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Conceptualising Just Acceleration: a Case Study of the Protein Transition

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Conceptualising Just Acceleration: a Case Study of the Protein Transition

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Summary

The urgency of undertaking actions to reverse and prevent further consequences of global warming caused by anthropogenic activities is growing rapidly. To overcome these grand societal challenges and ensure the well-being all societal groups of present and future generations, society must transition to alternative modes of operation in a fair and just manner. Transitions and just transitions literature are two literature streams that demonstrate courses of transition pathways. In both literature streams, the notion of 'accelerating transitions' seems to be gaining headway. However, both transitions and just transitions literature streams lack elements to guide socially desired and rapid change. These elements differ per literature stream but include the underexposure of social aspects, the incomplete incorporation of transition dynamics and indifferences on the definition and nature of acceleration as a concept. In an attempt to synergise the literature streams and overcome these differences and with that provide clearance and directionality to future sustainability transitions, this thesis has developed a conceptual definition of 'just acceleration'. Here, just acceleration is presented as desirable approach for tackling increasingly urgent grand societal challenges. A literature review that deciphered the underlying conceptual definitions of acceleration and justice in the transitions and just transitions literature streams resulted in the recognition of four relevant concepts for the conceptualisation of just acceleration: *regime dimension change*, *speed of (system) change*, *diffusion and scale*. These concepts were defined and operationalised based on key theoretical models from both literature streams, resulting in a conceptual framework of just acceleration. To validate and enrich the conceptual framework that was eventually used for the conceptualisation of just acceleration, the framework was employed through an empirical case study of the protein transition in the Netherlands. The case study demonstrated a strong relation between transition dynamics, and relatedly acceleration, and aspects of justice through the concept of accessibility. It showcased that acceleration and accessibility are implicitly linked and can reinforce each other when transitioning in the sustainability domain. This illustrates that a focus on increasing accessibility of the transition has the potential to advance acceleration in transitions. This emphasizes that there is an intrinsic link between the two concepts and that this relation should be manifested in sustainability transition pathways. The findings of the empirical case study demonstrate what interactions, relations and dynamics regarding the operationalised concepts were visible and how the relation between acceleration and accessibility is noticeable within the indicators of the conceptual framework. This essentially created a dialogue between the literature and the case study. This ultimately led to the incorporation of the relationships and dynamics between accessibility and acceleration in the conceptual framework. From this, a conceptual definition was constructed for just acceleration. This definition embodies the synergy between two literature streams and aims to steer sustainability transition pathways intending to accelerate change in a fair and just direction. The conceptual framework poses a way of recognising, analysing and understanding just acceleration.

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1. Introduction

Multifaceted societal problems such as resource depletion, environmental degradation and widening socio-economic inequalities caused by anthropogenic activities are considered grand societal challenges that have the possibility to invoke irreversible effects when not timely dealt with (Gorissen et al., 2018). These sustainability challenges are characterised by strong path-dependencies and socio-technical lock-ins to current practices which are not solvable by single actor groups, individual technologies or policies and make radical innovations necessary to overcome them (Markard et al., 2012). To overcome these challenges and be able to maintain the livelihood of current and future generations, society needs to transition to alternative ways of operating. Technological and societal transitions of this scale have been found to take anywhere between 30-90 years (Kern & Rogge, 2016). However, it is imperative that action to transition away from unsustainable practices is accelerated to prevent further irreversible effects caused by the abovementioned anthropogenic activities which are already currently observable (Rockström et al., 2009).

Transitions literature emerged to understand transition dynamics and uncover how emerging socio-technical innovations can reconfigure current practices (Geels, 2002; Gorissen et al., 2018; Hirt et al., 2020; Hölscher et al., 2018; Skjølsvold & Coenen, 2021). Transitions literature has proven useful in describing transition pathways as means to reach a desired goal. The dynamic character and facets of change are described with the purpose of reaching an alternative system state. *Sustainability* transitions literature built on this by adding the aspects of longevity, governance and fundamentality of change to shift to more sustainable production and consumption practices (Markard et al., 2012). However, the consequences of this change for marginalised social groups, related to the sociality of the transition are rather underexposed within transitions literature. This has resulted in unfair and unjust situations for specific social groups to emerge. Now that the necessity to transition to sustainable practices is growing rapidly and research on past transitions has exposed social inequalities to have emerged, it becomes apparent that the described transition pathways solely as a way to reach transition goals, need to be revised.

Just transitions literature developed parallel to transitions literature and exposed the wrongdoings of past transitions, by highlighting the negative externalities of transitions on marginalised groups (McCauley & Heffron, 2018; Upham et al., 2022). Here, injustices of decision-making processes and socio-technical developments are showcased, as well as the long-term effect of sustainability transitions on marginalised social groups. Justice is an essential concept to consider as it serves as the foundation of a just and equitable society. It incorporates principles of equality and fairness in how people are treated and how resources are allocated. While this literature stream accounts for the social equality aspect, that appears to be underexposed in transitions literature, it does not present alternative transition pathways that incorporate all active system dynamics or ways of dealing with the growing urgency for transitions to transpire rapidly.

In both literature streams, the notion of ‘accelerating’ transitions seems to be gaining headway (Derks et al., 2022; Skjølsvold & Coenen, 2021; Upham et al., 2022). As a result of the increasingly visible effects of climate change caused by anthropogenic activities, the necessity of accelerated change is progressively researched. As showcased above, however, both transitions and just transitions literature streams lack elements of socially desired and rapid change. When zooming in on the literature streams separately, disparities are found on how acceleration is defined and whether it is either an emergent phenomenon or deliberately induced. Earlier transitions literature scholars highlight acceleration as a separate phase of a transition, deliberately influenced by aggregating actions towards change (Geels, 2002; Hekkert et al., 2007; Rotmans et al., 2001). Other scholars describe it as a mechanism influencing the entire transition process (Loorbach, 2010; Skjølsvold & Coenen, 2021). Here, it is described as a natural occurrence or a phenomenon emerging when specific conditions or prerequisites are met through planning and strategic decision-making (Derks et al., 2022; Gorissen et al., 2018; Markard et al., 2020). Besides this, differences on how to incorporate and deal with justice aspects are seen in both streams. Still, thus far, there have been very few academic research attempts at combining acceleration dynamics with justice aspects aiming to influence the speed of just socio-technical transitions to sustainable alternatives. Mentions of accelerating just transitions have, therefore, been mainly in non-evidence-based sources, such as company websites, policy documents and conference evaluations (Ipieca, 2022). This theoretical gap entails the lack of a generally accepted definition of acceleration that encompasses both societal and technical domains, the lack of synergy and integration between transitions and just transitions literature, as well as the lack of directionality on how to accelerate sustainability transitions. Lack of directionality causes the inability to perform collective action,

a lack of shared vision regarding a desired goal, causing differences and inefficiencies in research streams, disagreements on transition pathways as well as biases and misconceptions (Greenland & Morgenstern, 1989; Weber & Rohracher, 2012). In an attempt to synergise the literature streams and overcome the conceptual differences and with that provide clearance and directionality to future sustainability transitions, this thesis aims to construct a conceptual definition of 'just acceleration'. Accordingly, the following research question has been formulated:

How can 'just acceleration' be conceptualised in the sustainability domain?

Theoretical and empirical findings are combined in this thesis to create a holistic conceptualisation of just acceleration. By deciphering the underlying conceptual definitions of acceleration and justice in the context of sustainability transitions in both literature streams, a conceptual framework was constructed, demonstrating the main concepts of just accelerations. These were operationalised with indicators using key theoretical models from both literature streams. To guide this theoretical analysis, the following sub-question is formulated:

1. *How can theoretical insights from transitions and just transitions literature be combined to contribute to the conceptualisation of 'just acceleration' in the sustainability domain?*

To validate and enrich the conceptual framework and to decipher its essence needed for the holistic conceptualisation of just acceleration, an empirical case study of the protein transition in the Netherlands employing the conceptual framework is conducted. The empirical case study was used to determine interactions, relations and dynamics among the operationalised concepts in the framework and how this relates to just acceleration. For this, a second sub-question was formulated:

2. *How can empirical insights from a case study of protein transition in the Netherlands be used to validate and enrich the conceptualisation of 'just acceleration' in the sustainability domain?*

Besides the explicit theoretical approach to the conceptualisation of just acceleration, the conceptualisation and framework of just acceleration also yield societal benefits. As this conceptualisation guides sustainability transitions in a fair and just manner, as well as the accompanied societal benefits from sustainability implementation, this thesis aims to provide benefits to all social groups. Furthermore, both literature streams currently employ a narrow focus on predominantly technological transition case studies such as those occurring in the energy and mobility sectors (Bergek et al., 2015; Delina & Sovacool, 2018; Kern & Rogge, 2016; Kern & Smith, 2008; Lindberg & Kammermann 2021; Skjølsvold & Coenen, 2021; Sondejker et al., 2006). As a result, the lessons from such research are not directly applicable to more social-culturally centred transitions, resulting in empirical shortcomings. Therefore, this thesis also strives to address the empirical shortcomings apparent in transitions and just transitions literature, by employing a socially centred case study. Accordingly, the protein transition is selected as empirical case study. Additional societal relevance is provided as knowledge is created on how to weather grand societal challenges by providing directionality to the acceleration of socially centred sustainability transitions research, that will benefit future sustainability transitions. Moreover, the protein transition is a novel research topic, meaning there is a lot to be gained from research (Bilali, 2019; Mylan et al., 2019). The case study adopts consumer perspective when examining the supply chain of the protein transition. A consumer perspective allows for a better indication of barriers for end users, gives an indication of the social dynamics and emphasizes the importance of equitable outcomes of systemic change to all social groups. Also, it facilitates a comprehensive view of market dynamics as the market aims to increase adoption of end users.

The reasoning for selecting the protein transition in the Netherlands is threefold. Firstly, the protein transition has the potential to avoid large amounts of Green House Gas (GHG) emissions. In 2019, the amount of GHG emissions including CO₂ and Nitrogen resulting from the food sector added up to 31% of total global anthropogenic emissions (Crippa et al., 2021; Tziva et al., 2020). More specifically, livestock production is responsible for 14.5% of global GHG emissions (Taillie et al., 2022). The transition towards plant-based meat substitutes has emerged over recent years as sustainable alternative to livestock production yielding the potential to reduce these large amounts of emissions (Camanzi et al., 2017; Tubiello et al., 2022). Secondly, growing social inequalities are expected to emerge because of the protein transition. This is due to the higher prices of meat alternatives, the limited distribution of products to rural areas and the expected unequal distribution of forthcoming benefits (Newton & Blaustein-Rejto, 2021; Tziva et al., 2020). This highlights the importance of early intervention and inclusion of justice principles. On top of that, generally acknowledged transition dynamics as described in transitions literature do not necessarily

seem to be applicable to this transition (Tziva et al., 2020; see section 3.2.). For these reasons, the protein transition was selected as a case study, to validate and enrich the proposed framework of just acceleration, as well as contribute to its conceptualisation by identifying the essence of the theoretical concepts in a socially centred sustainability transition.

Regarding the structure of this thesis, the theoretical background elaborates on the development of acceleration in transition literature and just transitions literature fields, deciphers the underlying conceptual definitions of acceleration and looks at how the justice is incorporated in both literature streams. The underlying conceptualisations of acceleration and justice are categorised into relevant concepts. These concepts are operationalised using key theoretical models from both streams. Following this, the methodological chapter goes deeper into the conceptualisation approach and sheds light on data collection and systemic analysis methods as well as the argumentation behind the chosen case study. The findings of the empirical case study are presented in chapter four, as well as the holistic conceptualisation and final conceptual framework of just acceleration. A discussion and conclusion chapter round out this thesis.

2. Theoretical background

This theory section examines two simultaneously developed literature streams, *transitions literature* and *just transitions literature*, and aims to understand how these literature streams conceptualise acceleration and consider aspects of justice. As this thesis builds upon existing conceptualisations, it becomes important to shed light on past developments and trends within the literature fields. Accordingly, this theory section aims to depict relevant concepts that can be used for the conceptualisation of just acceleration and that can be further analysed in the empirical case study. As was seen in the introduction, a perceived lack of direction occurs in both transitions and just transitions literature, regarding the concept of acceleration. By conceptualising just acceleration, this thesis aims to add directionality to future research. Socio-technical change requires direction for the making of collective choices towards a certain goal, the formulation of policy and the guidance of research (Weber & Rohrer, 2012). It transcends the notion of generating innovations as effectively and efficiently as possible and contributes to a larger role of systemic change (Schot & Kanger, 2018). By providing directionality in the form of consensus on conceptualisations you reduce biases, misconceptions and uncertainty (Greenland & Morgenstern, 1989). Besides this, this theory section also analyses the aspect of agency, to determine where acceleration needs to be initiated and to determine which roles are reserved for certain actor groups. Accordingly, the theory section is structured as follows: firstly the development of transitions literature is described together with the conceptualisation of acceleration in its most prominent theoretical contributions while determining the importance of justice within them; following, a similar design can be seen for just transitions literature; next, a reflection on agency is given; finally, identified concepts from both literature streams are integrated into a theoretical framework for just acceleration, where the relevant concepts are described in relation to the conceptualisation and operationalised through the recognition of indicators that are derived from the discussed theoretical models.

