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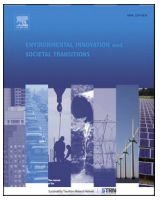

Spheres of transformation: exploring personal, political and practical drivers of farmer agency and behaviour change in the Netherlands

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ABSTRACT

Sustainability transitions research increasingly engages with agency and individual actor perspectives to explain complex system change. This paper introduces the spheres of transformation framework to study how and why 21 Dutch farmers, interviewed in the winter of 2020/2021, transform their business models towards sustainability. This framework is composed of three spheres: the personal (values and worldviews), the political (institutions), and the practical (everyday outcomes). Our results show that the interactions between spheres harbour the greatest potential for transformation as well as the greatest barriers, especially when all three spheres intersect. We furthermore identify individual actors' personal characteristics that are significant in transformations. We conclude that the spheres of transformation framework is a suitable middle-range framework for the study of agency and behaviour in sustainability transitions that bridges between local and global transition models, and that policymakers and researchers should consider all three spheres when engaging individual actors in efforts to make sociotechnical systems more sustainable.

1. Introduction

The sustainability transitions community has produced important research on changes in socio-technical systems to better deal with grand societal challenges, particularly through global models that "conceptualize and explain how radical changes can occur in the way societal functions are fulfilled" (Köhler et al., 2019, p. 2). Frameworks such as the multi-level perspective improve our understanding of long-term change in complex systems, and the study of innovation systems can identify barriers to the success of novel solutions to environmental issues (Geels, 2002; Wieczorek & Hekkert, 2012). These frameworks typically take worldviews, paradigms and other sociocultural constructs into account, but their implicit aggregation and abstraction distances the analysis from the perspective of individual actors. While local models like social practice theory do take individual behaviour as the primary object of analysis (Pantzar & Shove, 2010; Shove & Walker, 2010), the focus there is primarily on individual actors as users of a particular technology or consumers engaging in specific behaviour like recycling or showering (El Bilali, 2020). The field lacks lenses that investigate the agency and behaviour of individuals within the constraints of cultural and institutional factors (de Vries et al., 2021;

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Kaufman et al., 2021; Upham et al., 2020). Our paper aims to address this gap by introducing and applying a framework that focuses on individual actors' behaviour in transitions and their experience of structural factors, bridging between local and global models.

Foregrounding individual behaviour in transitions research is important for a number of reasons. First, transitions scholarship assumes that change is required at all scale levels and stages of production and consumption, yet "interest in consumption and everyday life has remained relatively marginal" (Köhler et al., 2019, p. 13). Everyday life is just as important in the study of entrepreneurship and innovation as it is in the study of consumption, as the literature on innovation as a lengthy process of "mindful deviation" has demonstrated (Garud & Karnøe, 2013). Second, individuals and their behaviour are a qualitatively different object of analysis compared to organizations and institutions or, more broadly, systems (Upham et al., 2020). Fully grasping how human behaviour can be brought in line with sustainability transitions requires attention to the "behavioural structures of decision-makers" (de Vries et al., 2021, p. 42). Third, if we accept that individuals are strongly shaped by sociocultural norms (Burton, 2004; Upham et al., 2019), we need tools to understand how such sociocultural conditioning affects individual behaviour. Values, worldviews and ideals may form the "micro-foundations" of transitions frameworks (Geels, 2020), but this interaction between *personal* motivations and everyday *practical* behaviour needs to be more closely studied from the actor's perspective. In addition, institutions and other *political* factors co-determine behaviour but can also be shaped by individuals through institutional entrepreneurship, activism and other means (Upham et al., 2018). In short, we need an approach that also looks from the individual at the system, rather than exclusively from the system at the individual. To that end, we introduce the Spheres of Transformation framework to the transitions community and apply it to the case of Dutch farmers in transition (O'Brien & Sygna, 2013).

Agriculture is emblematic of the transitions literature, as food provision is a fundamental human need that is fulfilled by a complex system with a host of sustainability challenges (Springmann et al., 2018; Willett et al., 2019). It is also emblematic because the study of food and agriculture in the field is dominated by systemic perspectives and institutional analyses (El Bilali, 2019, 2020). Some scholars have studied food production at the individual level but with a narrow focus on a particular technology or practice (Ely et al., 2016; Huttunen & Oosterveer, 2017). Work that spans scale levels is a useful lens to study interactions within networks of farmers (Klerkx et al., 2010; Wigboldus et al., 2016), but takes a systemic rather than an individual view as its starting point. Nevertheless, farming is a highly suitable case study to introduce a framework that aims at putting the individual actor at the centre of attention. There are more than 10 million farms in the EU (Eurostat, 2018); most of these are owned and run by families or individuals, and their personal lives and work are closely intertwined. This is a sector where an individual's beliefs, values and perceptions closely determine producers' operations and strategy (Burton, 2004; de Snoo et al., 2013; Westerink et al., 2019). Individual characteristics thus ultimately shape the sustainability of agri-food systems, reinforcing calls in this journal to focus more on both agriculture (Hebinck et al., 2021) and the individual's perspective (Upham et al., 2020).

2. Theory

Our aim in this paper is to introduce the Spheres of Transformation (henceforth SOT) framework to the transitions literature as a lens through which we can study the individual perspective on transition processes. It is comprised of three dimensions, or spheres, determining transformative change, and the micro-meso interactions between these spheres. It is a tool to understand "how, why and where transformations toward sustainability may take place" (O'Brien & Sygna, 2013, p. 1). It rests on an open and flexible understanding of human agency. We therefore begin this section with a brief review of the concept of agency in social theory and describe how different aspects of agency have been theorized and operationalized by transitions scholars. This allows us to highlight how the SOT framework complements this body of literature and where it can be located in the toolbox of transitions frameworks.

2.1. Agency in social theory

Scholarly engagement with the concept of agency has a long history. Enlightenment thinkers grappled with the question of whether we act out of calculated self-interest, or out of conviction about what is the right thing to do. Twentieth-century social theorist Talcott Parsons theorized social action as navigating between these two poles – contextual conditions and normative rules – through the notion of "effort", suggesting that individuals can overcome the tension between what is right and what is expedient through deliberate, purposive action (Emirbayer & Mische, 1998, p. 965). This is echoed in Anthony Giddens' notion of agency as the ability to "act otherwise" (Giddens, 1986, p. 14). Building on the work of Jeffrey Alexander, who saw the rational and normative dimensions of agency as "complementary but analytically distinguishable" (Emirbayer & Mische, 1998, p. 967), Emirbayer and Mische conceive of agency as a temporally embedded process constituted of routine (iteration oriented at the past), purpose (future-oriented projection), and judgment (evaluation oriented at the present; 1998). They emphasise that these are analytical distinctions, that "all three of these constitutive dimensions of human agency are to be found, in varying degrees, within any concrete empirical instance of action" (Emirbayer & Mische, 1998, p. 971).

2.2. Agency in the transitions literature

The routine or iterative dimension of agency describes "the selective reactivation by actors of past patterns of thought and action, as routinely incorporated in practical activity" (Emirbayer & Mische, 1998, p. 971). It is the least reflexive dimension of agency: actors behave according to schemata derived from experiences and routines they remember. These routines, or habits, are grounded in actors' own memories and (in)formed by socially constructed patterns and ways of doing things. In transitions research and applied sociology, this everyday dimension of agency has been conceptualized in theories of practice (Hargreaves et al., 2013; Shove & Walker, 2010;

Turner, 1994). Here, practices are seen as "made of skills (knowhow, competence forms), images (meaning, symbols) and materials that are recursively and actively integrated through everyday life" (El Bilali, 2020, p. 1697). Knowhow that is tacitly shared, reproduced, and enacted is furthermore considered an important part of organizational functioning and a contributing factor to lock-in and path dependence (Garud & Karnøe, 2001).

The purposive or "projective" dimension of agency describes "the imaginative generation by actors of possible future trajectories of action, in which received structures of thought and action may be creatively reconfigured" (Emirbayer & Mische, 1998, p. 971). This dimension of agency concerns actors' planning, goal-setting, and aspiring. Transitions scholars mobilize this dimension of agency frequently, using the term "strategic" in particular. Geels and Schot, in their response to criticisms that the multi-level perspective (MLP) does not account for actor perspectives, "assume that actors are self-interested, act strategically, and try to calculate which actions will best achieve their goals" (Geels & Schot, 2007, p. 403). This is echoed in the literature on the transformation of social-ecological systems, where "strategic agency is pivotal in moving a process of transformation forward" (Schultz et al., 2013, p. 2). De Haan and Rotmans "propose a conceptualisation of transitions wherein systems change is explicitly the consequence of strategic actions of people" (de Haan & Rotmans, 2018, p. 275). In contrast to social theorists, who have extensively written about the *quality* of agency, transitions scholars tend to focus more on *different types of* actors and actor roles. These express themselves mostly in purposive agency: intermediaries "influence sustainability transition processes … by connecting transition visions and demands of networks of actors with existing regimes in order to create momentum for socio-technical system change" (Kivimaa et al., 2019, p. 1072); boundary spanners create functioning relationships between organizations with divergent interests through convening, translation, facilitating collaboration, and mediation (Smink et al., 2015); hybrid actors bridge between niche and regime and share knowledge, advocate for change around a vision, and take risks to capitalize on opportunities (Elzen et al., 2012); and institutional entrepreneurs "seek to change the institutions governing a particular domain in the interests of realizing particular goals of their own" (Schultz et al., 2013, p. 2).

