCI ecosystem in Chile (Menéndez and Villaruel 2024), the National Strategy for Sovereignty and Food Security (ODEPA 2023), and documents related to the Transforma Alimentos (CORFO 2024) and Sustainable Productive Development (Gobierno de Chile 2024) programmes.

4. Findings: elements of emerging TIPs in the Chilean agri-food sector

In this section, we structure our findings around the different elements of our analytical framework (see Section 2.3), and we elaborate on how these elements emerge in TIP focused on the Chilean agri-food sector.

4.1 Grand challenges and inclusive growth

4.1.1 Societal challenges. Interviewees consistently highlighted climate change and water scarcity as dominant sustainability challenges, particularly due to their impact on agriculture (A1–A3, P2–P4, G3, G5, G6, G9, G10, and O2). In addition to these environmental issues, public authorities, academic experts, and the NGO actor (A2, A3, G4–G6, and O2) also emphasized socio-economic challenges, such as the vulnerability of smallholders, food insecurity, and the rising prevalence of obesity. Concerns regarding social justice and inclusive growth are actively considered in some policy strategies, for instance, in the National Strategy for Just Socio-ecological Transition, which aims to incorporate justice criteria in transition processes, and the 2023 National Sovereignty Strategy for Food Security 2023 (NSSA), which aims to promote a more inclusive and equitable food system (ODEPA 2023). In contrast, private sector interviewees (P1–P4) tended to place more priority on immediate, productivity-related challenges, including the need for market diversification to reduce reliance on flagship products, strengthen economic resilience, and meet growing consumer expectations for sustainable foods. This suggests a narrower focus on market-driven concerns, potentially overlooking broader socio-economic challenges and questions of justice in their innovation strategies.

4.2 Directionality

4.2.1 Vision on transformation. Public authorities highlighted efforts to articulate a transformative vision for the agri-food sector, focusing on concepts such as sustainability, just socio-ecological transition, food sovereignty, and food security (G3, G4, and G9). The NSSA 2023 strategy represents an initial step towards integrating these concepts (ODEPA 2023). However, many interviewees (A2–A5, P1, P3, P4, G5, G7, G10, and O2) noted significant challenges that impede a unified vision. Ministerial fragmentation was identified as an obstacle, with various ministries and agencies, even within the Ministry of Agriculture, pursuing divergent and sometimes conflicting agendas. For example, while some agencies such as CORFO and Oficina de Estudios y Políticas Agrarias (ODEPA), in English ‘Office of Agrarian Studies and Policies’ prioritize export-driven systems and large-scale agricultural production, others, such as INDAP, focus on supporting small-scale farming and rural development. These differing priorities arise from distinct institutional mandates, which often result in fragmented priority-setting and insufficient mechanisms for aligning efforts towards a unified innovation agenda (Klerkx,

Theis and Janssen 2013). The persistence of policy silos further hinders the development of an integrated vision for the agri-food sector, limiting the focus primarily to agricultural production rather than adopting a more comprehensive view of the entire agri-food sector. In this regard, an interviewee (G7) noted that the absence of a dedicated Ministry of Agriculture and Food (hence going beyond agriculture and taking a whole food systems perspective), which could coordinate sector-wide efforts, worsens these challenges. Additionally, some interviewees expressed scepticism about the depth of the emerging vision. As one private sector interviewee (P1) stated, ‘I have the impression that there are no significant new instances beyond those of the past to guide agri-food policy’. Another interviewee (A2) emphasized the influence of powerful business groups that often prioritize economic growth, noting how their dominance in policy-making hampers the development of a more transformative vision.

4.2.2 Which missions? Public authorities highlighted a shift towards challenge-led policies (G3, G4, G6, and G7), exemplified in initiatives like the CTCI 2022 (CTCI 2022) and NSSA 2023 strategies (ODEPA 2023). These initiatives address multiple goals, including sustainable productive development, just socio-ecological transition, food sovereignty, food security and climate change mitigation. According to some interviewees (A3, G6, and G7), the term ‘missions’ is deliberately avoided due to its politicized connotations. One interviewee (A3) explained, ‘There is an ideological issue with approaches like mission-oriented because these approaches are not neutral... when missions are discussed in Chile, everyone starts looking at the left’. This reflects political caution aimed at maintaining consensus, which is especially important in a country with strong ideological divides.

Challenge-led policies in Chile’s agri-food sector exhibit broad directionality, meaning that they allow for multiple approaches to addressing challenges rather than prescribing a single transformative approach (P3, G4, and G7). For example, one interviewee (G4) described the NSSA 2023 strategy as a ‘long-term policy’ that creates ‘space for all’, emphasizing shared concepts like sustainability without forcing one specific approach. Another interviewee (G7) added, ‘... the narrative must lead to the idea that all roads lead to sustainability, whether through agri-food tech or regenerative agriculture’. This inclusivity supports diverse approaches such as agroecology, regenerative agriculture, circular agriculture, and agri-food technology innovations. However, such a broad directionality can also present challenges in terms of policy coherence, as it risks dispersing efforts and resources, potentially diluting the impact these policies seek to achieve.

Concerns about insufficient governmental directionality in the agri-food sector persist among most interviewees (A1–A5, P1–P3, G5, and G10), with one interviewee (G5) observing, ‘There is a lack of directionality in the agri-food sector, with most innovation still focused solely on increasing production’. Academics (A1–A5) echoed this, highlighting an absence of clear guidance to address challenges.