2.1. Transitions literature

Transitions research originates from the combination of knowledge from multiple disciplines, such as innovation sciences, social sciences, political sciences and environmental sciences. Its emergence can be dated back to the early 2000s when the concept was originally proposed to understand political failures (Loorbach et al., 2015). Transition research initiated the emergence of a whole new academic research field of transition literature. Transitions are defined as: “[...] *fundamental social, technological, institutional economic change from one societal regime or dynamic equilibrium to another*” (Rotmans et al., 2001, p.16). Forthcoming frameworks emerged such as the Multi-Level Perspective (MLP) (Geels, 2002), the Technological Innovation Systems (TIS) Framework (Hekkert et al., 2007), Strategic Niche Management (SNM) (Schot and Geels, 2008) and Transition Management (Rotmans et al., 2001; Loorbach, 2010).

The next wave of transitions literature focused on sustainability transitions and emerged between 2010 and 2015. A sustainability transition is defined as: “[...] *a radical transformation towards a sustainable society, as a response to a number of persistent problems confronting contemporary modern societies*” (Grin et al., 2010, p.9). This development added social complexity and sustainability dynamics. Sustainability transitions research has mainly focussed on the initiation of change and the emerging phases of sustainability transitions. This becomes evident as most frameworks and tools are seen as strategic planning tools and take a managerial perspective (Loorbach, 2010; Skjølsvold & Coenen, 2021).

While both waves of transitions literature do not specify the temporal aspects of change, predominantly, transitions are considered to take between 30-90 years (Kern & Frogge, 2016). Extensive research on material scarcity, resource depletion and global warming has pointed to the necessity of accelerating systemic change towards sustainable practices (Gorissen et al., 2018). This has awakened the attention to temporal aspects within sustainability transitions literature. Mentions of acceleration and widespread accelerated diffusion of low carbon solutions became more apparent, but overall have received little attention in transition studies (Geels & Johnson, 2018). While research is reporting on acceleration dynamics (Gorissen et al., 2018; Markard et al., 2020) and entering acceleration phases (Brugge & Rotmans, 2007; Geels et al., 2008), varying definitions of acceleration, differences in interpretations of the concept and therefore differences in the usage of the term, ultimately lead to the lack of directionality towards acceleration in transitions literature.

In some cases, acceleration is considered the result of putting pressure on the transition process as a whole and solely focusses on the temporal aspect of the word (Kern & Frogge, 2016; Loorbach, 2010; Skjølsvold & Coenen, 2021). This caused the words speed, pace and acceleration to be used interchangeably. This sole temporal focus does not encompass the dynamic nature of the concept and disregards its multifaceted character. Other authors believe acceleration becomes visible when certain prerequisites are met. Here, adequate strategic decision-making and long- and short-term planning encompass the necessary actions for acceleration to occur (Derks et al., 2022; Gorissen et al., 2018; Markard et al., 2020; Kates et al., 2005). These studies consider acceleration to influence the transition as a whole and indicate acceleration to inevitably occur if the prerequisites are met. While these prerequisites vary per framework, they predominantly include the decline of the current regime, change needing to occur in the whole system, changes in demand patterns, collaboration between actors, upscaling of solutions, and embedding of new systems (Gorissen et al., 2018; Markard et al., 2020). In other cases there is a more explicit division of transition stages. Here acceleration is considered as something that is emergent, rather than influenced by actors in the system (Rotmans et al., 2001). All in all, inconsistencies exist regarding the use of the term acceleration and the contexts in which the concept is used. To provide a consistent definition of acceleration, it is important to consider the origin of the concept, as well as the dynamics influencing it. Therefore, the next sections illustrate how acceleration is defined in transition literature frameworks, and which concepts deem relevant.

2.1.1. Conceptualising acceleration in transitions literature frameworks

The Multi-Level Perspective (MLP) is part of the early transition literature movement and describes innovation dynamics between multiple levels (Geels, 2002). The MLP conceptualises dynamic transition patterns on the level of the system and presents how misalignment of the system can cause deconfiguration of established socio-technical configurations (Geels, 2011). Technological transformations are located in a nested hierarchy comprised of three levels: *Landscape, regime and niche*. The landscape entails the highest of the three and presents deep structural trends. The regime defines system dynamics in complex environments with institutions and infrastructures. When aligned, system dimensions compose the socio-technical configuration that can be destabilised by pressures from the landscape and niche levels, ultimately leading to reconfiguration (Geels, 2002). However, socio-technical lock-ins into the established configurations make change difficult. Especially in the case of sustainability transitions, where radical change does not necessarily lead to technological enhancements, and inadequate landscape pressures, make changes quite difficult. Radical changes start in the niche level of the MLP. Decumulation of diverse development paths leads to the emergence of a dominant design. In the field of transitions research, the MLP has formed the basis for understanding system dynamics when large-scale changes occur. While there are no direct mentions of acceleration in the MLP, Geels (2002) does mention the take-off phase, pointing to the fact that there is also an acceleration phase as this resembles similar theoretical models at that time. This is in line with the reasoning on the regime reconfigurations where the implementation of dominant designs grows and gains the necessary momentum in the take-off and acceleration phases to establish reconfiguration. Furthermore, Geels (2002) does not reflect on justice and does not incorporate justice concepts throughout the framework.

Brugge & Rotmans (2007) build further on the MLP by defining the four separate stages of transitions, where acceleration is considered as something that can be observed, rather than influenced by actors in the system (Kemp & Rotmans, 2004; Rotmans et al., 2001). The four phases are: *predevelopment, take-off, acceleration, stabilisation* (Brugge & Rotmans, 2007). This means that acceleration is considered a separate transition phase. According to *Figure 1*, during the acceleration phase, the state of the system changes a lot in a relatively short period of time. This indicates a pace or temporal aspect to acceleration, meaning that system change occurs faster in the acceleration phase than in any other phase. However, when dissecting their conceptualisation of the acceleration phase, it does not necessarily indicate a higher speed of system change, but rather a shift in power that is necessary for new technologies to cause reconfiguration of the regime. In their article, Brugge and Rotmans (2007) say that the acceleration phase is recognisable as the moment in time when emerging regimes acquire deciding power on the criteria for the next regime. This means that new formal and informal institutions and organisations take shape and have the ability to exert power on how the new regime must look like. These decisions can concern the best practices of different innovation networks, what regulations need to be in place, or the recognition of important actors for example. Old regime configurations lose validity and power and the prerequisites for the new regime form, while in the meantime different innovation networks are still competing to deliver a dominant design. They consider the selection of the dominant design as the outcome of the acceleration phase. In short, they say that the acceleration phase of transitions occurs when multiple regime level

dimensions change due to self examination (Gorissen et al., 2018), while it is still unclear in which way change is directed since no new emerging innovations are considered dominant designs, only to realise a dominant design as a result of the acceleration phase. This is in contrast with the MLP, which indicates that regime change only occurs when specific technologies are distinguished as the best alternative to take over the regime. Self examining regime actors and entrepreneurial niche firms are considered to initiate change in the system. Similarly, to the beforementioned framework, no mentions of justice came forth in this framework.

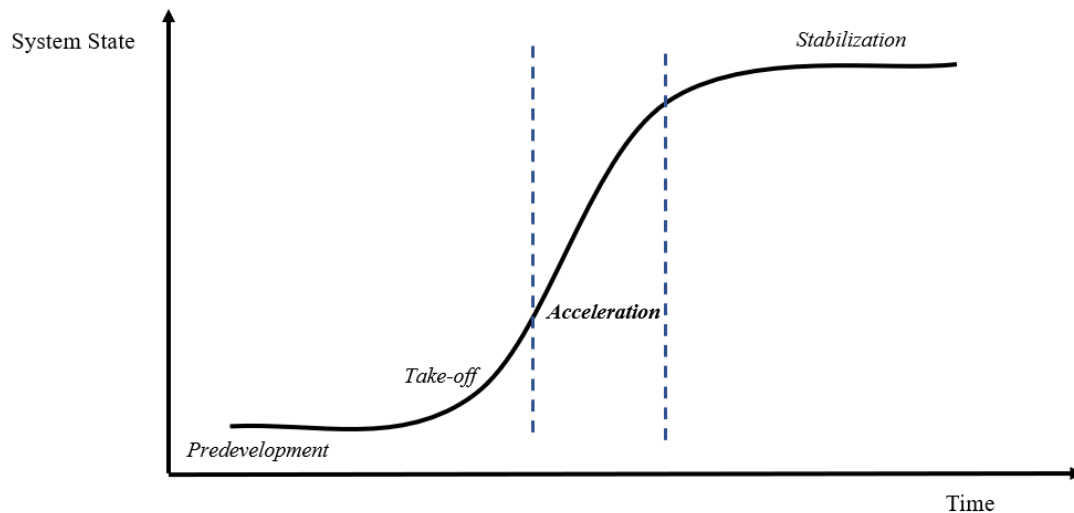


Fig. 1. Indicates the amount of change in the state of the system in relation to the amount of time needed in the acceleration phase as described in transitions literature

While Transition Management (TM) also distinguishes stages of transitions, it conceptualises acceleration as an influenceable factor that affects transitions as a whole through strategic planning (Loorbach, 2007 & 2010). Similar to MLP, the goal is to achieve fundamental systemic change through radical shifts in established processes. Contrary to the MLP, transition management focusses more on social change rather than technological change. As governance approaches generally focus on how decision-making processes are performed, they tend to concentrate on earlier stages in the transition process. This can also be observed here, where the aims of TM include reducing the lack of direction and coordination mechanisms within governance networks and therefore increasing the effectiveness of existing government forms, and creating operational policy models for sustainable development (Loorbach, 2010). While this indicates a prioritisation on planning and strategy building activities, acceleration here is considered to encompass transitions as a whole, as opposed to it being a separate stage of transition trajectories. Loorbach et al. (2015) recognise speed of system change as definition of acceleration. While they present transition management as a tool to better anticipate and adapt to acceleration challenges, they do not propose concrete actions to address the problems once they occur throughout the transition. Besides this, they also do incorporate justice into their framework.

Principally, transition literature frameworks consider transition trajectories to occur in phases, where there is a notable phase where regime alternatives gain momentum, system changes occur and a shift in actor roles takes place, leading to a reconfiguration of the embedded regime. This is illustrated in *Figure 1*. Noticeably, none of these frameworks includes aspects of justice, such as equality, inclusion, equity or fairness within its frameworks.

2.1.2. Conceptualising acceleration in sustainability transitions literature frameworks

Along the second wave of transitions literature, sustainability transitions literature further developed acceleration as an independent, dynamic concept that influences transitions as a whole. Increased and more explicit mentions of acceleration were observed, resulting in a growing understanding of acceleration dynamics. Frantzeskaki et al.

(2015) and Gorissen et al. (2018) developed a framework on mechanisms¹ that contribute to the acceleration of sustainability transitions in cities. They combine and adapt concepts from transitions literature, urban dynamics, governance and agency to suggest five acceleration dynamics that, when performed synergistically, increase the speed of change within cities. Regarding agency, they recognise the collaboration between local actors to initiate the change. They conceptualise acceleration as the speed of change and present it as an influenceable concept. Acceleration is measured by the number of Transition Initiatives (TIs) and their implementation and successes. The mechanisms have strong similarities with earlier transition works in regard to the stages of transitions. While those mechanisms conveniently identify acceleration dynamics, the geographical scale and scope of mechanisms make it difficult to apply to large-scale sustainability transitions which include both national and international governance and market dynamics but do pose a compelling starting point for further research on acceleration dynamics.

Newell and Simms (2021) link the necessity of accelerated transitions to the obligation to adhere to the Paris Agreement as well as to operate within the planetary boundaries as formulated by Rockström and colleagues (2009). Acceleration here is used interchangeably with the concept 'rapid' and points to the sole temporal focus of accelerations, ultimately conceptualising acceleration as speed of change. Newell and Simms (2021) mention that existing sustainability transitions literature lacks focus on how transitions can happen 'rapidly'. Therefore, they aim to provide comprehensible starting points aimed at businesses, citizens and policy-makers, considering them as initiators of change. They argue that accelerated transitions can emerge in both bottom-up and top-down fashions. They consider top-down initiated accelerated transitions to be regressive (inferior to the prior system), exclusive and destructive (for marginalised groups), while they are considered to invoke progressive social and environmental rationales. To demonstrate, they mention the relocation of poorer communities for the build of renewable energy sources by governmental actors, of which they are not able to reap the benefits due to higher costs (Newell and Simms, 2021). On the other hand, they consider bottom-up accelerated transitions to be more inclusive, resulting in large social and environmental benefits, such as food cooperatives. Nevertheless, they argue that there is no luxury of choice in the case of sustainability transitions, calling for a combination of both top-down and bottom-up transitions.