The "practical-evaluative" dimension of agency has received little attention by transitions scholars. It "entails the capacity of actors to make practical and normative judgments among alternative possible trajectories of action, in response to the emerging demands, dilemmas, and ambiguities of presently evolving situations" (Emirbayer & Mische, 1998, p. 971). This dimension of agency includes the deliberate (or "mindful") deviation from habits based on an assessment of present conditions; it describes the "exercise of situationally based judgment" (Emirbayer & Mische, 1998, p. 994; Garud & Karnøe, 2013). This judgment, situated in the present moment, can be linked to both past and future: an actor may choose to break with *past* habits based both on an assessment that these habits no longer meet their *current* needs, and because they realize that continuing to act in a particular way doesn't meet their *future* goals. Several perspectives on actors in transitions touch on this dimension of agency. Geels and Schot include "rational choice" and "interpretation" as part of the underlying qualities of agency (2007). De Haan and Rotmans hint at this dimension when they discuss that the success of transformative change is conditional on "the usual economic and technological constraints" (2018, p. 282), although they do not dwell on the cognitive process of evaluating how these constraints are to be navigated. Fuenfschilling and Truffer discuss the mundane, day-to-day side of maintenance in institutional work, but focus on shaping and changing institutions without accounting for changes at the operational or practical level (2016).

Existing transitions frameworks thus fall short on three accounts when it comes to agency and individual-level change processes. First, while many acknowledge agency as *explaining* complex systems change, few take the individual change *process* as the unit of analysis. Second, those that analyse such processes tend to focus on the iterative and strategic dimensions of agency and neglect the

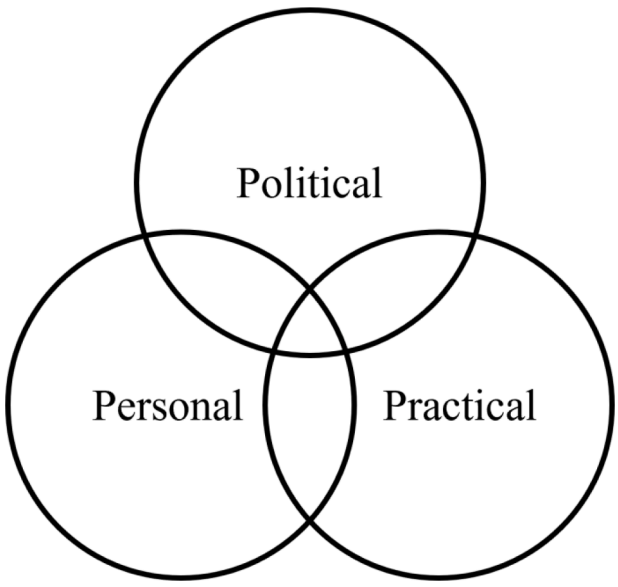

Fig. 1. Spheres of transformation depicted as overlapping areas of change (adapted based on Gosnell et al., 2019 and O'Brien & Sygna, 2013).

evaluative dimension. Third, approaches that do contain a focus on this neglected dimension of agency tend to only operationalize it with respect to a particular type of actor.

2.3. The SOT framework

Acknowledging the evaluative dimension of agency alongside the routine and strategic dimensions implies that behavioural changes can be triggered by information from, and interaction with, changes in the outside world, especially with changing practices and political conditions. The value of the SOT framework is that it recognizes and integrates these dimensions. The three spheres include (Fig. 1): the practical, representing "both behaviours and technical solutions"; the political, capturing the "systems and structures that create the conditions for transformations in the practical sphere"; and the personal, which includes "individual and collective beliefs, values and worldviews that shape the ways that the systems and structures (i.e., the political sphere) are viewed, and influence what types of solutions (e.g., the practical sphere) are considered 'possible'"(O'Brien & Sygna, 2013, pp. 4–5). The dimensions of agency discussed above do not map to particular spheres; rather, the SOT framework should be seen as a lens to uncover all temporal qualities of agency (past-oriented iterative agency, future-oriented strategic agency, and evaluative agency grounded in the present) *as well as* the importance of structural factors, in the process of transformation.

The personal sphere has "a pervasive, often subconscious impact on the political and practical spheres, which in turn shape the context in which worldviews are reproduced or transformed" (O'Brien, 2018). The significance of the personal sphere, as well as the dynamics between the different spheres, are backed up by empirical studies of human behaviour. A person's intention or propensity to act is considered the most proximate factor predicting behaviour (Ajzen, 1991; Blumberg & Pringle, 1982; Krueger et al., 2000). Intention is also influenced by practical factors, specifically whether a person thinks they have control over a situation and whether opportunities to act otherwise are present (Ajzen, 1991; Ölander & Thøgersen, 1995). Factors in the political sphere can also have an influence on the personal sphere: farmers for example operate in cultural, political, and economic systems where codified and uncodified expectations other actors have of them influence their views and behaviour (Burton, 2004; Runhaar et al., 2017). This is also captured by the concept of "common senses" as theorized by Antonio Gramsci (Patnaik, 1988). More broadly, informal institutions can mobilize values and emotions to create greater acceptance and legitimacy for an innovation (Tziva et al., 2020), and they can also constitute particular professional cultures that mediate the success of innovations (Wirth et al., 2013). On an everyday level, the "rules of the game" determine which practices individuals can implement, by for example requiring particular livestock management practices. This can create problems when conditions are not in line with an agent's personal values, beliefs or identity (Burton & Paragahawewa, 2011; de Snoo et al., 2013). Lastly, the political and practical spheres can interact insofar as successes of innovations like alternative farming practices can first legitimize and eventually institutionalize such practices (Westerink et al., 2019). The spheres can have both positive and negative influences on another. We follow Gosnell et al. in describing the former as "zones of traction" and the latter as "zones of friction" (2019).

The novelty of this approach lies in its focus on an individual or organization's transition process as a whole. The theory of change is that transformation in all three spheres brings the most potential for durable systems change. This is premised on an evolutionary understanding of system change analogous to that theorized in the MLP: "A regime shift cannot occur without changing worldviews, institutions, *and* technologies together, as an integrated system" (Beddoe et al., 2009, p. 2484). The personal sphere is important because different human values need to be acknowledged; the practical is important because actors are drawn to tangible outcomes; the political is important to generate institutional support for transformations "at the rate and scale called for in response to issues such as climate change" (O'Brien & Sygna, 2013, p. 7). This echoes a review of behaviour change initiatives, which found that interventions that target a combination of individual, social, and material contexts of consumer behaviour are more successful than those targeting only one of these contexts (Southerton et al., 2011). This focus on interaction between spheres furthermore responds to Kaufman et al.'s suggestion to draw on and explore "different perspectives with attention to what interconnections between behaviour and context they highlight, and obscure" (Kaufman et al., 2021, p. 599).

2.4. SOT as a transitions heuristic

We can distinguish between global and local models that serve to explain system change processes. The MLP is perhaps the best-known and most widely used instance of the former: it is "a global model that maps the entire transition process. Such a global model tends to give less attention to actors. Yet, the MLP does allow the analyst to zoom in on actors" (Geels & Schot, 2007, p. 414). Having zoomed in on the actors, a local model can then explain the evolution of ideas, practices, or technologies in a specific context and within the remit of a specific actor. The SOT framework bridges between local and global models: it is open to the different dimensions of agency discussed in Section 2.2, which in turn allows us to analyse how individuals come to make substantial changes in their life and work towards sustainability as part of larger systems they engage with in some purposive way.