Private sector views on the absence of directionality in agri-food policies were divided. One interviewee (P4) saw the lack of direction as positive, advocating for a market-driven approach where the government’s role should focus on creating favourable research and financing conditions,

while allowing market dynamics to shape transformative trajectories. This aligns with Chile's neoliberal policy context. Others (P1–P3) called for stronger governmental leadership to guide private sector innovation towards public goals. While top-down guidance may seem to be contradictory to TIP, it suggests a more centralized government role in initiating collaborative, multiactor innovation transformative efforts. Interestingly, beyond the agri-food sector, interviewees (A2, A4, P3, G1, G3, G6, and G10) pointed out more sharply defined mission-oriented approaches in sectors such as energy and mining, particularly in decarbonization initiatives like the green hydrogen development, coordinated through CORFO's Sustainable Productive Development programme (Gobierno de Chile 2024). These examples suggest that mission-oriented frameworks might face political barriers in the agri-food sector, while they are gaining traction in other domains. This contrast may be due to the stronger economic interests and market-driven dynamics present in energy and mining, which facilitate clearer policy directions.

4.2.3 Innovation and exnovation. Interviewees (A2, A3, G4, G5, and G7) noted that public institutions tend to prioritize innovation over exnovation. Weak regulatory frameworks and the lack of stringent regulations grant considerable freedom to the private sector, undermining efforts to transition away from unsustainable practices such as water over-extraction or unsustainable livestock production. Building on this, an interviewee (G7) emphasized that exnovation 'requires uncomfortable conversations, dealing with uncertainty, and adapting to change'. However, as this interviewee further commented, these discussions have been largely absent in Chile, partly due to cultural tendencies to avoid confrontation and conflict, leading to a preference for maintaining the *status quo*. Institutional resistance from powerful sectors, such as large agricultural or industrial groups, further hinders the implementation of stricter regulations and transformative reforms.

The challenges of implementing exnovation strategies become evident through the contrasting perspectives of two interviewees regarding specific exnovation instruments like extended producer responsibility laws and food labelling regulations. One (G6) viewed these instruments as catalysts for change, noting that while designed for exnovation, they inadvertently stimulated innovation. For instance, food labelling regulations prompted innovation as companies sought to avoid negative labels, reformulating products to reduce sugar or fat content. The other (P4), however, saw them as punitive and stigmatizing. This divergence illustrates the challenge of aligning diverse perspectives and interests when trying to phase out unsustainable practices, suggesting that exnovation involves not only technological or regulatory change but also the negotiation of competing economic and social interests.

4.3 Multifaceted policy intervention

The responses to whether coherent and comprehensive mixes of innovation policy instruments are deployed to address societal challenges revealed a range of insights, highlighting both progress and challenges.

Public authorities observed improved alignment among policy instruments within individual ministries and agencies (A4, G3, G4, and G9). For example, the Ministry of Agriculture is transferring funds to FIA, which is aligning its

funding priorities with the Ministry's goals, in areas such as climate change, sustainable food systems, gender equality, and cooperatives (G4). Similarly, CORFO is working to enhance the coherence of its internal policy instruments. However, challenges persist, including the presence of overlapping, outdated, or low-impact instruments that fail to address emerging needs (P3, G3, G6, and G10). This results in duplicated efforts, missed synergies, or undesirable policy outcomes (cf. Weber and Rohrer 2012). Such problems stem from uncoordinated decision-making within these institutions and underdeveloped policy evaluation methodologies, which hinder the ability to assess the effectiveness and relevance of instruments to determine whether they are achieving their intended impact. As pointed out by several interviewees (A1, A2, P1, P3, G4, G6, and G7), these internal coherence challenges are mirrored by similar issues in horizontal coherence between ministries and agencies (see Section 4.5). For example, one academic interviewee (A2) pointed out the misalignment of policy instruments between the Ministries of Finance (particularly CORFO) and Science, limiting streamlined R&D efforts and efficient funding allocation. Other interviewees (A4, G3, and G4) expressed optimism, noting that a growing common language around concepts such as sustainable productive development and just socio-ecological transitions could foster interministerial collaboration and political alignment.

Lastly, interviewees also identified gaps in the comprehensiveness of the policy mix for transformation. They noted the absence of exnovation instruments to phase out outdated or unsustainable practices (see Section 4.2.3) (G4 and G5). Second, the comprehensiveness of the policy mix is further hindered by the lack of instruments designed to address the barriers to scaling. As one interviewee (G7) summarized, 'The challenge lies in how we move from prototypes to fully implemented innovations that produce impact and achieve their intended results'. Moreover, many instruments focus on technological innovations, while overlooking social innovations (A2, G5, and O2).

4.4 Multiactor approach

Public and private sector interviewees (P2–P4, G4, G7, and G9) highlighted institutional efforts, particularly by institutions like CORFO, which have demonstrated the potential to promote collaboration across industry, academia, and government, in policy design and implementation. For example, two interviewees (P5 and G7) emphasized that CORFO's initiatives, such as the Transforma Alimentos programme, have created opportunities for diverse stakeholders to align around specific innovation goals. These programmes have initiated new partnerships in areas such as functional ingredients, territorial hubs, and initiatives like TT Green Foods (CORFO 2024). As one of the interviewees (G9) remarked, 'CORFO works closely with the private sector to develop policy instruments, constantly assessing industry needs and aligning the programs accordingly'.