Furthermore, a stream of sustainability transitions researchers has recognised that the fulfilment of prerequisites can lead to entering an acceleration phase (Derks et al., 2022; Kates et al., 2005; Markard et al., 2020). While these prerequisites vary, they are all considered to be manageable in the strategic planning phases of transitions. This goes beyond more immediate drivers of acceleration, e.g., capital, upscaling, subsidies, and looks at the challenges that require significant policy and academic attention. One of these papers, written by Markard et al. (2020), examines complex acceleration challenges. Contrary to other transition research, they distinguish two stages of transitions: emergence and acceleration. They take a more literal approach to their conceptualisation, portraying acceleration as enhanced diffusion, widening in both sectorial and geographical scope (Markard et al., 2020). They also portray the phases more linear than above, by stating a clear order between emergence and acceleration. Other acceleration research largely focuses on elements influencing acceleration, such as innovation intermediaries (Gliedt et al., 2018), advocacy coalitions (Lindberg & Kammermann, 2021), politics (Burch, 2017; Roberts et al., 2018), changing business models (Derks et al., 2022) and even acceleration by slowing down (Augenstein & Palzkill-Vorbeck, 2015). Generally, these frameworks portray acceleration as enhanced diffusion, widening in both sectorial and geographical scope (Markard et al., 2020).

Ultimately, sustainability transitions literature has put more emphasis on the examination of acceleration and the dynamic facets that surround the concept, resulting in a higher sense of directionality. However, the general focus of the mechanisms and ways of dealing with acceleration dynamics remains a governance approach, meaning that it predominantly focuses on the earlier stages of transitions and takes a managerial perspective. While mentions of justice aspects seem to occur more often within sustainability transitions literature (Frantzeskaki et al., 2015; Markard et al., 2020), still no adequate incorporation of the concept within the frameworks can be observed, resulting in the lack of integration of both literature streams.

¹ The mechanisms are: Replicating (taking up new ways of doing by other initiatives/actors), Partnering (pooling and complementing of resources, competencies and capacities), Upscaling (growth of members, supporters, users), instrumentalising (tapping into and capitalising on opportunities), Embedding (alignment of old and new ways of doing to integrate them in city patterns) (Gorissen et al., 2018).

Summarising, acceleration has been included in transitions literature quite extensively, especially within sustainability transitions literature. While there are different definitions of the concept, three factors stand out as being important concepts of acceleration: *regime dimension change*, *speed of change* and *diffusion* (Table 1). Regime dimension change refers to the destabilization of the status quo, posing opportunities for alternatives to arise. Speed of change naturally refers to the temporal aspect of acceleration and diffusion refers to the adoption of the niche alternative. Nonetheless, all transition literature articles predominantly neglect justice dynamics in their frameworks. The conceptualisations of acceleration as described in the different frameworks of transitions literature are summarised in a heuristic scheme that can be found in Table 4.

Table 1. Summarising table for acceleration and justice in transitions literature

Concepts of acceleration	Inclusion of justice
Regime dimension change, speed (system) of change, diffusion	Largely neglected

2.2. Just transitions literature

Just transitions literature finds its origin in the multifaceted concept of justice which was born from labour unions in the 1970s to provide support for workers to create fair and safe working environments (Bazilian et al., 2021). Literature streams around the concept of justice began to form, extending the definition of justice with concepts of inequality, equity, ethics, marginalised groups and inclusion (Heffron, 2021). One of the sub-streams of justice literature that received a lot of attention was energy justice (McCauley & Heffron, 2018). It received an abundance of attention due to the amount and magnitude of the injustices caused by fossil fuel industries and the growing urgency of environmental concerns resulting from the industrial revolution (Heffron, 2021; McCauley & Heffron, 2018). Energy justice research concerns the production and consumption of energy and its distribution. As time evolved, a new stream of literature emerged, just transitions literature (JTL). While there is no uniform definition of a just transition, it entails mitigating the effects of decarbonization for all groups dependent on carbon intensive industries as well as distributing the benefits of the alternatives to all social groups equally (Cha & Pastor, 2022; McCauley & Heffron, 2018; Swilling, 2020). Accordingly, the just transitions approach is more inclusive, involving all stakeholders in society, reduces built-in inequalities and promotes justice all along the transition process (Heffron, 2021). As we are now entering the transition to carbon free energy alternatives, Eisenberg (2018) distinguished two main uses of just transitions: 1) indicating that a low carbon society needs to be fair to marginalised populations, and righting the wrongs caused by the fossil fuel industry; and 2) the protection of employees and related communities who depend on carbon industries, from bearing the costs of the transition to low carbon alternatives. Essentially, this entails that the benefits of transitions need to transcend social groups, i.e., the benefits of the transition need to be distributed along all social groups regardless of demographic or geographical location (Cha & Pastor, 2022; McCauley & Heffron, 2018; Swilling, 2020).

While the speed of transitions as a result of growing urgencies is occasionally mentioned (Andersen et al., 2021; Heffron, 2021; McCauley & Heffron, 2018), the dynamics of acceleration and strategies for dealing with rapidly changing environments have been predominantly neglected. While transitions literature generally acknowledges transitions to transpire in phases, just transitions literature does not mention this, solely the recognition of the need to influence temporal aspects of transitions as a whole (Heffron, 2021; McCauley & Heffron, 2018; Morena et al., 2020). Just transitions literature, therefore, needs to accommodate acceleration dynamics (McCauley & Heffron, 2018), move past the injustices caused by the energy sector to be applicable to other sustainability transitions in different sectors (Andersen et al., 2021) and address large-scale systemic change.

2.2.1. Conceptualising acceleration in just transitions literature

Within academic just transitions literature, acceleration does not have a prominent role yet. However, a new wave of just transitions literature focussed on acceleration is expected soon. Mentions of acceleration have been increasing over the last few years, with a specific increase in attention in the year 2022. An example of this can be seen in the Earth System Governance Conference of October 2022, in which the theme was accelerating just transitions. As the conference was so recent, no significant publications have been published yet, but are expected to emerge in the coming year. Bauer and Faus Onbargi (2022) report on some of the main points made throughout

the conference. They mention that policy coherence was extensively discussed as an important tool to maximise synergies and reduce trade-offs to ensure just transitions. Besides that, inclusive cooperation was at the heart of the discussions on just transitions. Broadly, it appears that acceleration in this sense refers to the more rapid transpiration of just transitions, i.e., the goals of the just transition are to be reached more quickly. This indicates a temporal focus of just transitions literature on acceleration.

On the other hand, mentions of accelerated just transitions seem to arise more frequently in non-scientific literature. Mehra (2022), for example, stresses the need for accelerating just transitions and the roles different actors play in doing so. He mentions, for example, that the EU has taken important steps in setting up the principles for just transitions and designing agreements on transparency. These principles aim to guide sustainability transitions in occurring in a just manner, and mainly focus on the support for workers dependent on fossil fuel industries and reporting on progress regarding just transitions. While these principles thus far do not incorporate acceleration dynamics, they do raise awareness of just transitions and guide future research on how just transitions must transpire (UKCOP26, 2021). Not only public but also private actors have taken notice of accelerating just transitions. Ipieca, an oil and gas producing company, for example, mentions the need to accelerate just transitions and that this will require the collaboration between different actor groups, amongst them, governments, employers, businesses, unions, communities, civil society, UN agencies and other organisations (Ipieca, 2022). Furthermore, non-academic documents mentioning accelerating just transitions highlight specific aspects that can influence the acceleration, such as financial availability (Tasrif, 2022) and the creation of enough jobs (International Labour Organisation [ILO], n.d.).

Summarising, while acceleration dynamics have generally been absent in scientific literature thus far, it seems to be gaining ground in both scientific and non-scientific research fields. While there is no scientific consensus on the conceptualisation of accelerating just transitions, nor is there widespread adoption of the concept, all signs point to an attention shift towards accelerating just transitions in the coming years. Within just transitions literature, two factors of accelerating just transitions seem to stand out: *speed and scale* (Table 2). Here, speed refers to the temporality aspect of just transitions, entailing that the overall transition needs to occur in a shorter period of time. Scale is referred to by just transition literature as the scope to which the benefits of the transitions reach, encompassing both the geographical and demographical scopes. The conceptualisations of acceleration as described in the different frameworks of just transitions literature are summarised in a heuristic scheme that can be found in Table 4.

Table 2. Summarising table for acceleration and justice in just transitions literature

Concepts of acceleration	Inclusion of justice
Speed of change and scale	Largely included

2.3. Agency in transitions literature

Another important aspect to consider in transitions, especially regarding acceleration, is agency. Agency is a concept originating in the social sciences and is used to describe actions or activities of systems in specific contexts. Agency is defined as: the “*socio-culturally mediated capacity to act*” (Ahearn, 2001, p.110). This definition indicates the cultural dependency of the term, resulting in the different capacities to act globally. Within this thesis, the action at hand is initiating change or contributing to the act of transitioning. Therefore, agency is defined here as the capacity to initiate change. The possessors of agency are the actors that are capable of initiating change, i.e., who initiates the change. For this thesis, it is important to understand where change is initiated as well as who is capable of initiating change.

Within transitions literature (TL), variations can be observed in who are considered agents. What was seen in transitions literature is that predominantly change is initiated on levels separate from the established regime, by pioneering entrant firms (as seen in MLP) (Turnheim & Sovacool, 2020; Tziva et al., 2020). Nevertheless, research also highlighted that self-examination (as seen in the four-phase theory by Brugge & Rotmans, 2007) and destabilising regime actors (as seen in Transition Management) play an important role in reconfiguration. Besides this, research on policymakers has highlighted the importance of technology-driven regulations and the associated support in shaping niche markets. Within transitions literature, less focus tends to be on users of innovations,

despite them having a big influence on the social pressures and views on innovations (Tziva et al., 2020). Nonetheless, change within transitions literature is principally initiated in a bottom-up manner, by entrepreneurial actors participating in radical innovation while regime actors employ destabilisation actions due to self-examination (Brugge & Rotmans 2007; Geels, 2002; Loorbach, 2010; Tziva et al., 2021).

Within just transitions literature, there seems to be a consensus on who the actors that caused injustices in past energy transitions are, namely energy suppliers and policy-makers. Nevertheless, there are variations in opinions on where just transitions need to be initiated in future sustainability transitions. Scholars focusing on past (energy) transitions have recognised energy suppliers and distributors and policy-makers as causes of injustices (Heffron, 2021; McCauley & Heffron, 2018). As a result, NGOs, labour unions, and just transition scholars have demanded action from political actors, to compensate for the wrongdoings of these past transitions. For this, just transitions research directs efforts towards governmental institutions to compensate marginalised groups and create equality and guarantee inclusivity (Heffron, 2021). While the compensation of past transitions focusses on policy makers (Heffron, 2021), just transitions literature frameworks looking at future transitions, focus on the inclusion of multiple actors into decision making processes to ensure just transition processes (Bauer & Faus Onbargi, 2022; Ipieca, 2022; Tasrif, 2022). These actors include business actors involved in the respective transition, both national and international policy-makers, NGOs, labour unions and the collaborations between them. However, there seem to be variations in the roles of specific actors, making it unclear which agents are important for the initiation of change. Nonetheless, change within just transitions literature is considered to be initiated in a combined effort between both top-down actions, in the form of regulatory interventions and bottom-up, in the form of collaborations between actor groups that ensure equality for all societal groups.

As a result of this, *Tables 1 & 2* have been adapted to reflect the agency perspective. They are summarised in *Table 3*, as can be seen below.