A final theoretical consideration therefore concerns the link between individual and system, and how the SOT framework pertains to the question of scaling. It is limited in scope compared to work that focuses on the way innovations are transferred and multiplied in time and space. Rather, the SOT framework focuses on the genesis and development of change processes at the scale of individual actors. However, since such processes are often not confined to an individual actor (or farm, as we shall see), there are some links between the aforementioned approaches and the SOT framework. Individual actors can be active across spatial scales; they can participate in networks of different sizes; and they engage with innovations, administrations, and institutions in different ways (Hermans et al., 2016). They can engage in anchoring, i.e. "linking between a novelty and existing structures and institutions" (Elzen et al., 2012, p. 3). Geels and Raven (2006) propose an emergence of niche technological trajectories and rule sets through the

interaction between local projects and global level communities and fields. An individual's motivation in engaging in scale-crossing activities, and the barriers they encounter along the way, can be explored through the SOT. The same is true for scale-crossing actor roles, such as that of institutional entrepreneur (Fuenfschilling & Truffer, 2016), hybrid actor (Elzen et al., 2012), boundary spanner (Smink et al., 2015), or intermediary (Kivimaa et al., 2019): the SOT framework can help identify personal characteristics, motivations or circumstances that lead individuals to take on particular scaling-oriented roles.

The authors of the SOT framework have themselves elaborated on the matter of "scaling transformations to sustainability", developing a so-called "fractal approach" that builds on the SOT (O'Brien et al., 2023). This approach considers universal values, i.e. "intrinsic and shared qualities and characteristics that connect humans and nature in an acausal, coherent manner" (O'Brien et al., 2023, p. 5), as the foundation for scaling transformations. Its theory of change is that multiple individuals and organizations can depart from the same values, located in the *personal* sphere, to select and implement the required *practical* changes that overcome barriers in the *political* sphere. The pathway for scaling is in nested personal relationships: individuals who find success in transformation influence their family, friends, communities, peer groups etc., who can then in turn influence people they know. This is a highly organic, bottom-up approach; a question for further elaboration is how it can be managed and monitored, and exactly what types of interventions would lead to successful scaling.

3. Materials and methods

3.1. Case study description

In this article we focus on the agricultural transition in the Netherlands. Most Dutch farmers operate according to the rules and norms of a productivist food regime, where the focus on the production and export of commodities necessitates a continuing drive for efficiency and cost reduction (Burton, 2004; Gaitán-Cremaschi et al., 2019). The sector is characterized by high land and labour costs, which partly explains the drive for efficiency. It is a competitive sector that is undergoing steady consolidation: the number of farms has dropped from 97,389 in 2000 to 52,695 in 2020 (Centraal Bureau voor de Statistiek, 2021b), while the average standard output – a measure of the economic size of a farm – has more than doubled from €194,000 to €449,000 (Centraal Bureau voor de Statistiek, 2021a).

Agriculture lies at the heart of a number of interconnected environmental and social crises in the Netherlands. The sector accounts for 15 % of Dutch greenhouse gas emissions (Coenen et al., 2018), and has been a primary driver of a drastic biodiversity decline over the past half century (Bouma et al., 2020). Furthermore, societal and political tensions around agriculture have flared since a 2019 court ruling declaring the procedure for granting permits for nitrogen-emitting activities unlawful led to a series of farmer protests, some of which turned violent (van der Ploeg, 2020). This "nitrogen crisis" is emblematic of how a misalignment between SOT can lead to friction: regulations are driven by a political need to respond to emergency issues and change as frequently as new issues emerge (political); farmers have little financial room to invest in more sustainable production methods (practical); while they are often motivated by a long-term desire to maintain the business for future generations and as a result are risk-averse (personal).

While the majority of Dutch farmers operate in line with this conventional sector's norms and logics, contributing to and suffering from the consequences, an estimated 15 % of farmers operate more sustainably (Erisman and Frank, 2019). They incorporate nature conservation on their farms, utilize and protect ecosystem services, or strive for self-sufficiency in feed and circularity of nutrients. While most Dutch farmers are locked into unsustainable trajectories, others have created new paths and have chosen to deviate from the dominant model. While innovation systems for alternative forms of farming do not function optimally (Vermunt et al., 2022), a considerable number of farmers are able to switch to unconventional farming models. Looking at such farm-level transformations through the lens of the SOT framework can enrich our understanding of agency and behaviour in transitions and illustrate the merits of this framework. It can also provide policymakers and other agri-food system actors with insights to on the one hand remove unnecessary friction in their policies and programs, and on the other hand better understand how they can create more traction towards desirable change trajectories.

3.2. Data collection

We conducted interviews with 21 Dutch farmers in the winter of 2020/2021. These farmers are members of a learning network convened as part of the "Regenerative Farming" transdisciplinary research project[1]. Participants were found through purposive sampling and contacted through the network of researchers and practitioners in the project, and included farms of different types and sizes (Fig. 2). Compared to average Dutch farm size (van der Meulen, 2022), arable farms in our sample are somewhat smaller (53ha vs. 59ha); dairy farms are larger in acreage (89ha vs. 63.6ha) but almost the same in livestock numbers (115 vs. 113 dairy cows).

Farmers were selected based on their interest in improving farm-level sustainability outcomes in line with recently proposed outcomes for regenerative farming (Groot Koerkamp et al., 2021; Schreefel et al., 2020) through changes in their farming practices. Regenerative farming practices include for example holistic grazing, strip cropping, and no-till farming (Oberč & Schnell, 2020). The farmers' experience with such practices ranged from none (only interest and intention to improve) to 40 years (see Table 1). Accordingly, regenerative farming is not the only defining feature of this study or the network of farmers; what the farmers have in

[1] More information can be found at https://regenerativefarming.nl/

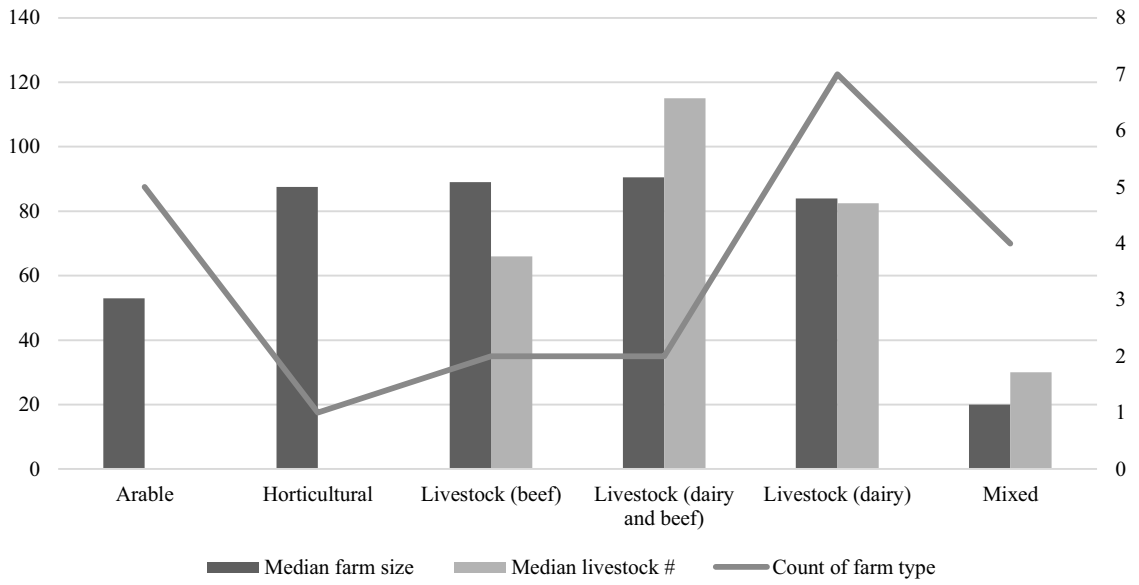

Fig. 2. interview subjects' farm types and sizes. Median farm size (in hectares and/or number of livestock, left axis) and number of interview subjects per farm type (right axis).

common is that they have all at least attempted to reorient their operations towards sustainability. Based on the interviews we furthermore classified the interviewees according to innovation adopter categories (Rogers, 2005): we assigned a point for each characteristic in the different ideal-type adopter categories (innovator, early adopter, early majority, late majority, laggard; see Rogers, 2005 p. 282-285) that a farmer exhibited. Farmers were then classified into the categories based on the category of which they exhibited the most characteristics. This was done based on interview transcripts and the first author's notes. An overview table of which characteristics were assigned to the farmers in our sample is provided in Appendix D. While most of the farmers can be classified as innovators, a third more strongly exhibited characteristics of other categories. Those that fall into the early and late majority categories provided a sample of more conventional Dutch farmers, although farmers with no interest at all in regenerative farming – or no awareness of this farming style – were not part of the analysis. Importantly, the majority of farmers interviewed began the process of transforming their business models on regenerative principles in the last ten years; this allowed us to uncover the "journey" from conventional to more sustainable business models and the friction and traction therein.