Despite these efforts, challenges remain in ensuring broader inclusivity in TIPs in the agri-food sector. One primary issue identified by interviewees (A4, G10, and O2) was the top-down nature of policymaking, which prevents meaningful stakeholder engagement. As one interviewee (O2) noted, 'Dialogue with institutions is not institutionalized.. participation often means reviewing pre-designed policies'. This suggests

that the design of innovation policies remains disconnected from the diverse needs of some stakeholder groups (e.g. NGOs and social organizations), limiting their ability to influence policy direction. A second theme was the perceived dominance of incumbent actors in shaping innovation agendas, particularly those with established economic influence (A1, G8, and O2). As one academic interviewee (A1) remarked, ‘The government tends to listen more to established incumbents rather than disruptive entrepreneurs’. This aligns with the literature on agri-food innovation, which has stressed that entrenched private sector interests can limit the transformative potential of innovation policies (Clapp 2021; Conti, Zanello and Hall 2021). While the shift towards challenge-led policies has opened spaces to broader participation (e.g. through the NSSA 2023 strategy), the persistence of incumbent power dynamics potentially remains a constraint for more disruptive transformation. Furthermore, power dynamics were seen to reinforce barriers to the participation of less-advantaged actors (A1 and G3). One interviewee (A1) noted, ‘entrepreneurs who receive government support tend to come from privileged backgrounds—well-educated, internationally exposed, fluent in English, and from affluent areas of Santiago’. This reflects barriers that exclude less-advantaged entrepreneurs, particularly those from peripheral regions or less traditional sectors, and limits the inclusivity of innovation policies.

Lastly, an interviewee (G10) pointed out that there is still a need for more support to enhance collaboration between the public, private, and academic sectors in the design of transformative policies, ‘We need to understand who we must engage, where to reach them, and whom we need to mobilize or transform’. This underscores the need for new strategies and capacity development to incorporate diverse perspectives into policy development.

4.5 Multilevel governance

4.5.1 Horizontal policy coordination. Public authorities acknowledged efforts to foster collaboration between ministries and innovation agencies (G3, G4, G6, G7, and G9). Examples include the NSSA 2023 strategy and the Transforma Alimentos programme, both of which aim to enhance intersectoral coordination in addressing challenges in the agri-food sector (G4 and G7). The Sustainable Productive Development programme also emerged as a standout example of effective coordination (A4, G3, and G6). Although not exclusively focused on the agri-food sector, this initiative brings together multiple ministries, including those of Economy, Science, Environment, Energy, Health, and Education (Gobierno de Chile 2024). The programme is viewed as a strategic effort to bridge institutional silos and encourage a more integrated approach to policymaking, driving sustainable productivity while aligning diverse policy agendas around common goals. As one interviewee (G6) remarked, ‘The program is provoking the coordination between different ministries... we need to protect this approach, because it is a very big hope. If this government is successful about that, we can change the trajectory to organize the state, the governance’.

Despite these promising initiatives, significant challenges remain in fostering horizontal policy coordination (A1–A4, P1, P3, G1, G3, G7, G10, and O2). As highlighted earlier, the lack of a unified vision often leads institutions to focus on their own agendas instead of intersectoral goals.

This fragments policy efforts and undermines the capacity to design and implement coherent and consistent policy mixes to address cross-cutting challenges like climate change. Adding to these challenges, interviewees (A4, A5, P2, G4, G9, and O2) highlighted limited resources in terms of time of assigned teams and managerial expertise to engage in collaborative processes required to implement transformative agendas. This, combined with an absence of adequate spaces for long-term strategic planning, deepens the fragmentation of efforts (A4, G7, and G9). Moreover, some interviewees (A2–A4, P5, G3, G6, and G7) pointed out that the slow adoption of challenge-led or mission-oriented policies reflects a broader institutional inertia, driven by entrenched routines, organizational structures, and bureaucratic practices that resist change. As an interviewee (G6) noted, ‘institutions are very hard to change in their common way of doing things, so it is an extremely slow process’. This resistance restricts the experimental, flexible, and anticipatory approaches that TIP demands, favouring immediate, short-term priorities over future-oriented planning.

4.5.2 Vertical policy coordination. Interviewees described a trajectory of centralization and ongoing decentralization efforts regarding policies on science, technology, knowledge, and innovation (A3, G1, G2, G3, G5, and G6). Key milestones in this process included the establishment of regional science and technology centres in the 1990s, the enactment of Law 21.074 in 2018, and the election of regional governors in 2020. Law 21.074 notably introduced Regional Committees for Science, Technology, and Innovation for Development, aligning regional strategies with the 2022 national CTCI strategy to strengthen local capacities, address regional challenges, and contribute to global agendas like sustainability and climate change (CTCI 2022).

Despite these advances, interviewees, particularly academics (A3–A5, G1, G2, G5, G10), identified persistent challenges to vertical coordination. A primary concern is the disconnect between national policies and regional implementation. As one public authority interviewee (G1) stated, ‘Strategic policies such as missions are often confined to elite circles and fail to permeate regional governmental structures’. This reflects a broader challenge of limited region-specific policies, such as those of the Ministry of Agriculture, and legal authority for governors, which restrict the capacity for local adaptation and innovation (A3 and G5). Additionally, centralized financial control by entities like Dirección de Presupuesto, in English ‘Budget Directorate’ and the national Comptroller’s Office leaves regional governments with little autonomy over budgetary decisions and resource allocation (A3, A5, G1, and G6). Strict controls and oversight mechanisms constrain local decision-making, as most significant financial decisions are made at the national level.