Table 3. Summary of relevant concepts of transitions and just transitions literature

Literature stream	Concepts of acceleration	Agency	Inclusion of justice
Transition literature	Regime dimension change, speed of (system) change, diffusion	Destabilising regime actors & niche level entrepreneurship – predominantly bottom-up.	Largely neglected
Just transition literature	Speed of change and scale	Public sector i.e., national and international policy makers & businesses, NGOs labour unions & Collaborations between them – combined bottom-up and top-down approach.	Largely included

Table 4. Overview of views on / conceptualisations of acceleration from transitions and just transitions literature. Here both strategic planning and niche-level starting points are considered bottom-up, as both recognise starting points of transitions to occur on lower levels, separate from larger scale environmental pressures. Also, aspects of agency and justice are given

Author	Frame-work	Conceptualisation acceleration	Phase or Whole transition	Where is the change initiated	Agency: Who initiates the change	Bottom-up or top-down	Incorporation of justice aspect
Geels, 2002	MLP	Speed, diffusion and the changes in regime dimensions. Momentum after dominant design emerges. And on the changes of regime dimensions and speed thereof.	Phase	Change is initiated through the accumulation of developments on all levels.	Firms with both entrepreneurial and institutional orientations	Bottom-up	No
Loorbach, 2010	TM	Speed of social system change	Whole	Strategic planning	Top-down strategic decision makers – government and other governance actors	Top-down	No
Brugge & Rotmans, 2007	4 phases	Shifts in regime dimensions and selection of dominant design	Phase	Regime-level through self examination and niche-level alternatives	Niche-level firms and self-examining regime actors	Bottom-up	No
Gorissen et al., 2018	Tl's	Speed of change measured by the implementation and success of transition initiatives	Whole	Local/ cities	Partnering local actors	Bottom-up	One mention, through partnering to overcome inequality
Newell & Simms, 2021	Rapid trans.	Speed of change	Whole	Public sector and cooperation networks	Businesses, citizens and regulation changes, bottom-up initiatives	Both	One mention, through the need to consider inclusivity and equity
Markard et al., 2020	Acc. challenges	Enhanced diffusion, widening in sectoral and geographical scale	Phase	Strategic planning	Policy makers	Top-down	Indirectly through compensating losers
Heffron, 2021	Def. JT	Pace and timelines of transition, i.e., speed of change	Whole	Policy making	Policy makers	Top-down	Yes, through defining JT
McCauley & Heffron, 2018	Def. JT (types)	Shortening timescale of transition, i.e., speed of change	Whole	Academic literature	Justice researchers	Bottom-up	Yes, through three forms of justice
Andersen et al., 2021	Trans. studies	Speed of change & broadening scope of transition benefits	Whole	Academic literature	Justice researchers	Bottom-up	Yes, through the distribution of benefits
Mehra, 2022	Acc. JT	Speed of change	Whole	Public sector and private sector	Policy makers and businesses	Both	Yes, through principles of JT
Ipieca, 2022	Acc. JT	Speed of change	Whole	Private sector	Businesses	Bottom-up	Yes, through inclusivity on collaboration
Bauer & Faus Onbargi, 2022	Acc. JT	Speed of change & broadening scope of transition benefits	Whole	Public sector and cooperation networks	Policy makers, businesses, NGOs, agencies	Both	Yes, through equity and inclusivity
Tasrif, 2022	Justice	Scale up technologies to grasp a wider scope of benefits	Whole	Financial sector	Banks and governmental finance	Both	Yes, through equal access to technology

2.4 Integrating transitions and just transitions literature for conceptualising 'Just Acceleration'

Thus far the lack of understanding of acceleration has hindered research on dealing with acceleration dynamics and therefore poses a key challenge to both research fields (Hurt, 2013). Neglecting justice aspects in transitions literature has caused sustainability transitions to lack a holistic and just approach. Moreover, the lack of theoretical integration between the two research fields led to insufficient knowledge of acceleration dynamics within just transitions literature. While these theoretical shortcomings are becoming more evident, research has yet to overcome them (Andersen et al., 2021; Atkisson et al. 2004; Delina & Sovacool, 2018; Geof & Phelan, 2016; Markard et al., 2020; McCauley & Heffron, 2018; Skjølsvold & Coenen, 2021).

A conceptual distinction is recognised between the concepts of transition and transformation. There appear to be contextual differences in their focus, processes, normativity and agency (Hölscher et al., 2018). Hölscher, Wittmayer and Loorbach (2018), describe that while transitions tend to focus more on socio-technical change within subsystems, such as the energy and mobility transitions, transformations focus more on large-scale societal change processes. Also, transition dynamics predominantly focus on shifts from unsustainable to sustainable practices, transformations encompass the avoidance of undesirable system change. In that sense, transitions entail solving past wrongdoings, while transformations aim to avoid them. Regarding agency, transitions analyse actor dynamics and describe intervention points to disrupt this, while transformations rather respond to implications of change (Hölscher et al., 2018). As the direction that this thesis aims to steer towards involves the transition from unsustainable to sustainable practices in sub-systems and provide intervention points on how to achieve this, this thesis uses the concept of transitions as opposed to transformations for its conceptualisation.

Combining both research fields does not come without friction. Rosa (2003 & 2013) argued two main points to demonstrate the friction between accelerating climate transitions and inclusive decision-making (Skjølsvold & Coenen, 2021). Firstly, increased social complexities have resulted in unstandardised governance practices, creating a need for constant decisions, but due to lack of time resources, this leads to delays in decision-making and ultimately leads to slowing down transition processes. As justice calls for widespread participation and consideration of all social groups, it may limit accelerated developments because inclusion of all social groups is considered to slow down transition processes (Tscherisch & Kok, 2022). Secondly, a prerequisite for large-scale adoption, which is necessary for acceleration from the consumer perspective, is the reliance on shared social views by mass publics. However, as there are large differences between geographical areas, groups and even generations, achieving shared social realities becomes complex. This could be the reason for the lack of integration between literature fields but needs to be dealt with to realise rapid sustainability transitions.

Despite the differences, there are also opportunities and benefits from combining concepts from both literature fields. The combination of transitions literature and just transitions literature allows for analysis on multiple levels, namely that of the system, as well as zooming in to each specific level and analysing its dynamics. Combining these will also incorporate the needs of the general public as well as that of specific groups, therefore targeting a broad scope. Additionally, the integration will lead to a more holistic conceptualisation that encompasses views from different agency perspectives (as seen in *section 2.3*). As the integration of these research fields seems to be lacking, this thesis will provide theoretical contributions to both literature streams.

Following the preceding chapters, four concepts of acceleration were deemed important when analysing the acceleration of sustainability transitions in a just manner in the transitions literature and just transitions literature strands. These concepts are: *regime dimension change*, *speed of change*, *diffusion and scale*. The concepts will from now on be named concepts of just acceleration. Below, the concepts and their definitions are elaborated upon, as well as their accompanied indicators and operationalisations. These indicators and operationalisations are based on the key literature models discussed above. They are presented in the form of a framework, that can be found in *Table 5*. An important nuance here is that the concepts as presented below are currently solely based on the definitions found in key theoretical models derived from both literature streams separately. This entails that *Table 5* and the descriptions below do not include the relation between the literature fields as this did not become apparent from the literature review on the two literature streams. In short, the integration of justice aspects in the concepts deriving from transitions literature is deliberately left out here as this did not become evident from current literature. As a consequence, in the framework, the overarching concept of just acceleration is followed by a questionmark. To validate and enrich these concepts and to uncover the dynamic relationship

between the concepts from both literature streams that were used for the conceptualisation of just acceleration, the framework was used on an empirical case study as described in the introduction.

Regime dimension change

The first concept of just acceleration that was seen in predominantly transitions literature is regime dimension change. As was seen in the literature review, transitions literature focusses on the description of how large socio-technical transitions occur. Regime dimensions refer to the matured set of institutions within the dominant system. Changes in these dimensions reflect room for new emerging technologies to reconfigure the current system. Brugge & Rotmans (2007) directly refer to shifts in power within these regime dimensions as a sign of acceleration. Loorbach (2010) and Geels (2002) take a more indirect approach to the definition and connect the speed and scale of regime dimension change to acceleration. Effectively this can be interpreted that when changes in the regime dimensions start occurring on a more frequent basis and those changes affect the system on a large scale, the acceleration phase has commenced. Geels (2002) has defined seven dimensions based on the earlier work of Kemp, Schot and Hoogma (1998). These seven dimensions will function as indicators for regime dimension change. By adapting the dimensions as formulated by Geels (2002) to reflect the speed and scale of change, the dimensions serve as researchable indicators of regime dimension change. This is reflected in *Table 5*. This led to the formulation of the definition of regime dimension change as concept for just acceleration: *The speed and scale of changes in regime dimensions that are nested in the current socio-technical regime.*

Speed of (system) change

The second concept, speed of change became apparent in both transition and just transition literature fields. While speed of change has a very literal and direct connection to acceleration there seems to be a distinction in the definition of the concept within and between the literature streams. As was seen in the heuristic scheme (*Table 4*) research either tends to consider acceleration as a phase or as something affecting the whole transition. The authors favouring acceleration as a phase tend to consider the speed at which changes occur as a result of changing pressures in a system and do not necessarily solely quantify speed of change as a unit of time (Gorissen et al., 2018; Ipieca, 2022; Loorbach, 2010; Mehra, 2022; Newell & Simms, 2018). They rather tend to focus on the rate at which emerging technologies gain *market share*. This definition still has a direct link to the concept of speed but describes not only *when* but also *how*. The growth of market share is quantifiable and measurable during the trajectory of the transition, making the speed of change observable throughout the transition.

Contrary to this, authors who consider acceleration as something measurable over the whole transition predominantly focus on the temporal aspect of acceleration i.e., the timeframe or duration of the transition (Andersen et al., 2021; Bauer & Faus Onbargi, 2022; Heffron, 2021; Ipieca, 2022; Loorbach, 2010; McCauley & Heffron, 2018; Mehra, 2022; Newell & Simms, 2018). Here the concepts defining acceleration are mainly temporality and speed and are used interchangeably throughout the papers. When authors refer to transition that 'needs to be accelerated', it refers to the need to achieve the transition goals on a shorter timescale. This is also the most common definition of acceleration as it is closest to the literal definition of acceleration. Accordingly, the indicator is *time in years*. However, this poses an obvious challenge, as the duration of a transition can only be evaluated ex-post (Van Mierlo & Beers, 2020). For this empirical case study, this indicator was therefore tested based on the perceived duration of the transition.

Diffusion

The third concept is diffusion, which was found in both literature fields. Different authors (partially) defined acceleration as the rate of diffusion of the niche product (Markard et al., 2020). As this conceptualisation focusses on systemic transitions, this definition does not only focus on the adoption of end users, but also on sectoral adoption. Sectoral adoption occurs when the sector validates the new technology and there is a visible market acceptance through, for example, incumbent spin-offs or product line expansions. This was quantified by two indicators, *net market growth* and *diversity in brand availability*. Here net market growth is used to account for the adoption of end users as well as the growth of relevant business actors and diversity in brand availability encompasses the sectoral uptake by business actors. This led to the formulation of the definition of diffusion as concept for just acceleration: *Widening sectoral scope through increased adoption by business actors and end users.*

Scale

The final concept, scale, predominantly descends from the just transitions literature stream and adds essential components of justice into the conceptualisation. Lessons from past (energy) transitions have demonstrated the

importance of early inclusion of all stakeholder groups to prevent issues of inequality and exclusion. Research has pointed out the possible growth in social inequalities caused by an increase in sustainable interventions (Neumayer, 2010). This is a result of the products' higher prices and their limited distribution and accessibility. Specifically, the food sector is a source of expected inequalities as a result of sustainable developments (Dowler, 2008; Tziva et al., 2020). Therefore, this concept is divided into two indicators, *demographic* and *geographic characteristics*. Inequality in access to sustainable products can be caused by the often higher prices of the respective products. This results in the possible exclusion of social groups with lower incomes, and therefore important to consider when executing a sustainable transition. Other demographic characteristics such as social class and level of education were not included due to the chosen boundaries of this research, as these factors are expected to be less influential. Besides this, they are closely connected to income, which makes this a good representation of the demographic characteristics (Neumayer, 2010).

Finally, inequality in the distribution of sustainable alternatives is also expected to cause social injustice (Mahoney, 2022). The geographical location of the users, therefore, plays a role in whether the sustainability transition is possible to occur. This is measurable on different scales, i.e., nationally, internationally and even globally. For this research, differences in distribution and accessibility were analysed nationally, with the intent of generalisation of the results.

In line with just transitions literature, it is important to include both direct and indirect aspects of these indicators. This entails that it is important to not only consider the direct distribution and access issues but also the indirect distribution and accessibility of the societal benefits of the technology. Consequently, it is important to consider dependencies on the current system and equal benefits of the emerging system. This led to the formulation of the definition of scale as concept for just acceleration: *The demographic and geographical scope to which the benefits of the transition reach*. Ultimately, this has led to the formulation of *Table 5*, as seen below.