The interviews were conducted by the first author accompanied by MSc students who interned with the project for their thesis. The interviewees gave written consent to record the conversation, take photos, share data with other researchers in the project, and to publish data anonymously. Interviews started with personal introductions, followed by explanation of the project and request to sign the consent and data sharing form. Next, basic information about the farm and farmer were recorded. The farmers then gave the interviewers a tour of the farm, during which we took photos and asked the farmers to explain their production practices. Farmers were then asked to assess their own performance on 16 outcomes for regenerative farming (Groot Koerkamp et al., 2021; also see Appendix B) for three time periods: the year 2000 or, if the farmer started working on the farm more recently, a more recent year; the fall of 2020, to assess the current situation; and the year 2040, to gain insights into the desired future situation on the farm. For each outcome and time period farmers were asked to score their farm's performance as basic, medium or high based on a short description provided (see Appendix B). This exercise facilitated a discussion about the areas that the farmer has worked on improving or has seen change in the past; to understand their current concerns; and to see what changes they wish to see in the future.

Second, farmers were asked to construct a timeline of significant events in their life from the moment they first contemplated farming as a livelihood to the present (see Fig. 3). Farmers were asked to list moments, events or decisions that had the most impact in their subjective experience. In some cases, we prompted the farmers with examples. Interviewees were free to first list these moments with the year and short description and then talk about each in depth, or to move chronologically. We then discussed these with the farmer based on a previously prepared list of questions (see Appendix C) as well as notes from the conversation before the timeline exercise.

The interviews were transcribed by the students, who were all native Dutch speakers, from audio to text within two weeks of the conversation. They were then imported into NVivo 12 for coding and qualitative analysis.

3.3. Data analysis

Interviews were analysed following a hybrid approach, in four steps (Fereday & Muir-Cochrane, 2006). First, we coded deductively using the three SOT as guidance. To do so, we used the definition of the spheres provided in Section 2. If a statement pertained to multiple spheres the statement was coded to all relevant spheres (addressing the overlapping areas of spheres in Fig. 1). Second, we

Table 1
Interview subjects' demographic characteristics and innovation adopter categories.

Farmer gender	No. of farmers (-)	Average age (y)	Min. and max. age (y)
Female	1	53	n/a
Male	20	47.6	28; 72

Innovation adopter categories	No. of farmers (-)	Average time since transformation (y)	Min. and max. time since transformation (y)
Innovator	14	9.1	0; 40
Early adopter	2	2.5	2.5; 2.5
Early majority	-	-	-
Late majority	5	0.5	0; 2.5
Laggard	-	-	-

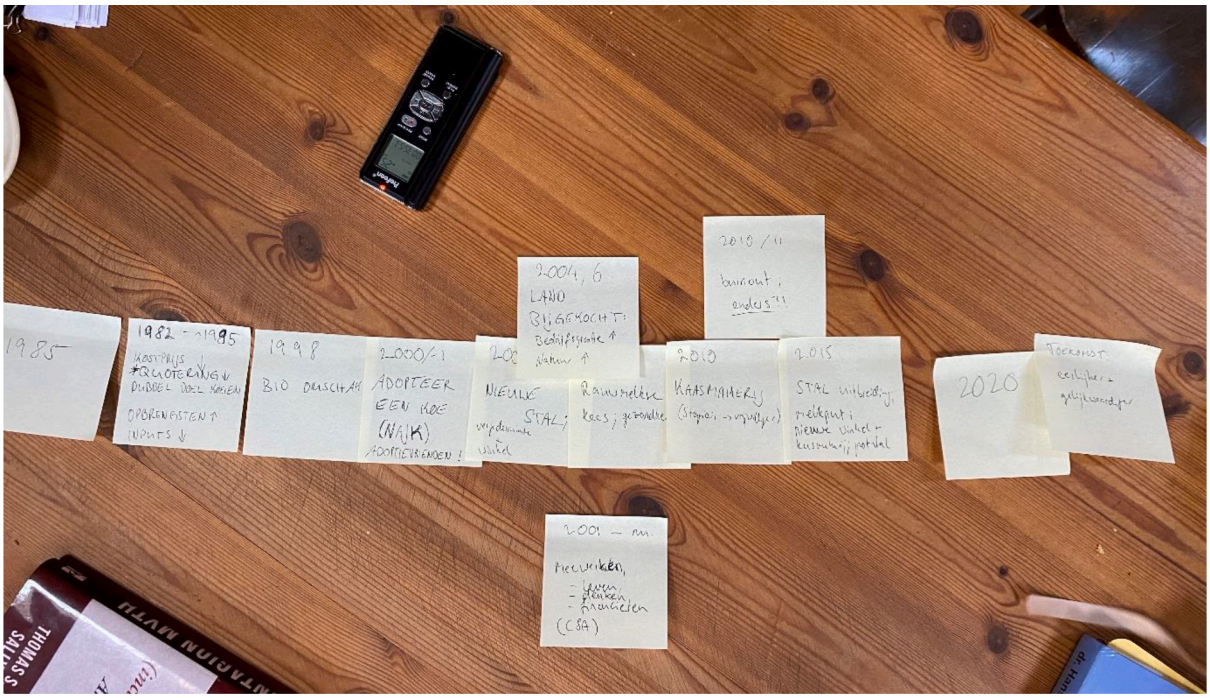

Fig. 3. Example of a timeline, with 1985 as the starting year (left) and 2020 the time of the interview (right). Between the two are post-it notes with key words and phrases relating to important moments and decisions in the life of the farmer.

identified zones of traction and friction – i.e., positive and negative changes – within the spheres. Third, we synthesized and abstracted underlying themes found within the different codes using the constant comparison method (Given, 2008). Thematic categories were derived from the statements created in step two. Fourth, where spheres overlapped, we identified if one sphere was the source of traction or friction for another. For example, if an interviewee related that they experienced success with a new technology (practical sphere) and found this motivating or increasing their confidence (personal sphere), this statement was categorized as the practical sphere influencing the personal. This was difficult when all three spheres interact: if for example a subsidy (political sphere) allowed a farmer to experiment (practical sphere) and adjusted their mindset accordingly (personal sphere), it was often not clear from the interview transcripts whether the change in mindset occurred before the practical change or vice versa. We therefore present issues of traction and friction found in the overlap of all three spheres as one category.

After coding the transcripts to thematic categories, these thematic codes were compared and re-examined until all transcripts were coded and distinct categories emerged. Authors two and three independently checked author one's coding to ensure intercoder agreement.

4. Results and analysis

This section details the ways in which friction and traction occurred in and between the spheres of transformation. We start with individual spheres and their influence on the other two, before elaborating on the interaction of all three spheres – in theory the site of most durable transformation. Table 2 provides an overview of all zones of friction and traction.

4.1. Influence of the practical sphere: source of (de-)motivation and means of institutional entrepreneurship

The practical sphere appears to cause considerable traction in other spheres. Tangible positive outcomes seem to have a powerful motivating effect on those whose actions are behind the outcomes, affirming beliefs and values. Experiences of interaction with like-minded farmers as well as receiving recognition from members of society are important sources of motivation and confirmation. Farming in, creating and experiencing an appealing landscape is another important source of motivation, mentioned by two-thirds of the interviewees:

> *"This is the most beautiful region in the country. You have elevated terrain, small streams, so much variety. If you ride your bike here for a day you pass through the forest and other types of landscapes. It's just so amazingly beautiful."*

Some farmers highlight that they consider their work meaningful because it is societally important, and feel they are able to "make a difference":

> *"I can decide to plant cover crops. And my neighbour who lives in a flat, they can shout all they want that everything needs to change, but they can't do much. And I have the honour, and the luxury, to actually make a difference."*

Zones of traction in the intersection of the practical and political spheres indicate the possibility of farmers creating and shaping social and economic structures, by for example setting up alternative organizational models with novel institutional arrangements, combining agricultural with institutional entrepreneurship. Some farmers were able to shape an institutional environment that suits them (by for example finding ways to get paid for providing ecosystem services) or bypassing official rules entirely (by for example circumventing regulations).

Table 2
Summary of issues from all interviews categorized according to the zones of friction and traction in three different spheres and their overlap.