Furthermore, interviewees consistently highlighted regional governments’ struggles to build necessary capacities for implementing TIP. They noted a focus on operational matters over strategic planning and a lack of exposure to external networks. Significant disparities in capacities between regions were also emphasized, with, for example, academic resources heavily concentrated in main regions like Santiago de Chile (A1, A3, A4, G3, G5, and G6).

Nevertheless, some interviewees (G6, G7, and G10) expressed optimism about the potential of decentralized governance. Regional innovation ecosystems were seen as

opportunities for collaboration among businesses, regional universities, and local governments, leveraging their understanding of local issues. As a public authority interviewee (G7) noted, ‘I believe the hope for TIP implementation lies in building stronger regional innovation ecosystems, with regional governments taking a leading role. In these spaces there is greater potential to align ideas and resources’.

4.6 The role of policy contexts

Based on the interviews, we identified four contextual factors strongly influencing Chile’s capacity to enact TIP in the agri-food sector: (1) organization of public administration, (2) national political dynamics, (3) national policy cultures, and (4) geographical contexts.

Firstly, Chile’s public administration is characterized by short policy cycles that conflict with the long-term planning required for TIP (A2, P3, G4–G7, G9, and G10). Funding structures favour short-term projects and sector-specific programmes, which limits the flexibility required for sustained, long-term transformative initiatives. As a result, financial support is concentrated in specific policy areas, reinforcing sectoral silos and constraining opportunities for cross-sector collaboration (A2–A4, P5, G3, G5–G7, and O2). Additionally, bureaucratic practices and lack of consistent leadership further complicate coordinated, long-term planning efforts. At the same time, as pointed out earlier, some interviewees (particularly public authorities) noted a positive shift towards intersectoral approaches, exemplified by the Committee of Ministers for Sustainable Productive Development and the Council of Ministers for Sustainability and Climate Change, among others. They also observed increased government proactivity in guiding innovation through data gathering, technology support, and anticipatory analysis, as reflected in the [CTCI \(2022\)](#) strategy.

Regarding national political dynamics, interviewees emphasized how frequent changes in political leadership disrupt policy continuity (A1, A2, G7, and G9). New presidential administrations often reset priorities, resulting in a lack of consistency and follow-through on long-term initiatives. As one interviewee noted (A2), this political instability fosters a ‘firefighting’ approach to governance, where policies are reactive rather than proactive. Additionally, as pointed out by a public authority (G9), congressional dynamics add complexity for TIP implementation. Unlike the executive branch, which reflects immediate priorities set by the president, the legislature is characterized by a broader ideological diversity and ongoing negotiation processes. This can both institutionalize and obstruct long-term policies such as TIP. For example, concepts like food sovereignty and socio-ecological just transitions can become highly contested due to ideological differences (G4 and G5). Lastly, recent shifts from the consensus-based governance that characterized Chile’s political transition post-dictatorship, a period marked by political stability and compromise among major parties, to more polarized, conflict-driven politics have created an unstable policymaking environment. As a private sector interviewee (P2) noted, this shift, driven by efforts to secure votes and deepen ideological divides, has hindered collaborative efforts across political factions needed for TIP.

Thirdly, interviewees, particularly from academia and the private sector (A1–A3, P1, P2, and G10), highlighted that Chile’s policy culture presents barriers to advancing TIP. One

theme was the paradox between Chile’s strong free market ideology and the substantial state support for innovation. An academic expert (A2) noted that while the government invests heavily in innovation, powerful business groups often advocate minimal state intervention, limiting policy ambitions for transformative change. This tension is further exacerbated by the private sector’s conservative approach and limited investments in innovation (A1, P1, P2, and G10). The ideological adherence to market-driven principles restricts the capacity of the state to intervene in traditionally market-dominated sectors, inhibiting debates and policies aimed at actively directing innovation toward broader societal goals.

Lastly, Chile’s unique geography was cited as a significant factor influencing TIP emergence (A1, A3, and G5). The country’s diverse climate and ecologies, spanning from Patagonia in the south, the Andes mountains, and the Atacama Desert in the north, necessitate flexible regional policies, particularly in sectors like water management and agri-food. As one respondent stated, ‘The diversity of agri-food business models, challenges, and potential solutions differs per region, demanding tailored approaches’. While centralized governance was limiting responsiveness to these regional variations, as noted before, there is a trend, while still limited, towards decentralization and policy experimentation, driven by new social and political demands.

5. Discussion

In this section, we first present the key findings of our empirical analysis and highlight implications for TIP (5.1). Based on these, we further articulate our theoretical contributions to literature by elaborating on the importance of considering the roles of policy capabilities and proto-institutions in TIP development (5.2). We then reflect upon the study’s limitations and present several directions for future research (5.3).

5.1 Key findings and implications for TIPs

In our analysis of the Chilean agri-food sector, we sought to identify the emergence of TIP by focusing on six key characteristics (cf. [Haddad et al. 2022](#)). Our findings suggest that while TIP has been taking shape in recent years, its manifestation is primarily evident in high-level policy discourses, with implementation efforts and (coordination of) concrete instrument mixes still in full development without being fully coherent and institutionalized. In [Table 3](#), we present the key findings organized around our analytical framework, along with their implications for TIP.