Table 5. Indicator table for just acceleration based on concepts from existing transitions and just transitions literature

	Concepts	Definitions	Indicators	Operationalisation
Just acceleration?	Regime dimension change	<i>The speed and scale of changes in regime dimensions that are nested in the current socio-technical regime</i> (Geels, 2002; Loorbach, 2010; Brugge & Rotmans, 2007)	Industrial Networks	Formation of industrial networks aimed at enhancing niche developments
			Techno-scientific knowledge	Shift in knowledge creation towards niche developments
			Sectoral policy	Inducement of policies in favour of niche developments
			Markets, user practices	Users adopt
			Technology	Technological enhancements of niche product
			Infrastructure	Increase in necessary infrastructure for niche product
			Culture	Shift in culture in favour for niche product.
	Speed of (system) change	<i>Rate at which the Niche technological dominant design gains market share</i> (Loorbach, 2010; Gorissen et al., 2018; Newell & Simms, 2021; Mehra, 2022; Ipieca, 2022)	Growth of market share	$\frac{\text{Market share}}{\text{Time [Y]}} * 100\%$
			<i>The duration of the transition</i> (Newell & Simms, 2021; Loorbach, 2010; Bauer & Faus Onbargi, 2022; Heffron, 2021; McCauley & Heffron, 2018; Andersen et al., 2021; Mehra, 2022; Ipieca, 2022)	Time in years
	Diffusion	<i>Widening sectoral scope through increased adoption by business actors and end users</i> (Derks et al., 2022; Markard et al., 2020)	Net market growth	Reflection the user and business adoption of niche product
Diversity in brand availability			Wide variety of brands at different price points	
Scale	<i>The demographic and geographical scope to which the benefits of the transition reach</i> (Tasrif, 2022; Bauer & Faus Onbargi, 2022; Andersen et al., 2021)	Demographic	Income – adopters come from all income groups	
		Geographic	Equal distribution of products in geographical area under investigation.	

3. Methodology

3.1. Research design and operationalisation

This thesis intended to provide directionality to sustainability focussed transitions and just transitions literature by presenting just acceleration as desirable approach for tackling increasingly urgent grand societal challenges. As this thesis developed new theoretical concepts, it can be considered an inductive study (Hyde, 2000). To create a holistic conceptualisation, this thesis used multiple data sources. Academic and empirical evidence were combined for the final conceptualisation. The retrieved data is qualitative is non-numerical in nature and thus can be utilised to capture and analyse social dynamics (Bryman, 2016). An analysis of the history and perceived research direction of both literature streams and their conceptualisations of acceleration provided relevant concepts related to just acceleration. These concepts were operationalised in 2.5. based on the most influential theoretical models as summarised in the heuristic scheme. An empirical case study tested the relevance of the theoretically determined concepts, recognised differences between previously researched technically centred transitions and more socially centred transitions, and also added novel relevant concepts. Combining the two data sources initiated a dialogue between the data sources that eventually led to identifying the essence of just accelerations. In line with the research question, sub-questions and above described research design, this analysis is conducted through three stages, as visualised in *Figure 2*.

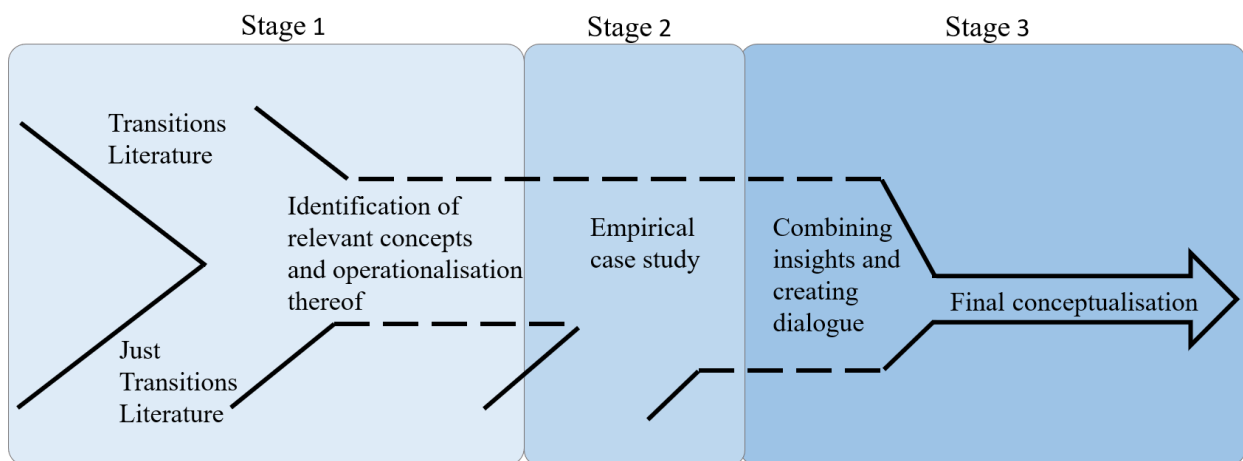


Fig. 2. Visualisation of research design

The case study adopts consumer perspective when examining the supply chain of the protein transition. The consumer perspective emphasized the importance of ensuring equitable outcomes for all social groups and highlighted the effects of the transition on marginalised groups. It helped to better identify the barriers of access to the transition and therefore aligns better with the needs of end users. Furthermore, taking a consumer perspective allowed for a better indication of the social dynamics and possible intervention points aiming to induce cultural shifts. Lastly, it allowed for a comprehensive analysis of the market dynamics as the market aims to increase adoption of end users.

3.1.1. Stage 1. Identifying relevant concepts from existing literature streams

The first stage of this research aimed to identify relevant conceptualisations of acceleration in transitions and just transitions literature accompanied by their inclusion of justice considerations and what this entails. As there is a known urgency for rapid sustainability transitions and a lack of consensual definition of acceleration, the first step was to identify how different theoretical models conceptualise acceleration. For sustainability transitions to be successful, at least partial participation of all actor groups is necessary, calling for wide scale inclusion. Also, contrary to past transitions, it is desirable to minimize the negative externalities of transitions and distribute benefits evenly. As past transitions literature predominantly discards aspects of justice, resulting in partial participation of specific societal groups as well as the unequal division of benefits, it became clear that future sustainability transitions need to include aspects of justice, described in just transitions literature. Therefore, the

degree of inclusion of these aspects was also examined in transitions literature, as well as identifying its essence in just transitions literature. This is summarised in the heuristic scheme (*Table 1*). This led to the identification of the most relevant concepts in the conceptualisation of acceleration and justice aspects deriving from just transitions literature, possibly pointing to just acceleration. After the relevant concepts were identified, they were operationalised based on key theoretical models. This combined theoretical models, as well as the most used approaches and definitions. These were argued and described in 2.4.

For the final conceptualisation to be adaptable throughout the research and stay open for additional concepts deriving from the empirical research, the concepts of just acceleration were formulated as sensitising concepts. This entails that the concepts function as “*a general sense of reference and guidance in approaching empirical instances*” (Bryman, 2016, p. 388). This guided the direction of the search and posed the foundation for the empirical research, without closing off the conceptualisation from further development. Equally, the indicators were operationalised as specific as possible to reduce the lack of direction, increase conciseness and provide an adequate starting point for the analysis.

3.1.2. Stage 2. Empirical research

The second stage of this research was executed to test, elaborate and reformulate the concepts that were identified by the literature, to determine their relevance and influence on socially centred sustainability transitions and to further investigate the essence of just accelerations. This was accomplished through an empirical case study of the protein transition in the Netherlands. The concepts were tested on how they resonate with socially centred sustainability transitions leading to elaborations and reformulation to better reflect the essence of just transitions. Additionally, the empirical case study identified three additional concepts relevant to the conceptualisation of just transitions and the corresponding framework. The protein transition in the Netherlands was chosen due to its socially centred character, which was expected to showcase significant differences to the technologically focussed transition literature streams, creating a dialogue between the two. Section 3.2. elaborates on the reasoning behind the protein transition and will explain what it entails.

The case study entailed conducting semi-structured interviews with different actor groups along the supply chain of the plant-based meat alternative innovation ecosystem. Gathering insights from different actors is necessary to gain a holistic view of the transition. Relevant actors were determined based on existing literature, as can be read in 3.2. Besides this, different sampling methods were used to reach relevant actors. This is elaborated upon in section 3.3.

3.1.3. Stage 3. Conceptualising just acceleration

The final stage of this thesis combined the findings from stages 1 and 2 to create a holistic conceptualisation of just acceleration. This was done by creating a dialogue between the theoretical and empirical data sources by recognising differences and similarities within the findings. From this, a final conceptualisation followed which was been substantiated by multiple data sources and can thus be used to guide the search and development of future transition trajectories to low-carbon alternatives that are not solely technology focused.

3.2. Case description: the protein transition in the Netherlands

This thesis employed an empirical case study to validate and enrich the just accelerations framework in a real-world sustainability transition. For this, the protein transition in the Netherlands was selected. The protein transition concerns the transition from animal-based protein sources to plant-based protein alternatives. Plant-based meat substitutes aim to eliminate meat in human diets though maintain the dietary benefits from meats such as protein. The substitutes are comparable to meat in forms of texture, taste and appearance (Tziva et al., 2020). These raw ingredients are industrially processed and procured into protein concentrates. After this, they are processed into texturized intermediary products, whereafter they take their final form (Tziva et al., 2020).

Population growth and changing dietary patterns have led to rising concerns regarding the negative health and environmental impacts of large-scale meat consumption. Both the average per capita and total amounts of global meat consumption are rising (FAOSTAT, 2018; Tziva et al., 2020). Plant-based meat alternatives pose a potentially more environmental and healthier alternative to growing meat consumption. Firstly, for health reasons, plant-

based alternatives present a healthier alternative, especially to large-scale red meat consumption. While the consumption of meat enriches human diets with important nutrients, recent scientific studies have demonstrated increased risks of diet related diseases and even cancers due to large amounts of red meat consumption (Charlebois et al., 2016; Næss and Bårdsen, 2015; Rubio et al., 2020; Tziva et al., 2020). Plant-based diets do not appear to carry these increased health risks, making them more healthy protein sources. Switching to plant-based diets, or even partly plant-based diets is said to have positive health benefits (de Boer, Schösler & Aiking, 2014). Besides health, environmental benefits characterise plant-based meat alternatives. Multiple scientific studies demonstrate the large amounts of green house gas emissions, water depletion, disrupted phosphorus cycles and biodiversity loss deriving from the food industry (Næss & Bårdsen, 2015). Meat and dairy production specifically is exposed as one of the main contributors to increased green house gasses, leading to detrimental effects to the environment (Aan den Toorn et al., 2019; Bilali, 2019; Mylan et al., 2019; Tziva et al., 2020). Studies show that plant-based substitutes are drastically less detrimental to global warming and are seen as a major opportunity for mitigating climate change (IPCC, 2019; Tziva et al., 2020).

Furthermore, the protein transition seems to be particularly interesting for this thesis, due to its cultural dependence and because generally accepted transition dynamics do not necessarily seem to be pertinent here. The protein transition was largely selected on its socially centred character. This is mainly because of the predominant focus on energy and mobility sectors of past transitions and just transitions literature, and presents an opportunity to broaden the scope, with the view on upcoming sustainability transitions. Its socially centred character comes from its dependence on cultural change that shapes this transition. Locked-in social norms, values, cultural aspects, and habits to animal protein cause social complexity (Mylan et al., 2019). Besides social complexity from cultural aspects, growing social inequalities are expected to emerge because of the protein transition. This is due to the higher prices of meat alternatives, the limited distribution of products to rural areas and expected unequal distribution of forthcoming benefits (Newton & Blaustein-Rejto, 2021; Tziva et al., 2020). This highlights the importance of early intervention and inclusion of just transition principles, making this transition suitable for this research. Moreover, some generally accepted transition dynamics, as portrayed by the transitions literature stream, seem to be applicable for this transition. Generally, socio-technical transitions are initiated by niche level firms employing radical innovations to trigger a paradigm shift. In the protein transition, however, large-scale incumbent participation characterises the meat mimic market. Incumbent firms have contributed largely to the innovation trajectory by creating subdivisions and even spin-offs for the development of meat substitutes as opposed to the expected discursive and defensive strategies. Also, generally radical innovations lead to paradigm shifts and system transformations. Though here, incremental innovations have generally fuelled the transition. Even more, the protein transition and the introduction of plant-based meat substitutes were solely motivated by consumer demand and dissatisfaction with the animal meat market. The strong vegetarian and vegan movement initiated a change within food processing firms, which led to the introduction of plant-based meat substitutes. Lastly, this transition has also received very little global political attention. There has been complete neglect of regulatory interventions in the form of favourable taxation schemes for example (Tziva et al., 2020). Due to existing regulatory boundaries, industry opposition, lack of adequate intervention tools, and lack of shared vision, national and international regulatory institutions seem to counteract one another and create barriers for regulatory support (Fellmann et al., 2017; Tziva et al., 2020). For these reasons, the protein transition makes for a compelling case study for this research.

The boundaries of this case study are set at the geographical and political boundaries of the Netherlands. The Netherlands is considered a front runner in plant-based meat substitute innovation, due to its numerous industry networks, number of incumbent firms, research publications and government involvement (Michel et al., 2021). The Netherlands is the first country to possess an industry association, incorporating 18 firms, both incumbents as new entrants (Tziva et al., 2020). On top of that, collaboration networks such as the Green Protein Alliance, The Green Protein Accelerator and the Sustainable Food Initiative all shape the Dutch market for meat substitutes significantly. The market for plant-based meat substitutes is growing rapidly and the total plant-based protein market turnover is estimated at roughly 370 million euros (DistriFood, 2017; Tziva et al., 2020). Additionally, the governmental involvement through altered dietary guidelines and collaborations with governmental research agencies make the Dutch market interesting for analysis (Tziva et al., 2020). Besides this, the Dutch Ministry of Agriculture, Nature and Food Quality (LNV) has announced their participation in a transition goal stimulating plant-based protein consumption. This transition goal aims to achieve a 50/50 ratio between animal and plant-based protein consumption by 2030 (Transitiecoalitie Voedsel, 2022). This is likely to lead to more political attention and interventions in the coming years. As the Netherlands is considered a frontrunner in this transition, transition

dynamics were expected to be rather explicit, which is beneficial for the validation and enriching of the just acceleration framework.