	Friction	Traction
Practical	• Agronomical challenges • High cost of production • Lack of knowledge • Organizational challenges • Sales and marketing challenges	• Interaction and cooperation with non-farmers • Interaction with consumers • Lower operating costs
Political	• Inadequate vision and directionality from government and value chain • Policy focus on projects rather than system change • Power of large companies • Resistance of other farmers to change	• Increased awareness of alternative farming methods • Older farmers retiring • Potential for attractive lease conditions by "benevolent landlords"
Personal	• None	• Christian values • Confidence, daring, decisiveness • Entrepreneurship
Practical influences political	• None	• Circumventing regulations • Farming outside of the conventional farming system • Realizing payment for ecosystem services
Practical influences personal	• Inability to realize ambitions • Negative social consequences of farming differently	• Farming in, creating and experiencing an appealing landscape • Interacting and cooperating with like-minded farmers • Learning and figuring things out • Making mistakes and overcoming them • Meaningful and satisfying work • Receiving recognition and appreciation
Political influences practical	• Difficult farming transition process • Higher cost of production • Regulatory challenges • System geared towards conventional farming • Unfavourable immediate institutional environment • Unfavourable market conditions	• Favourable market conditions • Institutional support
Political influences personal	• Conflicting values between farmers and other stakeholders • Fear of change of farmers • Negative and outdated image of farmers by society	• Alignment between norms and expectations
Personal influences practical	• Internalized productivist values • Time commitment to non-farming activities	• Intuition and common sense
Personal influences political	• Lack of trust in monitoring / Key Performance Indicator systems	• None
All three spheres	• Being pigeonholed • Difficult for frontrunners to influence conventional farmers • Farming has become less personal • Having no choice but to intensify • Low willingness to pay by consumers • No trust in the media • "Rule-bending" by some organic farmers	• Anticipating system change • Demonstrating the viability of an alternative farming model • Realizing the conventional farming system is not sustainable • Working towards ambitions and future plans

Some instances of the practical sphere leading to friction in the personal were reported. Farmers that have high ambitions sometimes fail to meet their goals, which was experienced as frustrating and demotivating. When the behaviour of the farmer is judged negatively by peers or neighbours the resulting negative social consequences can be hurtful to the farmer, in extreme cases leading to ostracization in the community.

4.2. Influence of the political sphere: structural conditions and normative (mis-)alignment

The zones of friction in this sphere clearly show how structure can limit agency. Economic factors threaten the business viability of regenerative farmers. Even beginning the transformation is difficult, as production often initially declines while higher prices may not be realized until later (through organic certification, which takes time, or by finding buyers that pay more for product quality). All but seven farmers described how unfavourable market conditions negatively affected their farming business and livelihood. Regulatory challenges are often mentioned, particularly by dairy farmers, and some farmers report operating in an unfavourable institutional environment (e.g. zoning restrictions, short-term land lease contracts).

The fact that the farming system is geared towards conventional farming affects the interviewed farmers widely on a practical level. They do not benefit from an enabling environment wherein banks, knowledge and information providers, subsidy schemes, inputs, and advisors are mostly set up to support an efficiency- and export-focused farming model:

> *"It's mostly technical innovation that is subsidized. And if I apply with another type of solution then it's not accepted because it doesn't fit the picture."*

Regarding advisory and extension services, a number of farmers criticized the lack of independent advisors, noting sarcastically that advice from a feed company is free. Similarly, some experienced that agricultural education is primarily focused on the dominant economic logic:

> *"When I have interns here from the agricultural schools, they are told to do optimization calculations. And they always need to include loans and investments. Why can't you challenge people to leave things out, to reduce costs?"*

The political sphere also negatively affects the personal. Farmers reported that the public discourse on farmers portrays them negatively. They experience this as demotivating and frustrating:

> *"I don't run around with a red handkerchief around my neck and a stalk of grain in my hand, like you still see in children's books these days. That's really such an antiquated image, that really bothers me sometimes."*

While these results show that predominantly zones of friction emanate from the political sphere, some instances of positive structural conditions and normative support were reported. Selling to the local community, having a strong position in the value chain due to a unique product, and good communication with value chain partners are all strategies that improved these farmers' position. Making use of subsidy schemes, for example for nature conservation and composting, allows farmers to benefit from institutional support. Farmers appear to have some degree of choice in value chain partners, landlords and other collaborators, while they cannot choose the laws they are governed by (though they can in some cases circumvent them). Often, structure is reshaped when value chain actors, landowners and other organizations make exceptions to institutional arrangements on the basis of farming methods, as illustrated by successful price negotiations for high-quality sustainable produce or payments for ecosystem services.

4.3. Influence of the personal sphere: doubt and drive

In some cases, farmers are undermining their potential for change in the practical sphere due to internalized productivist values, as their values and beliefs around biodiversity for example prevent them from changing their practices:

> *"If you look out the window here you see a beautiful productive meadow, but it's only English ryegrass. A biologist would call it 'grassphalt'. And look, that's what you produce on expensive land, that's how I see it. Biodiversity is a luxury that you can only create on cheap land."*

For other farmers that have successfully transformed their businesses, their commitment to non-farming activities – motivated by values of transparency and seeking connections with citizens – detracts from their core activities. Zones of traction emanating from the personal to the practical include using intuition and common sense to take decisions that are not in line with what most other farmers would do, such as selling land to downsize the farm and finance the transition towards more costly regenerative production practices.

Numerous farmers have no trust in monitoring and Key Performance Indicator systems, which in the aggregate can lead to sentiments of scepticism and mistrust that undermine the institutions governing such systems (see also van der Ploeg, 2020). This shows that belief in institutions – or lack thereof – can be significant if enough actors hold these thoughts.

The frequently discussed zones of traction stemming from the personal sphere indicate this to be a strong positive driver of transformation. It is also one with a lot of "two-way traffic": personal traits enable, and beliefs motivate, practical action; successful outcomes in turn form and affirm beliefs and create motivation. Compared to the political sphere, the practical is one where positive experiences can be more easily sought or created by farmers: this can increase a sense of control and independence, but seems to require a certain mindset and perhaps also a somewhat advantageous "starting position" (in terms of e.g. financial situation, location of the farm or age). This supports the idea that, ideally, all three spheres align for transformation.

4.4. All three spheres interacting: virtuous circles and downward spirals

In theory, transformations are most durable and successful when all three spheres align; similarly, barriers are greatest when friction occurs in all three spheres simultaneously. Our case shows evidence of both dynamics. Two farmers stated that they found it difficult to influence conventional farmers if they are perceived as radical. Here their ambitions and hopes to influence other farmers clash with a culture in which their alternative farming practice is portrayed and perceived as radical, making it difficult or impossible to inform and convince other farmers to farm differently. This illustrates a well-known problem in the diffusion of innovation literature: there is a chasm between innovators and the majority of potential adopters (Rogers, 2005). This is difficult to bridge until enough members of the majority have started to adopt different farming methods and can serve as "figureheads", which in the Netherlands are lacking (Vermunt et al., 2022).

One farmer stated that they have no trust in the media, resulting from a clash between their own observations of wild animals and reports of biodiversity decline in what they call 'mainstream media'. They also found it offensive that consumers expect farmers to farm differently but are not willing to pay and thus do not help create more favourable market conditions. These experiences seem to have profoundly shaped their pessimistic and dejected attitude. Another farmer related that they had no choice but to intensify due to the capital intensity of the sector and low dairy prices, describing a feeling of powerlessness. Another farmer stated that being associated with organic farming led to them being pigeonholed by classmates during their education. These examples show that observations in the political sphere, coupled with experiences in the practical, can create and reinforce negative thoughts and feelings in the personal sphere.

The realization that conventional farming is not sustainable was a driver of change for multiple farmers. In some cases, it started with an observation of negative outcomes from one's own farming practices, which was then related to the embeddedness of these practices in the conventional farming system, and ultimately led to a change in beliefs and values. In other cases, it was a confrontation with new information about fossil fuel use in the farming system and the realization that it affected one's own farm too which led to the change in the personal sphere:

> *"The soil here, it was useless. Working it you would use 100 litres of diesel per hectare. I remember, as a boy, you could go through it with a cultivator quite easily and sow grass. And 10 years later that same soil was useless. That was something that really got me thinking."*

All three spheres aligned in the farmers' work towards fulfilling ambitions and future plans. In one case the farmer was strongly motivated by their ambition to promote fully grass-fed dairy farming, for which they see a wider role in meeting the country's sustainability challenges. Other farmers have similar ambitions, albeit on a smaller scale, wishing to for example create a more vibrant rural community, to prove they can farm without using chemicals, or to create a farm they can pass on to their children. A related zone of traction is demonstrating the viability of an alternative farming model; some farmers explicitly mentioned that they are proud of disproving doubt and scepticism from naysayers.

Another instance of alignment between the three spheres is when farmers anticipate system change. They work from a positive, proactive attitude and see societal change as an opportunity to meet societal expectations before they become "hard" requirements:

> *"Most farmers only change things when they have to. I prefer to change a few years earlier, or even 10 years earlier. I prefer to try things in advance and see how that goes, because then you have time to adjust and understand it."*

These zones of traction indicate virtuous circles when personal, political and practical spheres align.