Notably, there is an absence of strong overarching shared labels such as ‘missions’ due to political sensitivities. Instead, TIP implementation has largely occurred through challenge-led innovation and the reframing and rebranding of existing policy instruments, echoing findings elsewhere (e.g. [Grillitsch et al. 2019](#)). However, our findings also highlight that new and dedicated strategies and programmes are being developed by innovation and government agencies. The situation in the Chilean agri-food sector in that sense resembles the case of New Zealand, where elements of TIP are emerging, but not yet in a coherent and consistent fashion ([Klerkx, Turner and Percy 2023](#)).

Another key finding is that the challenged-led innovation approaches emerging in the agri-food sector are broad

Table 3. Overview of key findings and implications for TIP in Chile.

Key characteristic	Key empirical findings	Implications for TIP in Chile
Grand challenges and inclusive growth	<ol style="list-style-type: none"> Overall, there is a focus on grand sustainability challenges, particularly climate change and water scarcity. Public authorities, academics, and NGOs also emphasize socio-economic vulnerabilities and justice, while private sector actors prioritize market-driven challenges. 	<p>TIP needs to be sensitive to place-based challenges, recognizing that despite the need for national-level policy efforts to coordinate, there are no one-size-fits-all solutions.</p> <p>TIP could explicitly account for considerations of socio-economic vulnerabilities and social justice by targeting existing injustices, preventing new ones and ensuring equitable innovation benefits, while considering the market-driven priorities of private actors.</p>
Vision and directionality	<ol style="list-style-type: none"> There is a plurality of visions in the public sector, which are not perceived as uniform (or even as a vision) by private sector and academia actors or even within the public sector itself. There is broad directionality, focusing more on stimulating innovation than on phasing out unsustainable practices (exnovation). 	<p>TIP needs to balance pluriform visions and transition pathways with coherent policy instrument mixes.</p> <p>TIP should balance broad directionality with clear focus to avoid dispersing efforts and ensure policy coherence.</p> <p>TIP needs to balance innovation with exnovation pathways, using instrument mixes to phase out unsustainable practices, while addressing diverse perspectives and interests.</p>
Multifaceted policy intervention	Ongoing efforts to develop new or adjust existing TIP instruments, though not yet fully coherent or comprehensive.	Coherent and comprehensive mixes of instruments should be further developed and implemented.
Multiactor approach	Cross-sectoral and transdisciplinary collaborations are taking shape, especially involving the private sector. Policy-making remains rather top-down, favouring incumbents with limited inclusion of grassroots initiatives, social movements, and citizens in TIP.	Deploying multiactor processes, including ‘unusual’ collaborations with social movements and disruptive entrepreneurs, could strengthen legitimacy and implementation of transition pathways supported by TIP.
Multilevel governance	<ol style="list-style-type: none"> Horizontal coordination is taking shape, also in the form of new institutional arrangements, but remains challenging due to sectoral divisions and organizational structures. There is recognition of the importance of vertical coordination with the regions; however centralization remains, and regions have limited transformative capacities to implement and further develop TIP. 	<p>Government structures (incl. budgeting) and organization should be adapted so that it supports cross-sectoral transformative innovation policymaking.</p> <p>TIP is mostly considered at national-level policymaking, while regions will need to play a role in implementation and contextualization. Regions need resources, skills, leadership, and strategic vision to effectively implement TIP.</p>
Policy context	There are several contextual factors that influence the emergence of TIP and often hinder development and implementation of TIP instruments: (1) organization of public administration, (2) national political dynamics, (3) national policy cultures, and (4) geographical contexts.	<p>Actors and organizations in both public and private sectors need to strengthen capabilities to work within policy contexts, as well as create institutions that support TIPs.</p> <p>Government structures (incl. budgeting) and organization should be flexible and adaptable to support implementation of TIP instrument mixes.</p> <p>TIP should take into account diverse geographies, by further enhancing collaboration between regions and the central government in TIP development</p>

in its scope and direction, allowing for different pathways towards sustainable development. Such a broad focus is understandable given the diverse structure of the agri-food sector, ranging from smallholder farmers to large export-oriented producers, leading to varied and often competing visions for future agriculture (Gaitán-Cremaschi et al. 2019, 2020). This makes it particularly difficult to reconcile and implement a unified, long-term transformation vision for the agri-food sector. At the same time, technology-driven pathways seem more dominant than those focusing on social innovations. While the issue of social justice was present in government strategies (such as focusing on food sovereignty) and agencies (such as the recently established Office of Just Socio-Ecological Transition), for innovation policy, justice concerns seemed less visible than environmental or economic concerns. Therefore, the innovation policy in Chile seems to develop more toward ‘accelerator missions’, that are often

R&D-focused or technology-driven, aiming to provide (technological) solutions while addressing market and institutional failures, rather than ‘transformer missions’ that seek to address broader socio-economic structures (cf. Wittmann et al. 2021).