Regarding agency in the protein transition, significant actors, projects and networks have influenced the development of plant-based alternatives. In their research, Tziva et al. (2020) conducted a structural analysis of the innovation system surrounding plant-based protein developments. As a result, they highlighted relevant actor groups in the transition based on their contribution to the development of the system. These insights provided an overview of the dynamics in the system and demonstrate the agency aspect of the protein transition. Their structural analysis was used to determine relevant interview participants for this thesis. An overview of these relevant actors can be found in *Figure 3*.

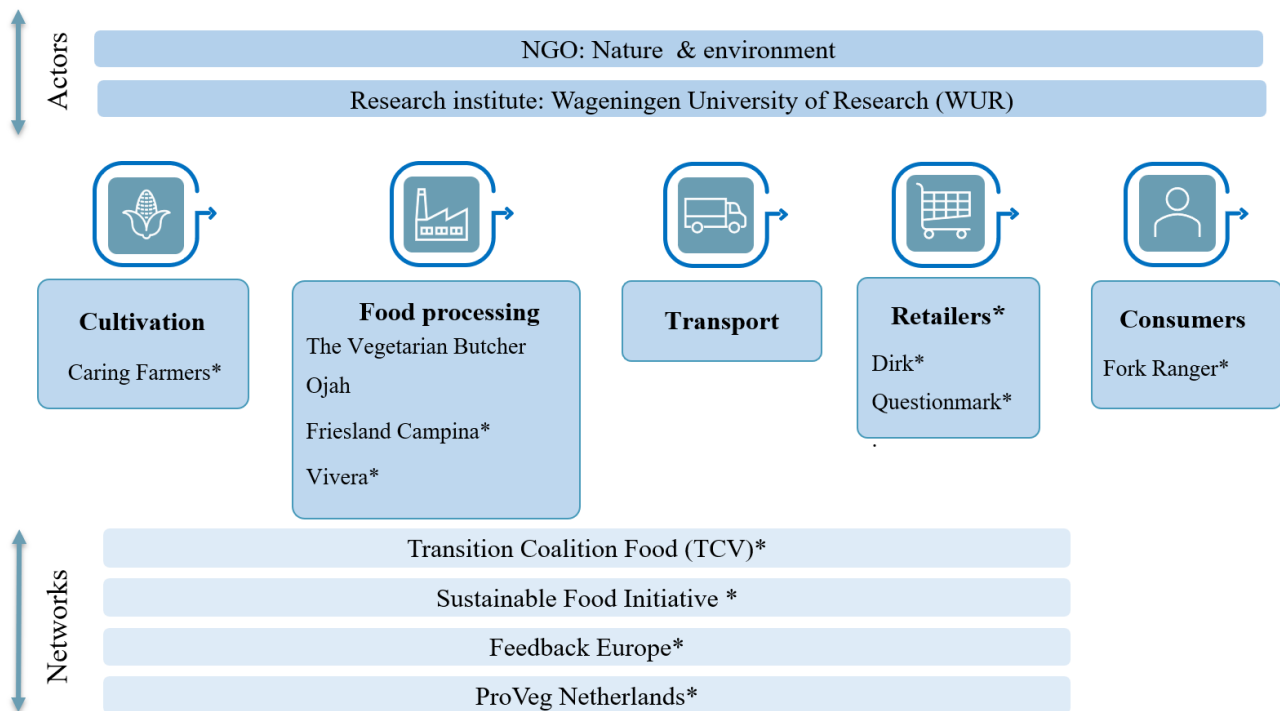


Fig. 3. Actors and networks along and surrounding the supply chain that constituted the respondent firms for the empirical case study, adapted from (Tziva et al., 2020). * Not derived from Tziva et al., (2020), added due to lacking response from respondents

3.3. Data collection

3.3.1. Stage 1. Literature review for formulation framework

Stage 1 conducted a systematic scientific literature review, through desk research. The literature review established how the concept of acceleration was defined and discussed in both transitions and just transitions literature. Following, the key aspects of justice, as recognised by just transitions literature were identified. Initially, literature from the two streams was researched separately. The necessary data was collected through online data sources, predominantly consisting of Google Scholar and Scopus. Search terms that only reflected the separate literature streams were used to research the separate literature streams, such as: *Transition Literature*, *Multi-Level Perspective*, *Just Transitions Literature*. Later, these search terms were combined with specific aspects reflecting acceleration to better understand the state of the art on acceleration research, such as: *acceleration*, *speed*, *pace*, *justice*, *agency*. A temporal scope regarding transitions literature is set at the year 2000, as this reflects the emergence of the transitions literature stream. Due to the high number of relevant transitions literature sources, only frameworks that have been widely cited or displayed significant impact in the literature field were included. This resulted in the inclusion of seven relevant theoretical models, as can be seen in the heuristic scheme. All these papers have been cited over 100 times. Three key models, *the Multi-level Perspective*, *the Technological Innovation System* and *Transition Management* were cited respectively 7940, 3423 and 1217

times and were thus mostly used for the operationalisation of the identified concepts. The combination of these theoretical models resulted in theoretical saturation. The temporal scope of just transitions literature was set at 2015, as its emergence became evident around this time. Relevant academic papers of just transitions literature were cited between 300-500 times. As was seen in chapter 2, little academic literature was available on acceleration in just transition literature. To achieve theoretical saturation, non-academic literature was used to supplement the analysis, such as conference reflection reports, company websites and policy documents. The result of the initial data collection is summarised in the heuristic scheme.

3.3.2. Stage 2. Semi-structured interviews for empirical case study

Semi-structured interviews were conducted with actors along and surrounding the supply chain of plant-based alternative meat products. The semi-structured character of the interviews allowed for the recognition of additional concepts that the respondents identified as relevant to the conceptualisation. Purposive sampling was used to target relevant respondents that were identified by Tziva et al. (2020). Purposive sampling is a non-probability approach that increases the relevance of data sampling (Bryman, 2016). As not all respondents that were identified based on the paper of Tziva et al. (2020) responded, snowball sampling was employed to further broaden the interviewee list. Eventually, 34 respondents were contacted resulting in 15 interviews. Three respondents replied that they were not involved in the protein transition, namely the governmental research institute for policy making (WRR), the consumers association (Consumentenbond) and an NGO. As only one retailer was interviewed, and data saturation regarding the retailer's perspective was not reached through the interviews. Therefore, the Super List Green report published by Questionmark, which analyses the sustainability behaviour of supermarkets and also reports on their plant-based sales, was included in the analysis to reach data saturation. Data saturation was reached in the remaining supply chain categories. All interviewees received anonymity to foster open dialogue. Each actor was given a corresponding reference code for the analysis section. These can be found in Appendix I. As the expertise of the respondents differed, the aim per actor group also varied. Appendix II elaborates on the interview goals per actor group and shows the questions all respondents were asked.

3.4. Data analysis

This thesis employs a combined qualitative content analysis and grounded theory analysis approach in accordance with the different stages. To analyse the scientific literature used to formulate the framework table, a qualitative content analysis was employed. This is the most prevalent approach to document analysis and was intended to discover underlying themes within documents (Bryman, 2016). Initially, the individual conceptualisations of acceleration, together with some other aspects that can be seen in the heuristic scheme, were deduced. From this, the underlying themes in the conceptualisations were analysed and formulated. This was carried out by coding themes found in relevant documents which were continuously revised, and continuously open to constant discovery and comparison of themes. Examples of such codes were *pace/speed*, *diffusion*, and *inclusivity* (Bryman, 2016). This led to the recognition of four relevant concepts for the framework of just acceleration. The concepts were then operationalised by the most influential theoretical contributions from both transitions and just transitions literature.

The interviews conducted in stage 2 were analysed by using a grounded theory methodology. This iterative analysis method aims to produce theory from research data by identifying close fits between the two (Bryman, 2016). Once conducted, the interviews were transcribed verbatim. Grounded theory was used to identify relevant concepts of just accelerations from the data by employing a constant state of potential revision and fluidity (Bryman, 2016; Strauss & Corbin, 1990). The different steps of grounded theory, namely *initial coding and selective/focus coding*, customarily occur subsequently but were employed simultaneously here. As the case study was used for validation and enrichment, the coding process needed to reflect this with the different coding methods. Focus or selective coding was applied to validate the concepts of the proposed framework. This was done by coding the interviews to the existing concepts. Initial/ open coding was used for the enrichment of the framework. Here, additional codes were identified from the transcribed interviews and categorised accordingly. Coding was performed in NVivo. The coding scheme can be found in Appendix III.

3.5. Research quality

Research quality is dependent on the reliability and validity of the research methodology (Bryman, 2016). The reliability of research concerns the degree to which the study can be repeated (Bryman, 2016). External reliability was difficult to obtain as social settings change over time, meaning that replications of the study might present different outcomes due to different social settings. This is also reflected on in the discussion. External reliability was addressed here through methodologic transparency, providing an overview of the interview guide and coding schemes. Besides this, the framework was built for repeated research with different boundaries. This research also attempted to increase reliability through data triangularity by validating concepts of just accelerations through two different data sources, namely scientific literature and an empirical case study. On the other hand, validity is divided into internal and external validity. The extent to which results can be generalised to other social contexts is known as external validity. While the context of the Netherlands is unique, nuances were added to the framework to account for this. Also, the conceptualisation was largely based on existing literature, which increased its generalisability, as this makes the results less case specific. Lastly, internal validity refers to the extent to which the chosen methodology fits the research question. Through constant reflection and rigorous coding schemes, internal validity was addressed.

4. Results

4.1 General results

Thus far, this thesis has identified four relevant concepts for the conceptualisation of just acceleration, namely: *regime dimension change*, *speed of (system) change*, *diffusion and scale*. These concepts derive from a literature study on the development of the transitions literature and just transitions literature streams. This literature study identified the different conceptualisations of acceleration within key theoretical models of transitions and just transitions literature, as well as identified whether aspects of justice were included. On top of that, just transitions literature demonstrated how justice aspects should be included to ensure just transitions. This results chapter presents the findings of the empirical case study, which employed the framework containing concepts related to just acceleration (as presented in 2.4. and can be seen in *Table 5*) on the protein transition in the Netherlands, to validate and enrich said framework. Here, the interviewees' interpretation of the proposed concepts is demonstrated, showcasing the validation of the concepts. The conducted expert interviews also enriched the conceptual framework through the recognition of novel concepts.

What became clear from the empirical case study was a strong implicit connection between the aspects of scale, deriving from just transitions literature and the concepts originating from transitions literature. This was observed through the recognition of the dynamic relation between the concepts *accessibility* and *acceleration*. What was seen was that nearly all identified concepts affect or have the potential to affect the acceleration and accessibility of the protein transition, in essence referring to both 'just' and 'acceleration' aspects. This validates the relevance of the identified concepts. Essentially, what became clear was that even though the concepts deriving from transitions literature did not explicitly mention justice aspects in their theoretical models, the case study demonstrated a connection between the transition concepts and justice through the relation of the concepts on the accessibility of the transition, which is then again linked to the aspects of scale deriving from just transitions literature. Vice versa, the same effect applies where the focus on accessibility has the potential to influence transition dynamics and with that the acceleration of the transition. The interviewees identified the importance of participation in the transition by all social groups and recognised that increasing the accessibility of the products to all social groups, independent of geographical or demographical factors, is a way to achieve this. Accordingly, the results shed light on how the operationalised concepts are disclosed in the protein transition and how the relation between accessibility and acceleration is apparent within these concepts. As an example, technological process developments² on production simplifications of plant-based meat alternatives stimulates acceleration due to higher production capacities and increases accessibility to lower income groups as the simplification of the production process will result in price decreases as well as the fact that it will allow for local adaption of the technology, increasing the global accessibility to the products (see 4.2.3.).