5. Discussion

5.1. Reflections on the results

The results emphasize the importance of overlapping spheres in farmers' transformations towards sustainable business models. When we consider examples of friction, we see that it is predominantly the political sphere that limits not only an actor's practical action perspective but also their cognitive perspective and intentions (personal sphere). An example is the farmer quoted in Section 4.3 who cannot imagine anything but generating maximum profit on their land and who considers biodiversity a "luxury" condemned to marginal lands; another is the perceived need of many Dutch farmers to help "feed the world" that legitimizes the productivist regime (Viviano, 2017). This is in line with research in the transitions literature that shows how institutions hamper efforts to behave more sustainably (Plumecocq et al., 2018; Schiller et al., 2020; Sixt et al., 2018; Vermunt et al., 2022). Considering traction, there is a notable two-way dynamic between the personal and practical sphere, where traction in one sphere has a positive effect on the other. This suggests that deep, radical change can be quite 'down to earth' and can be found within an agent's direct domain of influence: all farmers interviewed are bound by the laws of the jurisdiction they operate in, but when it comes to their immediate environments – their farms – it is a case of "where there's a will there's a way." Showcases of success created in this way are crucial to eventually influencing the political sphere by building advocacy networks, bridging the chasm between innovators and majority, and reaching tipping points towards adoption of more sustainable practices (Bernstein & Singh, 2008; Moore & Westley, 2011; Rogers, 2005). These examples also foreground the evaluative dimension of agency: for farmers to realize they need to change their practices, they need to make an assessment in the present moment of what works and what doesn't. This can be at the start of the transformation process (exemplified by the farmer quoted in Section 4.4 who came to realize that the soil was "useless"), but also throughout, as farmers evaluate the merits of practical changes.

A number of interviewee characteristics stand out because they allow farmers to make far-reaching changes: risk-averseness, open-

mindedness, reflective capacity, and sociability with peers.

With regard to risk-averseness, farmers 4 and 18 described their switch to a different farming model as a very sudden and almost rash process; both implemented substantial changes to their practices within a year and against the counsel of their advisors. Farmer 2, by contrast, was more concerned about uncertainties and implemented changes at the fringes of their farm, and even stopped a manure processing experiment because they found it too risky. This indicates that some appetite for risk may be necessary to experiment with new technologies or practices, increasing the potential for positive feedback between the practical (success with innovation) and personal (confirmation, motivation).

With regard to open-mindedness, farmer 1 talked at length about their openness to change as well as their attitude and strategy of anticipating rather than resisting change, while farmer 5 lamented societal trends at length and expressed their distrust of the media, science and social movements. Open-mindedness may therefore be required to allow an actor to recognize positive trends and signals in the political sphere to draw personal inspiration from, in turn stimulating more innovation in the practical sphere.

With regard to reflectiveness, farmer 11 described a gradual and evolving thought process of more than three years which eventually led to their adoption of regenerative practices, while farmer 21 has held firm convictions on biodynamic farming for over three decades, with little reflection apparent in our interview. Reflectiveness could allow one to be realistic about one's situation, contextualize one's ambitions and performance, and to realize when adjustments to practices or strategy in the practical sphere are required (Tschakert & Dietrich, 2010).

Sociability with peers requires more nuanced reflection. Farmer 9 is active in a conventional farmers' association while running a cooperative farm that is largely separated from the conventional farming system, while farmer 16 has been told by public officials that their drastic transformation away from conventional farming makes them a bad example for other farmers to follow. Farmer 1 exhibited both a sincere interest in transforming their farm and a high degree of sociability with conventional peers and farmer networks. Farmers 1 and 9 then are vital in bridging the gap between frontrunners and laggards because their achievements in the practical sphere are recognizable by their peers, and because they tend to engage proactively with those in charge of the institutions that make up the political sphere. Whereas frontrunners are rightly celebrated for their achievements in the practical sphere, they may not be the type of agent that can act as a local leader. It may help to consider this characteristic in terms of the niche-regime situatedness of an actor. Adherence to regime norms and interaction with mostly mainstream peers and media is unlikely to lead to transformation away from the status quo, as the personal sphere is too aligned with dominant paradigms. Niche actors on the other hand, who isolate themselves from regime norms and actors, may come to see the political sphere as beyond hope, and limit their information sources to a familiar small circle. While this allows strongly internally driven actors to deepen transformation within their own domain of influence, systemic change is unlikely to stem from such actors. Between the two extremes are hybrid actors like farmers 1 and 9 who operate in niches and regimes simultaneously (Elzen et al., 2012). This not only enables them to reap the benefits of aligning their work with the political sphere, but also perhaps makes them better institutional entrepreneurs.

In terms of the different dimensions of agency, these characteristics furthermore indicate how different dimensions can come to the fore to varying degrees: habit was a strong constraint for some, while others could easily break with established routines and take risks; open-mindedness and reflectiveness could be described as a relatively strong expression of evaluative agency in the present moment; sociability with peers shows the dilemma between routines that are socially constructed and a strategic reorientation that peers oppose.

5.2. *Reflections on the method*

While following our approach to operationalizing SOT can provide a rich, detailed analysis, we also need to highlight some limitations. First, there may be limits to the population size in future studies if this level of detail is maintained. Scholars may be able to mitigate this by focusing the analysis on particular aspects of transformation or by employing a predefined coding framework, though this may obscure subtleties in the subjects' experiences. Second, not all farmers shared the same level of detail of the changes they made in their transformations. This is due to the long time horizon our interviews covered, low level of interviewer control over the conversation, and broad scope of the interviews in general. Third, habits and routines that are relevant to a farm's transformation may not have been mentioned by the interviewee. Since important activities on a farm (and in a transformation more generally) can evolve over time and slowly become taken for granted (Driessen & Heutinck, 2015), this might require a research setup with longer-term observations and researcher presence. This has obvious practical ramifications (time, cost, smaller sample) which may not be desirable. Fourth, the focus on the individual at the core of the transformation process may be biased and obscures other relevant individuals' assessments of, and roles in, such a process. We were able to avoid this incidentally when a business partner, spouse, child or employee was present for some part of the interview; implementing this structurally could be an uncomplicated improvement to our approach.

Subject choice is another matter for methodological reflection. Scholars investigating SOT may ask themselves what their subjects need to have in common to generate a meaningful analysis: do they need to have only considered, or actually attempted and even succeeded at transformation? If the latter, how should success be measured? In the case at hand we made a conscious choice to study farmers who cover the spectrum from innovator to late majority (Rogers, 2005). This uncovered a range of experiences of transformation processes, including some cases of resisting the idea of a transformation. While this gives a good insight into the complexities of overcoming diverse challenges by a diverse set of actors, and produced examples of zones of friction that some actors turned into or experienced as zones of traction, it may also be prudent to seek a more homogenous group of interview subjects for better intra-group comparability. Further, seeking homogeneity in for example the practical sphere (i.e. farms of similar size, type and location; on similar soil type; adopting a similar set of new practices and technologies) could in effect "fix" one sphere in the analysis and further expose

commonalities and differences in the other spheres. This would allow a better assessment of the framework's validity across different contexts and scopes of application.

The SOT framework should not be limited to the study of agrarian actors and can likely be applied to the study of decision-makers in organizations as well as individuals and organizations in other sectors. The personal sphere may have a relatively higher significance for family farms, where the boundaries between work, leisure, family, and individual identity are blurred. But there are other sectors in which important actors are relatively small organizations whose leadership is tight-knit and personal and interpersonal factors are important, as the literature on "hidden champions" and family firms purports to show (Lehmann et al., 2019; Zellweger & Sieger, 2012). Studying how multiple members of a team or even the management of larger corporate or public sector actors experience the SOT could be a fruitful extension of the study of (institutional) entrepreneurship vis-à-vis societal challenges (Garud & Karnøe, 2001). This is particularly important as the sustainability transitions community is moving away from a dichotomous understanding of niche and regime, instead considering the role of hybrid actors (Elzen et al., 2012) and possibilities of endogenous regime change (Runhaar et al., 2020; Vermunt et al., 2022).