However, without social innovation and an explicit focus on justice considerations in agri-food transitions, technological solutions may lead to adverse effects and run into entrenched cultural norms, power structures, and institutional inertia (e.g. Kaljonen et al. 2021; Kok and Klerkx 2023). Studies into the Chilean context have elaborated on the entanglement between the agri-food sector, sustainability challenges, and social justice concerns (Parraguez-Vergara et al. 2018; Carranza et al. 2020), and while the National Strategy for Just Socio-ecological Transition.² contemplates this, it seems not yet that explicit for the agri-food innovation how to achieve this. Hence, bundles of socio-technical

innovations are essential to ensure that innovations align with societal contexts and are effectively adopted (Barrett et al. 2022). Our analysis suggests that transition pathways that target both technical and social innovations could be strengthened for TIP in the Chilean agri-food sector. Furthermore, recent work suggests that diversities and directionalities in transition pathways and search directions in agri-food transitions are not mutually exclusive, but can co-exist in addressing grand challenges (Bulah et al. 2024).

Our analysis also revealed developments towards coherent TIP mixes in the Chilean agri-food sector, as well as challenges that emerge in that process. In particular, strategies to implement broad visions on agri-food sector transformation remain fragmented across government levels and agencies, and our analysis suggested challenges in both horizontal coordination (at national level, for instance, due to fragmented and siloed ministerial policies in a centralized government system, separating agricultural and environmental domains) and vertical coordination (for instance, due to the lack of innovation capacities and funding in many regions, in combination with centralized funding instruments). Furthermore, our analysis revealed that innovation policy focuses more strongly on innovation than on exnovation, implying the need for novel instruments to support exnovation of unsustainable agri-food practices in the policy mix. While we did not analyse the relationship between policy instruments in detail, our analysis suggests that policy layering might occur, whereby new instruments are added to policy mixes while existing goals and instruments remain in place (cf. Howlett and Rayner 2014). In the Chilean agri-food sector, this is reinforced by both strategic concerns of policymakers (such as the avoidance of the term ‘mission’) and government organizational structures and power dynamics that favour more incremental changes in policy instrument mixes. Such challenges, emerging from the complexity of agri-food systems (see also Conti et al. 2024a), as well as the fragmented nature of policy instruments and goals regarding agri-food innovation, resemble developments in Costa Rica, where emerging TIP is hampered by fragmentation and lack of coordination between instruments (Rodríguez-Barillas, Klerkx and Poortvliet 2024).

Importantly, our analysis indicated that the emergence of different TIP elements is strongly influenced by a variety of factors related to the Chilean policy context. These factors are highly diverse, ranging from institutional factors (such as sectoral government organization and legal-financial factors such as budget constraints) to material structures such as varied geographical contexts leading to diverse agricultural practices. Government structures have emerged due to historically grown path dependencies. These included shifts towards an export-oriented and market-oriented agri-food sector with a strong neoliberal legacy, political polarization where ‘missions’ are seen as part of a political left-wing ideology, a centralized organisation of national government, and a large influence of private sector interests driving agri-food sector development.

This context drives the strategies that government actors (can) use to implement (elements of) innovation policies, often complicating implementation of coherent and long-term TIP. The need to consider how directionality takes shape and which strategies are used to implement it is increasingly recognized in the TIP literature (e.g. Parks 2022; Bergek, Hellsmark and Karltorp 2023). To this body of work, our analysis adds

the importance of considering complex policy contexts in driving directionality of TIP. Therefore, while TIP approaches using mission-oriented innovation are promoted by international organizations such as Organisation for Economic Cooperation and Development (OECD), this must consider that this approach will take unique shapes in different policy contexts. This, we believe, also directs attention to how capacities of governments and emerging institutions can facilitate TIP implementation.

5.2 Emerging capabilities and proto-institutions for TIP

Our findings revealed that alongside the emergence of TIP, a variety of institutions are developing to facilitate TIP and its associated policy instruments, providing support through, for instance, funding programmes, networking support, and foresight. In particular, our analysis suggests that these institutions take shape as new organizational structures and policy practices (such as collaborative policy work) aimed at fostering transformative innovation and addressing societal challenges. They involve a variety of actors, including governmental bodies, research institutions, universities, private companies, and consortia.

As described in the analysis, these efforts are materializing through different policy arrangements, including new ministerial offices (e.g. Office for Just Socio-Ecological Transition), new interministerial taskforces or regional committees, new funding instruments such as developed by CORFO, or new roles for scientific committees and councils (e.g. National Council of Science, Technology, Knowledge, and Innovation for Development). Our analysis suggests that these emerging institutions fulfil different roles, which include (1) innovation system coordination, (2) science-policy advice, (3) fostering cross-sectoral approaches, (4) multistakeholder engagement, and (5) learning and experimentation. Furthermore, while new institutions are still evolving, our respondents considered a crucial role for these institutions in building capabilities needed to advance policies for transformative innovation. These emerging institutions can be seen as proto-institutions that shape structural innovation in innovation policy (Howells and Edler 2011), but have not yet consolidated. In Table 4, we provide an explorative overview of different functions that emerging proto-institutions fulfil in supporting TIP in Chile.

Following Spanó et al. (2023), who conceptualized the capabilities of scanning, seizing, and transforming (see Section 2.2), our analysis revealed that Chilean institutions (such as ministries and new taskforces) are actively scanning the environment by identifying emerging trends and challenges in the agri-food sector. Seizing is exemplified through the development of new policy instruments and programmes by CORFO (Transforma Alimentos and the Sustainable Productive Development programmes) and other institutions, as well as collaborative platforms and interministerial committees (e.g. Sustainable Productive Development Committee of Ministers for Sustainable Productive Development and the Council of Ministers for Sustainability and Climate Change). Transforming could be illustrated by the ongoing institutional reorganization, such as the creation of new offices, government laboratories, and councils, as well as efforts to restructure and align funding to support agri-food transformation.