Besides *infrastructure* and *net market growth*, all indicators as described in the literature were identified as important indicators of just acceleration by the respondents, influencing both acceleration and accessibility. While *infrastructure* is argued to remain important for the regime dimension change in 4.2.7., *net market growth* appeared to be less relevant for the conceptualisation of just acceleration and is argued to be taken out of the framework table. This is further explained in 4.3.2. On the other hand, additional indicators became apparent from the empirical case study: *transition goals*, *disappearance of jobs* and *price parity*. *Transition goals* displayed a strong relationship with the concept *speed of (system) change* and describes the effect of goal formulation on the accessibility and acceleration of the protein transition. This is further described in 4.3.3. While this thesis yields a consumer perspective, *disappearance of jobs* appeared to be important for another reason besides the obvious here. It is namely the influence of the farmers in the Netherlands on the polarisation of the population that largely influences the just acceleration of the protein transition, and therefore an important aspect of scale that became evident from the interviews. This is argued in 4.5.3. Lastly, *price parity* emerged as one of the most mentioned concepts influencing both the acceleration and the accessibility of the protein transition and is therefore also added as indicator. Though not originally identified as dimension of regime change, 4.6. argues the addition of price parity to the seven other regime dimensions identified by Geels (2002).

² Technological developments is identified as an indicator for regime dimension change, and derives from the theoretical model of Geels (2002) on the Multi-level perspective

What also became apparent from the interviews was the view on agency and responsibility to initiate change within the protein transition in the Netherlands. While few argued in favour of the top-down responsibility by the state and international law, a consensus was seen on the combined bottom-up and top-down approach, also described by the literature (Newell & Simms, 2021). Companies (both retail and production), government and consumers were the three main actor groups holding responsibility in this transition according to the respondents, with an important note that this responsibility is shared among these groups. Retail was mentioned as having a large role in influencing the transition but was posed as generally responding slow and safeguarding the meat sales due to high revenue streams (Pr2, Co1, NA3, Pr6, RI2). The government, as also can be read in 4.2.2., was argued to have a major responsibility in the destabilisation of the current regime, as well as being responsible for the allocation of benefits to all societal groups and the mitigation of the negative externalities for marginalised groups. According to the interviews, consumer responsibility lies in the self-education of the benefits and experimentation with plant-based products and conscious non-adoption of animal meat. Additionally, producers were found to selectively target a small eco-elite part of the population and exclude many potential adopters from advertisement and familiarisation. Besides this, collective action and non-economic motivated action were mentioned often as important aspects of agency in the protein transition.

The biggest contrasts between the literature and the case study were seen in the different perceived importance and influence of the concepts on just acceleration. This became apparent through the number of references of the indicators throughout the interviews. The number of references can be seen in *Table 6*. Here the additional indicators deriving from the empirical case study are indicated in bold. The results will therefore be structured based on the number of mentions per indicator, as visible in *Table 6*. Each subsection also provides a visual representation of the percentile division of the number of references to stress the found importance of different indicators.

Table 6. Representation of the number of references of indicators by the respondents from the empirical case study

	Concepts	Definitions	Indicators	Number of references
Just acceleration	Regime dimension change	<i>The speed and scale of changes in regime dimensions that are nested in the current socio-technical regime</i>	Culture	84
			Sectoral Policy	44
			Technology	37
			Industrial Networks	12
			Techno – scientific knowledge	7
			Market, users	5
			Infrastructure	0
	Speed of (system) change	Transition goals <i>The duration of the transition</i>	Transition goals	18
			<i>Time in years</i>	15
			<i>Rate at which the Niche technological dominant design gains market share</i>	Growth of market share
	Diffusion	<i>Widening sectoral scope through increased adoption</i>	Diversity in brand availability	13
			Net market growth	0
	Scale	<i>The demographic and geographical scope to which the benefits of the transition reach</i>	Geographic	22
			Demographic	18
Disappearance of jobs			9	
Other	The price level that values the current and niche technologies as equals	Price parity	31	

4.2. Regime dimension change

As seen in *Figure 4* below, there is a strong difference in the number of references and accordingly perceived influence of the regime dimensions on the just acceleration of the protein transition. Culture, sectoral policy and technology became apparent as the most referenced indicators. Especially culture played a large role in the protein transition in the Netherlands according to the interviewees. Due to the strong emotional connection to food, perceived forced changes can cause a lot of resistance. From the interviews, a mechanism of social complexity was distinguished and described in 4.2.1. Also, possible intervention points to stimulate just acceleration were identified. As was seen in the general results, a large role is accounted to the government and the creation of sectoral policy for the success of the protein transition. Section 4.2.2. illustrates the contrasting opinions of the respondents and possible policy instruments that were mentioned. Regarding technology, three main elements of technology appeared to be important for the course of the protein transition: technological development, quality of the niche product and lastly, as possible enhancement of just acceleration, local adaption of technologies. The remaining dimensions are briefly described as they appeared to be less influential.

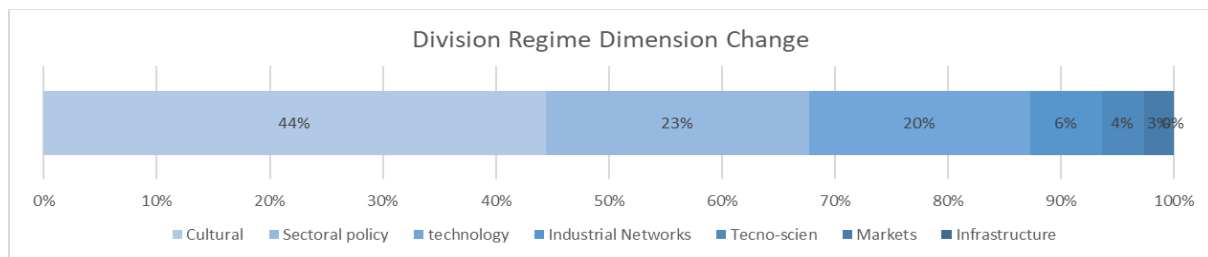


Fig. 4. Visualisation of division percentile references of indicators regime dimension change by respondents

4.2.1. Culture

Culture was the most mentioned indicator of all the concepts, presenting both the biggest threat and opportunity influencing both the acceleration and accessibility of the transition. This element of the framework portrays a large part of the human aspect of this transition and illustrated a mechanism of social complexity influencing the protein transition. This mechanism includes multiple elements as mentioned by the respondents, among them: *cultural dependence, behavioural change, awareness, nudging, familiarisation and information*. These elements appear to be formatted in a nested hierarchy. This hierarchy of social complexity is visualised in *Figure 5*.

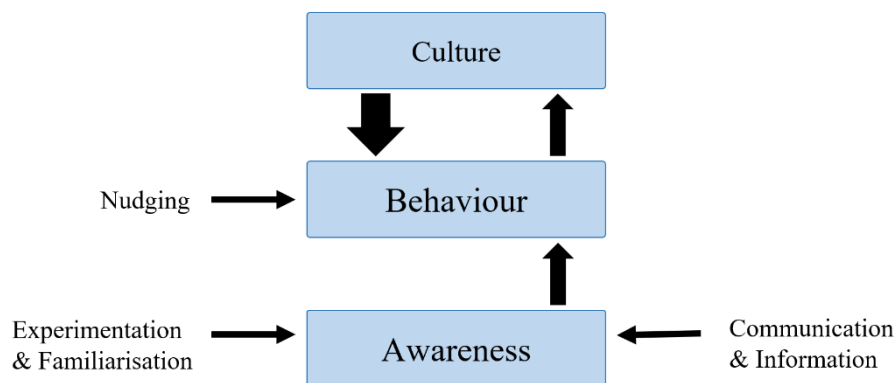


Fig. 5. Hierarchical mechanism of social complexity apparent in the protein transition in the Netherlands

At the top of the hierarchical model is the element of culture. Here culture is understood as “.. *the set of attitudes, values, beliefs and behaviours shared by a group of people, but different for each individual, communicated from one generation to the next.*” (Spencer-Oatey & Franklin, 2012). Essentially, it is the deep rootedness of the beliefs and values that strongly influences individuals to act. All respondents recognised this strong influence of cultural beliefs on the willingness to participate in the protein transition. As meat, and food in general, are deeply rooted

in the way people orchestrate holidays, social gatherings and celebrations it enhances social complexity (R12, Co1, NA1, Pr2). *“People have a very strong emotional connection with meat and meat dishes, so when confronted with the negative effects of meats, it can be perceived as a personal attack that strikes an emotional chord that actually creates negative emotions towards meat alternatives”*. (Pr1). This results in the fact that targeting the root cause of this social complexity, i.e., deep rooted beliefs and values, is particularly difficult and could possibly be counter efficient and even decelerate the protein transition.

Below culture, the element of behaviour is nested. As seen in the figure, cultural aspects highly influence individual behaviour. However, behavioural changes influence cultural beliefs and values as well and even have the potential to alter cultural aspects in the long run. There is a visible change in the behaviour of Dutch consumers. All the respondents recognised the growing behavioural shift towards (partial) plant-based diets and highlighted that this has directly influenced all interviewed organisations. While there is a strong perceived behavioural change, actual animal meat consumption does not seem to be decreasing at the same pace (see 4.2.6., R1). This demonstrates the apparent complexity of behavioural change towards green decision-making. Nonetheless, there do appear ways to influence individual green consumption choices according to the interviewees. Two main ways to invoke behavioural change that became apparent from the interviews and were deemed most appropriate for the protein transition were: external influence from actors such as policy-makers, retailers and firms in the form of nudging and the creation of awareness through the expansion of knowledge and familiarisation.

Nudging through external parties was mentioned as an effective way of initiating behavioural change by multiple respondents (R11, R12, PR3, R1, NA3). Nudging entails the implicit steering of behaviour and choices in a certain desired direction. This was deemed the most effective as multiple respondents recognised the importance of slow and subtle changes in behaviour to overcome resistance and increase acceptance of plant-based products. This is linked to the fact that people greatly value the perception of freedom of choice, and will pose resistance when perceived to be coerced into making personal decisions. Nudging can for example be employed by retailers in favour of plant-based choices. *“Generally, 80% of consumer decisions made in supermarkets are influenceable by the supermarkets themselves.”* (R1). Through product placement and advertisements, there is a large opportunity for retailers to stimulate plant-based protein consumption and thus initiate behavioural change (R12, R1).

Another way to influence behavioural change, and at the same time the next hierarchical element of the mechanism, is through the creation of awareness. This was mentioned often by the respondents as being the most targetable intervention point in the social complexity mechanism. Here, two main interventions stood out: *communication and information and experimentation and familiarisation*, both being linked to different responsible parties. *“The lack of knowledge and familiarity of the benefits of the protein transition limits the acceleration thereof.”* (Pr3). Firstly, awareness can be raised by increased communication and information. The interviewees recognised a joint responsibility of multiple parties, amongst them the government, producers, retailers, NGOs, educational bodies and self education by adopters. The threat of miscommunication or selective information makes this step difficult and thus must be treated with care. Therefore, respondents recommended the largest responsibility to belong to parties who do not possess a stake in the success of the market and thus must be unbiased and independent. Secondly, experimentation and familiarisation were mentioned by producers and retailers as effective way of creating awareness amongst possible consumers (Pr4, Pr5, Pr6, R1). This is because the entry motivations of consumers can vary greatly from price, to taste and quality, but also to ignorance on how to prepare the products well. Having ready-to-try products helps with the acceptance and adoption of niche products.

All things considered, according to NA3, *“it is deterministic to think that awareness will inevitably lead to changing behaviour.”*. Therefore, it is important to note that it is a combination of creating awareness, nudging and changing cultural beliefs that make up the potential to invoke just acceleration of the protein transition. Besides this, one more element seemed an important human aspect: personal benefit. While this will differ for different adopter groups, it will increase the possibility of continuous adoption leading to behavioural change. In the case of the protein transition this personal gain is often linked to ethical reasoning, such as ecological benefits or animal welfare, and/ or health benefits.

Another social aspect that needs to be considered for the acceleration and accessibility of the protein transition. This is related to the polarisation argument before, causing division within populations, namely stigmatisation. The stigmatisation of plant-based dietary preferences has resulted in negative social interactions and unwillingness to participate in this transition. This form of social profiling has been known to decelerate transitions and cause

division between social groups. In the case of the protein transition, plant-based diets are associated with eco-elitist unpleasant individuals that predominantly occur in the urban agglomerated areas of the Netherlands (Michel et al., 2021). Therefore, it is also linked to the general stigma of this urban agglomeration, namely white, highly educated and rich people. This has a strong negative effect on people who distance themselves from these social prejudices and their willingness to adopt niche products. This stigma needs to be overcome to be appealing to a wider demographic.

Transitions literature describes the regime dimension *culture* as the shift in cultural aspects in favour of the niche product (Geels, 2002). What is demonstrated above is cultural change can be accelerated through interventions on lower hierarchical levels of the social complexity mechanism. By focussing the intervention efforts on all social groups evenly and thus increasing the accessibility to the transition, the threat of opposition due to cultural beliefs is reduced and accordingly the niche product is expected to be adopted by a larger and more diverse group of end users. In other words, there is an apparent reinforcing relation between acceleration and accessibility here.