5.3. Reflections on theory

Looking through the lens of overlapping SOT, we can observe all three types of agency at play: past-oriented iterative, present-oriented evaluative, and future-oriented strategic agency (Emirbayer & Mische, 1998). Habits like continuous engagement in activities that show positive results show how iterative agency is a source of traction. It can also be a source of friction, when routines curtail the ability to change course (as with the farmer whose productivist mindset limits them from seeing biodiversity as a good in itself). Agency in the present moment, evaluating information "in the here-and-now", is an important building block for transformation. This is true both for less tangible behaviour, such as acting on instinct and against what would widely be considered common sense, as well as for concrete milestones in a farm's transformation, such as the oft-reported decision to switch to a different farming style based on the assessment that the current system is unsustainable. Strategic agency by contrast takes a future perspective. This can have a very long, even indefinite time horizon, for example acting on the wish to pass on a viable farm to one's children and grandchildren, or a mindset of stewardship for future generations more generally. But it can also take more short- and medium-term forms, for example envisioning and realizing a business model built around multiple ecosystem services, or anticipating regulatory changes.

With regard to the scaling of farm-level transformations, the political sphere in particular allows us to observe the interviewees taking on a range or roles (Wittmayer et al., 2017) and scaling through various networks and communities (Hermans et al., 2016). Starting with the failure to scale, we learned from a number of farmers that they tried in vain to influence conventional farmers in the local community or in peer groups. These could be seen as unsuccessful hybrid actors (Elzen et al., 2012): they had the ambition to share their knowledge and experience with peers who farm according to regime logics, but due to the large differences between them they were unable to share these innovations. However, numerous farmers were successful in similar endeavours when differences were smaller, or the "recipients" of such innovations more open-minded. Farmers thus shared knowledge and values out of a desire to change the system, concretely through media appearances, speaking at farmer meetings, opening their farms to peers and consumers, or organized learning networks. Some farmers can also be characterized as engaging in institutional work (Fuenfschilling & Truffer, 2016): aiming to ensure their own farms' viability, they set up novel organizational and business models, seek out and make use of subsidy schemes, or convince partners (such as landlords or local government) to make exceptions to accommodate them. Another type of role the interviewees took on is more community-oriented, both in a commercial sense (setting up local farm shops or participating in a community-supported agriculture scheme) and out of more convivial motivations (wishing to create and contribute to a better local community).

Research on complex systems from different perspectives has shown that regimes are not monolithic (Fuenfschilling & Truffer, 2014; Niederle, 2018), and it is no surprise that actors within such systems behave differently. The added value of the SOT framework is that it sheds light on *how and why* actors in the same system behave differently. Here, the personal and practical spheres provide additional explanatory power to the political sphere that transitions scholarship commonly explores. This explains for example why two farmers who grew up in the same area, went to the same agricultural college at the same time, and who both run relatively large dairy farms, have ended up with such different farming styles: farmer 6 runs a conventional operation focused on high input use efficiency and cost reduction, whereas farmer 18's business model is the extensive production of organic milk supplemented with income from selling carbon credits; farmer 6 was motivated by entrepreneurship in line with a conventional business model and perceived radical change as too risky, while farmer 18 drew on a deep connection to the landscape and foreign travel to decide to make a radical break with business as usual. The SOT approach allowed us to analyse configurations of practices and agents as well as the structure surrounding them, and perhaps more importantly takes deliberate changes in practices (including stopping / starting) into account. This makes the SOT framework appropriate for studying deliberate local change processes.

While the SOT framework has proven flexible in its application to the present case study and enabled us to uncover a variety of insights on farmers' transformation processes, it can benefit from further conceptual and methodological development as well as integration with other transitions frameworks. We already expressed in Section 2 that this framework could bridge between local and global models. Whereas the MLP describes the constellation and evolution of sociotechnical systems operating according to certain rules, the SOT describes how an individual experiences and engages with these rules. We tentatively suggest a connection of the two models through institutional structures, whether as typically more distant regime configurations or typically more closely experienced niche communities and projects. Such structures act on and constrain individual agency, but they are also shaped by it. This furthermore echoes Geels and Raven's conception of niche-development trajectories as a dynamic of framing, coordination, aggregation, and learning between local projects and global-level communities and fields as a cornerstone for successful transitions (Geels &

Raven, 2006), or lack thereof as a barrier to transition if individual belief systems clash with institutional logics (Smink et al., 2015). Citing again the example from the previous paragraph, two farmers who operate in the same political sphere and with a similar physical and financial starting position tapped into different value sets, experimented in different directions, and engaged in institutional work in different ways: whereas farmer 6 is active in a local cooperative that markets efficiently produced conventional dairy, farmer 18 is a pioneer on the national stage in the combination of organic farming and valorizing ecosystem services. By contrast, farmer 16's farming style and mindset clashed with the values and logics of local officials who deemed them unfit to serve as a figurehead for their peers (see also Section 5.1). The SOT perspective thus allows us to see both how and why these individuals changed their own farms, and then made efforts to redesign the context in which they and their peers operate.

6. Conclusion

Our aim in this paper was to uncover previously under-researched processes that determine agency and behaviour change in sustainability transitions by introducing an integrative, multi-dimensional approach to the transitions literature. The proposed spheres of transformation framework, already gaining traction in adjacent scholarly fields, is well-suited to the analysis of individuals and their role in sociotechnical transitions. It is a middle-range framework that bridges local and global models explaining change in complex systems, highlighting how individual actors' agency is embedded in and conditioned by structures. It explains successes and failures of behaviour change towards sustainability as a consequence of political, personal, and practical forces coalescing.

In line with previous work employing the spheres of transformation framework (Gosnell et al., 2019), we discovered the significance of the personal sphere in Dutch farmers' transformations towards more sustainable farming practices. When agents derive motivation and self-affirmation from inner worlds, comprising values and beliefs, this personal sphere can be an important driver of change. It can also be the locus of doubt, fear and other negative emotions that hamper transformation. Scholars and practitioners of sustainability transitions should be sensitive to both the positive and negative aspects of this sphere. We also found that the interactions between spheres harbour significant dynamics of behaviour change. The subjects of our study derived great satisfaction, motivation and confidence at a personal level from successes in the practical sphere. This suggests that small-scale experiments and deviations from business as usual are a motor of transformation for individual actors. The political sphere on the other hand emanates a great deal of friction with both the personal and practical spheres, confirming widely demonstrated notions of institutions as a barrier to change, although we also found some noteworthy examples of institutions and networks facilitating positive change. The real value of this framework lies in the connection between the inner and outer worlds; it allows us to look at the system from the individual agent's eyes while allowing the great diversity of individual perspectives, as well as different dimensions of agency, to come to the surface.

This study has three practical implications. The first is that hybrid actors – individuals that are familiar with, and comfortable acting in, both established regimes and emergent niches – should receive recognition for their achievements and support for their role in transitions. More attention should be paid, by policymakers and scholars alike, to how these hybrid actors can be supported in their role, and to how actors with regime or niche roots can transform into more hybrid actors. The second implication is that policymakers should recognize and reflect on the diversity of their subjects. Taking different personalities and mindsets into account (such as risk appetite and open-mindedness as identified in our study), both in policy design and in communication, can help eliminate unnecessary friction. This is particularly relevant for local and regional administrative levels as well as landlords and conservation agencies that set rules for behaviour, as these types of organizations tend to work more closely with the affected farmers. The third and related implication is that the different spheres may offer different departure points for encouraging and incentivizing transformation. One farmer may be encouraged to change their business model after successful practical experiments; another may do so only after a change of heart; yet another may only do so if regulations leave them no alternative. Once policymakers have a better view of the diversity of their subjects, policies can be tuned and targeted accordingly. On the whole, we need policies that allow for more tailored approaches addressing individual contexts for effective transformation. This contrasts with current transition policies that mainly target the innovation ecosystem, focusing on the institutional environment of the farmer and ignoring their agency. This echoes previous research on the governance challenges around farmland nature conservation and nature-inclusive agriculture (de Snoo et al., 2013). Practically, this would likely require more resources and staff at lower administrative levels to foster participative, context-specific, and inclusive policy design for the agricultural transition (Pollermann & Fynn, 2021).

Farmer protests from The Hague to New Delhi are testament to the fact that policies and market interactions not only have calamitous socioeconomic and environmental repercussions, but can also encroach on the dignity of the individual. Ultimately, traction is impossible without some friction: our analysis shows that farmers who have made substantial changes to their business models have overcome great hurdles. But not everyone can overcome the same amount and type of adversity, and policymakers must recognize and act on this insight. Finally, we ought to ask ourselves how the spheres of transformation perspective could shape a research and change agenda for corporate and state actors in a food system transition. If we expect only farmers to undertake difficult and often existential transformations, and see more powerful and less numerous actors as merely facilitating and supporting, such a transition will have a serious legitimacy deficit – and therefore may not succeed at all.

Declaration of Competing Interest

The authors declare the following financial interests/personal relationships which may be considered as potential competing interests:

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Data availability

The data that has been used is confidential.

Appendix A. Farm and farmer characteristics

Table A1

Table A1
Overview of interviewees.