Table 4. Overview of identified functions of proto-institutions in supporting TIP.

Function	Description	Examples
Innovation system coordination	(Public–private) Partnerships and initiatives that reflect a collective effort towards common innovation objectives.	There are intentions for joint innovation programmes and partnerships among companies, particularly for addressing challenges like the circular economy, and open innovation strategies, which may contribute to the formation of proto-institutions. Universities, research institutes, and private companies are collaborating through consortia and technological networks. This coordination is fostering the emergence of proto-institutions within the innovation ecosystem.
Science-policy advice	Advising politicians on (transformative) innovation strategies and implementation.	The new institutional framework for Science, Technology, Knowledge, and Innovation reinforces the role of the National Council of Science, Technology, Knowledge, and Innovation for Development (CTCI council). This autonomous advisory body, mandated to advise the President and formulate national strategies, exemplifies a proto-institution.
Fostering cross-sectoral approaches	Breaking down institutional silos, promoting innovative practices and cross-sectoral policy work.	The establishment of the Office of Just Socio-ecological Transitions within the Ministry of Environment and the development of an associated Strategy for Just Socio-Ecological Transitions signifies the emergence of a proto-institution focused on facilitating transition processes to address challenges such as climate change. Despite its formalization, the office is still in the process of defining its role and building networks, indicative of proto-institutional development. The Government Laboratory, operating independent of governmental changes, acts as a proto-institution, promoting innovative practices and breaking down institutional silos. Despite its formal structure, its role in fostering innovation signifies the evolution of proto-institutional dynamics within governmental entities. The Council of Ministers for Sustainability and Climate Change approved the Climate Change Adaptation Plan for the Agri-Food Sector, developed by the Ministry of Agriculture and in collaboration with the Ministry of the Environment. This plan aims to coordinate actions across government services and engage public and private institutions.
Multiactor engagement	Integrating stakeholder perspectives into innovation policy processes.	Initiatives such as National Commission for Food Security and Sovereignty, with their intersectoral and public–private governance, highlight the potential for transformative change in food systems Governance models exemplified by Transforma Alimentos function as proto-institution fostering collaboration, knowledge exchange and innovative solutions across diverse stakeholders.
Learning and experimentation	Developing experimental approaches to governance (on local or national levels) in efforts to support capacity building.	Pilots with basin councils coordinated by the Office of Just Socio-ecological Transitions within the Ministry of Environment exemplify proto-institutions striving to incorporate local adaptive governance.

Furthermore, our analysis suggested increasing attention for capacity building initiatives such as anticipatory skills exemplified in the CTCI strategy,³ strengthening interdisciplinary education and research at universities and redistributing resources to transformative and collaborative research and regional innovation programmes.

At the same time, how proto-institutions fulfil such roles and the extent to which they develop is contingent on the context-specific legal-institutional design of the existing innovation policy system (Spanó *et al.* 2024). As we elude to above, the organization of public administration focused on innovation, driven by various legal-institutional factors, strongly influences how TIP is emerging in the Chilean agri-food sector. This also aligns with recent work of Kalvelage *et al.* (2023) on the importance of considering contextual factors in agricultural policy development. Therefore, we argue that it is important to consider how such institutions are

related to and embedded within broader government structures and to analyse how a variety of emerging institutions support or hinder each other in the design and implementation of TIP.

Our analysis revealed that (in particular) government actors working on the agri-food sector innovation sought to develop institutional support for more transformative approaches and instrument mixes. This aligns with ideas from Smolka and Heugens (2020), who emphasize the need to consider how (policy) entrepreneurship influences institutional development. Our work suggests that developing (capabilities for) TIP involves understanding how policy actors nurture and support proto-institutions to effectively engage in ‘doing’ transformative innovation policymaking in practice. As Spanó *et al.* (2024) argue, and our findings reflect, this requires considerable building of capabilities (see also Ghosh *et al.* 2021).

5.3 Limitations and future research directions

Our work serves as an exemplary case illustrating the importance of considering the (political) dynamics of implementing TIP in practice, as well as how implementation dynamics take shape across different sectors and contexts. At the same time, our study has several limitations that also provide avenues for future research. For instance, while we focused on the emergence of elements considered part of TIP, we did not conduct a comprehensive evaluation of the effects and outcomes of different (new and old) innovation policy instruments. We also conducted a ‘snapshot analysis’, focusing more on the underlying dynamics of policy emergence and the current state of TIP, rather than conducting a long-term assessment of policy mix development and institutional change. At the same time, as our interviewees have considerable experience in the Chilean agri-food and innovation domains, they were able to point out relationships and historical trajectories underpinning the current state of affairs, allowing us to observe the role of policy contexts. Additionally, while our work focused on Chile as a whole, we did not map out all the interactions between specific regional innovation systems and national policies, thus not observing how regional differences manifest.

Based on our findings and the limitations of our study, we identify five directions for future research.

First, while our study contributes to the body of work on TIP as a policy framework (e.g. Ghosh et al. 2021; Janssen et al. 2021; Haddad et al. 2022), by analysing the implementation dynamics of emerging TIP, we did not assess the policy mixes themselves and the extent to which they are transformative. Future research should explore the coherence within and between different instruments in emerging TIP mixes (cf. Rogge and Reichardt 2016) and how these lead to specific impacts or outcomes of TIP, for example, in the Chilean agri-food sector (following similar analysis by Rodríguez-Barillas, Klerkx and Poortvliet 2024). In particular, we suggest further exploring how processes of policy layering (whereby new elements are added to existing policy mixes) and policy drift (whereby goals of policy mixes change, while keeping similar instruments) relate to policy outcomes in the Chilean context (cf. Howlett and Rayner 2014).