#	*Farm type*	*Farm size (ha / herd size)*	*Farmer gender*	*Farmer age (y)*	*Time since transformation (y)*	*Adopter category*
1	Livestock (dairy)	92 ha / 115 dairy cows	M	47	1-5	Early adopter
2	Livestock (dairy)	55 ha / 120 dairy cows	M	39	0	Early / late majority
3	Arable	25 ha	M	29	1-5	Innovator / early adopter
4	Arable	53 ha	M	38	1-5	Innovator
5	Arable	125 ha	M	58	0	Late majority
6	Livestock (dairy)	313 ha / 265 dairy cows	M	52	>10	Innovator
7	Mixed	20 ha / 10 beef cattle, 20 pigs, 245 chicken	M	58	1-5	Innovator
8	Mixed	20 ha / 10 beef cattle, 20 pigs, 249 chicken	M	41	1-5	Innovator
9	Mixed	20 ha / 10 beef cattle, 20 pigs, 237 chicken	M	28	1-5	Innovator
10	Livestock (beef)	120 ha / 130 beef cattle	M	46	1-5	Innovator
11	Arable	370 ha	M	50	1-5	Innovator
12	Horticulture	84 ha	M	59	5-10	Innovator
13	Arable	44 ha	M	57	0	Late majority
14	Livestock (dairy and beef)	100 ha / 25 beef cattle, 85 dairy cows	F	53	>10	Innovator
15	Livestock (dairy)	50 ha / 99 dairy cows	M	38	0	Late majority
16	Livestock (dairy)	89 ha / 109 dairy cows	M	48	1-5	Innovator
17	Livestock (dairy and beef)	81 ha / 20 beef cattle, 80 dairy cows	M	55	>10	Innovator
18	Livestock (dairy)	225 ha / 253 dairy cows	M	53	5-10	Innovator
19	Livestock (beef)[2]	55 ha / 2 beef cattle	M	42	0	Innovator
20	Livestock (dairy)	82 ha / 89 dairy cows	M	42	1-5	Late majority
21	Mixed	50 ha / # livestock animals unknown	M	72	>10	Innovator

This farm is currently run as a hobby; plans for a farm building license are pending with the municipality. Once granted, the ambition is to create a mixed farm.

Appendix B. Regenerative farming themes

Table B1

Table B1
Regenerative farming themes (Groot Koerkamp et al., 2021).

Theme	*Description*
Soil quality & fertility	Maintenance and improvement of soil quality and fertility as the basis of soil-based food production
Primary productivity	Output of high-quality and safe food
Carbon & climate regulation	Maintenance of soil carbon content, reduction of energy use and production of renewable energy
Water purification & regulation	Reduction of leaching and blue water use; improvement of soil water retention
Provision & cycling of nutrients	Use of fertilizers from renewable sources and reduction of emissions of nitrogen and phosphor
Local air quality	Reduction of particulate matter and nitrous oxide emissions
Biological control	Enabling the presence of natural predators of pest insects
Pollination	Enabling the presence of pollinators
Genetic diversity	Maintaining a diversity of flora and fauna, both in nature and on productive areas of the farm
Habitats for species	Maintaining habitats for biodiversity and targeted protection of priority species
Farmer income	Having financial means for a good life of farmer and their family as well as for investment in the farm
Animal welfare	Attention for animal health and striving for good facilities
Attractive work	Having opportunities for attractive and meaningful work
Attractive landscapes	Attention for a visually appealing and culturally appropriate landscape
Farmer-consumer connection	Improving relations between farmers and non-farmers
Significance for local economy	Contributing to societal needs beyond nutrition

Appendix C. Interview questions

Intro & process (15–30 min.)

Introduce each other, ask for permission to record and take photos, sign data agreement, explain the process of the visits and goals of the study.

Basic information about the farm and farmer:

- Age
- Year they started farming (in general / on this farm)
- Highest level and type of education
- Profession of parents, spouse, children (if applicable)
- Farm succession: are there plans, if so with farmer's children or someone else?
- Farm size: land owned vs leased / rented
- Which crops / animals (in general; details on rotation etc. will come out of second visit)
- Other products / services generated by the farm
- Farmland history: what was there before?
- Side activities (LTO, collective, NGO)
- Income sources other than farming, and their importance for the livelihood of the farmer
- Value chain farm is embedded in / main customers
- Participation in agri-environmental schemes

Tour (30–60 min.)

See the farm and get a sense for what actually happens (differently) here. If permission granted, take photos. Ask what they are particularly proud of.

Self-assessment Donut – method in separate ppt (30 minutes)

Get an overview of how the farmer thinks (s)he is performing on the 16 RF criteria.

Timeline (60 minutes)

Understand moments and events of significant change.

1. Explain idea behind the method: to understand which changes were important in the history of the farm(er), what brought them about, how they were dealt with, what was learned from them.
2. Set up and explain how it will work:
   a. Ask farmers to write down significant events, moments of change or turning points on post-it notes
   b. Ask farmers to add a date and a short description
   c. If necessary, the following examples can be used to prompt:
      i. starting or stopping to use a certain farming practice or technology
      ii. buying or leasing additional land
      iii. a change in laws / regulations with an impact on the farm
      iv. a moment of realization, shock, wonder
3. Events can include changes that were not / could not be made / that failed
4. Once farmer has recorded all events, ask for a moment of reflection to see if anything is missing; if so, allow them to add (with additional sheet if necessary)
5. Deepen understanding of events with the following questions:
   a. If the event was a change initiated by the farmer:
      i. What led you to implement something new?
      ii. How did you make this decision? Did you discuss it with anyone (family, neighbors, advisors, customers)?
      iii. Did you feel positive or negative encouragement (motivation / pressure) to take the decision (from a certain actor like the bank, or more generally from society or fellow farmers)?
      iv. Would you have done anything differently in this situation if you had had more knowledge, experience or resources?
   b. If the event was a change in laws / regulations:
      i. How did you experience and adjust to this change?
      ii. Did it have long-term consequences? If so, which ones?
      iii. Did it influence the way you make decisions, weigh up your options?
   c. If the event was a learning moment:
      i. Who or what did you learn from?
      ii. Do you generally trust this source of information?
   d. If the event was a personal insight or realization:
      i. What was your thought process here?
      ii. Do you remember what kinds of feelings or emotions you had?

6. General questions at the end:
   a. How did you experience these change personally? Have they influenced what you believe in or how you see the world?
   b. How did the people around you (family, friends, neighbors) experience these changes? Did their experience influence your own subsequent behavior?
7. Lastly, ask the farmer to continue the timeline: what does the future of the farm look like in 5 / 10 years? What will be the significant events and changes both on the farm and in the wider context?

Additional questions (15–30 min.)
Direction

- How do you see the future of agriculture in the Netherlands in the coming decades?
- Which opportunities, challenges and solutions do you see?

Farmers and their place in society

- What makes a good farmer?
- How do you think Dutch people view farmers in general, and farmers like you specifically?

Farmer's view of nature

- Do you consider your farmland to be part of nature? Where does nature start for you, and what's your understanding of nature in general?

Appendix D. Farmer innovation adopter characteristics

Table D1

Table D1
XXXX.

		Farmers																			
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Innovator	interest in new ideas	x	x	x	x	x	x	x	x	x	x	x	x		x	x	x	x	x	x		x
	cosmopolite social relationships							x	x	x	x	x			x	x			x	x		x
	network w other innovators	x		x	x		x	x	x	x	x	x	x		x		x	x	x		x	x
	large financial resources			x	x		x		x	x		x						x		x		
	ability to understand and apply complex knowledge	x		x	x				x	x	x	x	x		x		x	x	x			x
	ability to cope with uncertainty				x					x	x	x	x					x	x			x
	desire for rash, daring, risky				x						x	x					x		x	x		x
	willing to accept setbacks				x					x	x	x	x					x	x			x
	not respected by local peers							x					x		x		x	x	x			
	imports knowledge from outside system							x	x	x		x			x				x	x		x
Early adopter	more integrated in local system	x	x	x		x	x													x		
	opinion leader among peers			x												x						
	change agent	x		x				x	x	x		x	x									x
	respected by peers	x					x															
	more judicious / less risky	x		x												x						
	puts stamp of approval on new ideas																					
Early majority	interacts w peers													x								
	not often opinion leader		x																			
	provides interconnectedness in networks																					
	long innovation-decision process		x			x										x						
	deliberate follower		x																			
Late majority	adopts out of economic necessity or peer pressure																				x	
	skeptical, cautious		x			x								x		x					x	
	don't adopt until others have																					
	guided strongly by system norms		x											x		x						
	relatively scarce resources					x								x		x					x	
	uncertainties must be absent before adoption		x																			

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