Second, we suggest further integrating the literature on TIP and insights from institutional theory on proto-institutions. Future research could assess the different roles and functions of proto-institutions and their consolidation in the formation of TIP and analyse how they contribute to developing policy capabilities in different contexts (cf. Spanó et al. 2024; Penna et al. 2025). In particular, given that we studied the case of Chile which is a Latin American high income country, we believe that it is important to direct attention to the specific policy contexts of low- and middle-income countries across the globe, in particular, as these have received less attention in the field of (agri-food) transition studies (Ramos-Mejía, Franco-García and Jauregui-Becker 2018; Hebinck et al. 2021). This could also help to further explore how TIP contributes, if at all, to socially just agri-food transitions, a topic gaining prominence in the field (Hebinck et al. 2021; Kaljonen et al. 2021).

Third, our findings suggest that the private sector plays a key role in shaping innovation system dynamics and interacting with (transformative) innovation policy processes. Future research could disentangle the different roles that (large) companies (cf. Clapp 2021), and start-ups (Klerkx and Villalobos

2024) fulfil in hindering or promoting (transformative) innovation policies in the agri-food sector and in setting policy agendas. Understanding how policy actors could, and should, engage with different private sector actors is needed to help design TIP that does justice to social, environmental, and economic interests.

Fourth, our work highlights the importance of exploring the relationships between regional authorities (including the geographical diversity and agri-food sector diversities that become manifest in regions, cf. Gaitán-Cremaschi et al. 2019) and TIP, which are often formulated at a national governance level. This requires developing understandings of TIP that are sensitive to ‘place’ (Uyarra et al. 2025). Insights into place-based governance (Sonnino and Milbourne 2022; Janin et al. 2023) and the roles of place-based transition intermediation (Loeber and Kok 2024) could help understand how TIP ‘hits the ground’ in different regions and how the transformation of regions can be strengthened.

Lastly, while we specifically looked into the dynamics of agri-food sector innovation policies, our findings suggest clear links with other sectors and policy domains. Future research in the Chilean context could provide insights into the (synergetic or competitive) dynamics between missions in different sectors, such as agri-food, mining, and energy. This could help define and implement strategies that foster co-evolution of missions in different societal domains. Comparative analysis between missions is still lacking in the field (Hekkert 2023), and such research could address this gap.

6. Conclusion

In this paper, we asked the question: how have TIPs in the agri-food sector taken shape in Chile? To answer this question, we conducted a qualitative and paradigmatic case study. We structured our findings by building on the work of Haddad et al. (2022) and identified how TIP is emerging in terms of innovation policies’ focus on different elements in the categories of (1) grand challenges and inclusive growth, (2) directionality, (3) multifaceted policy intervention, (4) multiactor approach, (5) multilevel governance, and (6) policy context. Our findings suggested that elements of TIP are emerging and actively promoted in the Chilean agri-food sector, but that the implementation of TIP is challenging due to a wide variety of reasons, most prominently due to challenges in coordination and a lack of capacities.

Importantly, our case serves to stress that TIPs do not develop in a vacuum but need to consider policy contexts and the political dynamics in which innovation policies emerge. The Chilean innovation system’s idiosyncrasies, as in any context, make that a context-specific translation needs to be found for a generic policy concept. Our analysis thus also identified that four distinct factors in the policy context were crucial for understanding how elements of TIP take shape. These are (1) organization of public administration, (2) national political dynamics, (3) policy cultures, and (4) geographical contexts. In our discussion, we therefore highlight the importance of strengthening policy capabilities to advance (the implementation of) TIP, as well as the potential that proto-institutions hold for developing TIP and the required capabilities for doing so. We conclude by re-articulating the importance of considering policy contexts as the starting point for

developing TIP that does not only ‘tick the boxes’ but also works in practice, to really advance the implementation of missions that promote sustainable and just futures.

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Declaration of Generative Artificial Intelligence! and Artificial Intelligence-assisted technologies in the writing process

The literature search and review, data collection, analysis, and writing of this paper have been fully done by the authors, but the authors used ChatGtp-4.0 as an editing tool to enhance readability and language quality. After using this tool, the authors reviewed and edited the content as needed and take full responsibility for the analysis and content of the paper.

Notes

1. Given that this paper focuses on emerging TIP rather than evaluating an established TIP mix that has been operational for several years, our primary interest lies in exploring whether emerging TIPs exhibit signs of coherence between established policy processes and consistency among the deployed policy instruments.
2. Which is currently (December, 2024) under development: <https://mma.gob.cl/estrategia-nacional-de-transicion-socioecologica-justa/> [Consulted 20 December 2024].
3. The National Council of CTCI is gaining a more institutionalized status as an ‘autonomous body that advises the Presidency of the Republic, whose main task is the preparation and review, with a systemic and long-term perspective, of the National Strategy for Science, Technology, Knowledge and Innovation for Development, which provides a framework for regional strategies and policies that the state promotes in these matters’. See also <https://consejctci.cl/rol-del-consejo/> (accessed on 20 December 2024).

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