4.2.2. Sectoral Policy

One of the most referenced indicators of regime dimension change was sectoral policy. With that, the government and its ability to create sectoral policy were seen as one of the most influential factors in accelerating the transition, as well as carrying the responsibility for the transition to transpire in a just and fair manner. Nevertheless, the respondents displayed disparities in their opinion on the role that the government could and should play, as well as in their views on the rate at which the government is acting and the degree of current involvement. This difference can be simply illustrated in a quadrant with two axes. On the y-axis, the contrast between dependence and independence of sectoral policy for the just acceleration of the protein transition is depicted. Here, dependent refers to the dependency of the protein transition on sectoral policy to ensure an accessible and accelerated transition. Independence refers to the fact that the strong involvement of the government and sectoral policy will not necessarily lead to just acceleration and action by other actor groups are more likely to invoke the desired changes in the system. The horizontal axes represent the view of the respondents on the current involvement of the government and the influence of current policies or governmental instruments. The personal view of the respondents is visualised in the quadrant as seen in *Figure 6* below where the numbers refer to the number of the interview.

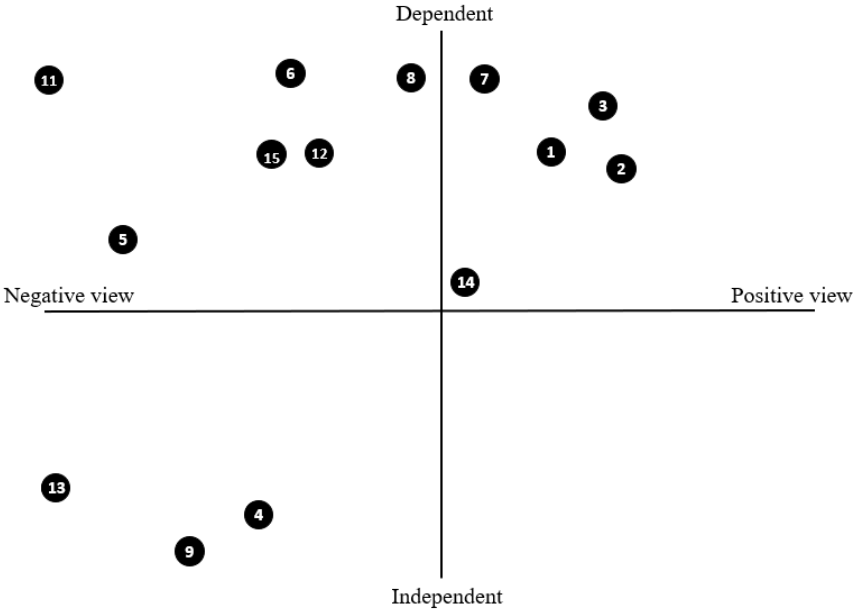


Fig. 6. Visualisation of respondents’ stance on role and influence of sectoral policy formulated by the national government for just acceleration of protein transition

Most respondents agreed on the large role of the government and dependency on sectoral policy to influence just acceleration of the protein transition but are dissatisfied with the actions the government is currently taking, as it seems to be holding on to the current meat dominated regime more than desirable for the development of the plant-based protein market. Especially, dissatisfaction regarding the financial support of the meat industry is seen

in, among other things, subsidies for fair pricing, advertisements, maintenance of current market relations and especially safeguarding the state revenue generated by the Dutch meat export industry (RI1, Pr3). In the period between 2018 and 2021, the amount of money that was appointed to meat was 71 times higher than the money allocated to meat alternatives, and the amount of money used to sustain the meat industry was 137 times higher than the plant-based alternative market (ProVeg, 2022a) *“While this is an understandable approach, it also means that people are not paying the ‘real price’ for animal products”* (Pr3). This makes it increasingly complex for plant-based meat alternatives to compete with meat products based on price. Contrary to this, some respondents projected to have a slight satisfaction and positive view on the changing behaviour of governmental bodies through the increasing interest in information regarding plant-based meat alternatives, subsidies for research projects, and formulation of goals. As seen in the bottom half of the quadrant, three respondents argued for the necessity of the transition to remain independent due to the lagging character of the government and generally slow response rate and expected the transition to be dependent on the demand and supply occurring in the market as well as the joint efforts of research institutes, NGOs and producers. They argued that waiting for governmental intervention would ultimately decelerate the transition.

Notable is that none of the respondents identified with the positive-independent quadrant. This means that none of the respondents believed that the free market would provide sufficient incentives for both producers and consumers to engage in the transition to achieve desirable changes. Nevertheless, the respondents predominantly ascribe a large part of the just acceleration of the protein transition to the dependency of the government to intervene in the market. Policy instruments such as plant-based meat subsidies and meat taxes were mentioned as the most effective. Besides that, multiple respondents mentioned the ban on meat advertisements as a possible effective measure, as most meat is sold in bulk when meat products are on sale/discounted.

The relation between acceleration and accessibility in the indicator *sectoral policy* can be found in the trade-off between equal distribution of externalities from the transition. In that sense, negative externalities due to the breakdown of the current system need to be compensated for. Besides this, through the equal distribution of benefits, in this case accessibility to the protein transition, policy has the potential to accelerate the transition.

4.2.3. Technology

Technological development

As this case study was selected on being less technologically driven, technological developments were not expected to be one of the most mentioned indicators of regime dimension change. However, respondents mentioned technology as a crucial part of the development of the protein transition and acceleration thereof. *“I think in this market, there are habits and attitudes that are consumer enabled, but then there are other areas that are unlocked through innovation and technology”* (Pr2).

While the protein transition is largely dependent on social and cultural factors for its development course, the plant-based protein market is currently experiencing technological product and process developments simultaneously. Product innovations, however, seem to be at the heart of all developments right now, focussing mainly on taste, texture and juiciness of plant-based meat alternative products. All producers mentioned the necessity for continued research for products that aim to mimic animal meat products, and that there is quite a lot of work to be done on existing products as well as creating new product lines (Pr1-6).

On the other hand, supply chain or process developments are becoming more and more apparent (Pr1, Pr2, Pr4). Currently, the process of plant-based meat production and processing is rather complex, involves many stages and results in highly processed ingredients. This high complexity is a threat for just acceleration for multiple reasons. Firstly, the scalability of the production remains low as the processes take relatively long to complete. This results in limited production capacities leading to limited distribution. Secondly, the decidedly processed character of the products results in less appeal for consumers who are motivated by health benefits. As highly processed foods are generally less nutritious, or at the very least stigmatised that way, possible adopters might refrain from consumption. Third, procedural complexity creates high entry costs for new entrant firms. As can be seen in 4.4.1., diversity in brand availability positively influences just acceleration, process complexity negatively influences this and fewer firms might enter the market. Lastly, complex production processes have a direct effect on the price of the products. *“Prices might be higher due to higher complexity of the processes. But we do not leverage on quality for the sake of price.”* (Pr2). Therefore, continuous process developments positively influence both acceleration and accessibility of the protein transition.

Quality of niche product

Another important technological aspect that was mentioned by the respondents was the quality of the niche products. It was described as one of the most essential aspects in the acceptance of plant-based protein products (Pr1, Pr2, Pr4, Pr5, RI1). What became evident from the interviews was that consumers who are not directly motivated by ethical reasoning tend to expect the quality of the niche products to deliver a near identical sensory experience to animal meat products. As the quality of the plant-based meat alternatives does not fully meet these expectations, consumers that try the products are more likely to be put off the products than to become frequent adopters (Pr2, Pr5). Resultingly, it might take quite some time before consumers will try another product. This is mostly seen in store brand meat alternatives and less in plant-based meat specialised brands (R1, Pr2, Pr5), but has become better over the years. All in all, the quality of the niche product can largely affect the just acceleration of transitions based on the degree of resemblance of the niche product to the established product.

Local adaption of technology

A possibility that was mentioned by the respondents to increase the accessibility of the technology to a broad scale and with that increase the adoption, is the local adaption of the technology, also linked to the process developments mentioned above. This would entail using local ingredients for production and adjusting the diversity of the products according to local demand. Distributing the production to more local production would not only increase local adoption but would also decrease the ecological footprint of the plant-based alternatives as the products being produced in Europe are shipped all over the world (Pr1). This would also stimulate the local economy in the form of job availability and would likely decrease the threat deceleration due to cultural aspects. It is important to note that this possible solution is closely linked to the necessity for simplification of the production process, as the entry barriers for local producers might be too high to overcome. This solution also demonstrates the relation between acceleration and accessibility. When technological developments are not only focused on enhancing the product but also on the simplification of production processes it can stimulate both acceleration and accessibility. Acceleration is stimulated due to the larger production capacity leading to increased adoption by end users. Accessibility is increased as local adaption of technology will result in wider geographical distribution and could reduce prices, making the products more accessible for lower income groups, ultimately accelerating the transition.

4.2.4. Industrial Networks

Closely linked to the abovementioned dimensions is the formation of industrial networks aimed at enhancing niche developments (Geels, 2002). The importance of this indicator was confirmed by the case study and the respondents. However, there was quite a difference in the view of industrial networks between the respondents. Generally, network actors, retailers, consumer representatives and research institutes were positive about industrial networks and indicated a positive correlation between industrial networks and acceleration and accessibility, while producers seemed less positive, especially regarding networks formed around producers. *“Often, we get asked for information in these types of networks as opposed to receiving valuable information. So, we don’t participate too often in the collaborations, but it happens sometimes.”* (Pr1). This can be explained by the fact that the market is still in a phase where brand loyalty, reputation and history dependent factors do not necessarily determine the choice of products, but rather the quality and price which could be affected when production firms collaborate.

On the other hand, retail is increasingly involved in collaboration networks in combination with NGOs and governmental bodies. *“It really helps that other supermarkets are also participating in this goal and that we can use their knowledge on consumer behaviour for example.”* (R1). The number and traction of these collaborations are growing (RI1, Pr3). This demonstrates a positive effect on acceleration, as relevant parties obtain the necessary resources to facilitate the sale of the niche products. As the niche products would become increasingly available for end users, acceleration is stimulated and with that also stimulates accessibility due to the probable increased geographical access to the products.

4.2.5. Techno-scientific knowledge

While techno-scientific knowledge was not directly mentioned as influential to just acceleration, it implicitly was very visible and recognisable in the protein transition. When looking at the theoretical definition, ‘shift in knowledge creation towards niche developments’, it became clear that there was a significant shift in knowledge creation towards the plant-based protein sources, visible in both incumbents, new entrants, research institutes

and governments (Pr1-6, R11). *“We have a big and important centre of innovation where we continuously create new innovations with new technologies and work together with research institutes”*. (Pr2). To increase accessibility, it is important that within the creation of knowledge forthcoming societal effects are considered. Knowledge on societal effects can be translated into strategic decision-making focussing on increasing accessibility of the niche product, stimulating acceleration due to avoiding possible resistance.

4.2.6. Markets, user practices

The interviews suggest that while the number of plant-based protein adopters is growing, there seems to be a minimal decrease in animal meat consumption. All respondents recognised the growing demand and implementation of plant-based diets and the growing importance thereof. As an example, roughly 50% of Dutch citizens claim to be flexitarian today, as opposed to approximately 0% in 1990 (NA4). However, on the other hand, general animal protein consumption does not seem to be decreasing (Pr4, NA4, R1). While the plant-based meat alternative consumption among the total population has grown by 450% in a period between 2007-2021, only a decrease of 18% in animal meat consumption was seen in that same period (WateetNederland.nl, 2021). Although there is a growing vegetarian, vegan and flexitarian movement, a strong polarisation of animal meat consumers seems to be growing in response (Co1). Nevertheless, as plant-based diets have become much more popular, another behavioural element seems to influence the pace of the protein transition. This could be partly ascribed to the low visibility of the transition. *“People often perceive themselves greener than they are, and this also translates to meat consumption. This makes the flexitarian movement so difficult to grasp.”* (NA4). Within the flexitarian movement, which as was seen now consumes roughly 50% of Dutch citizens, people mean to consciously eat less animal meat but will continue to eat meat on certain occasions, these often being social gatherings and celebrations. However, this then becomes difficult to monitor as people claim to eat less meat when dining alone or with their partner, which most likely will be less often than people advocate to others. So there seems to be a difference between actual green behaviour and perceived green behaviour as well as a strong polarisation of non-adopters. To increase acceleration and accessibility, it is vital that users from all social groups are targeted and have the ability to become adopters.

4.2.7. Infrastructure

A necessary change in infrastructure was not recognised as an important or influential indicator for regime dimension change in the protein transition as described by the respondents. In the case of the protein transition, this is understandable as the infrastructure necessary for the protein transition products hardly changes. However, the complex production process, as described in 4.2.3. needs to be added for the protein transition to be successful. Besides the production and cultivation steps, the remainder of the supply chain is quite compatible and does not require large-scale infrastructural changes, as suggested by the interviewees. As this indicator received zero mentions and recognition by the respondents, it is difficult to determine the importance of this indicator. Though, it is expected that in other sustainability transitions, as seen with the energy and mobility transitions and confirmed by the literature, infrastructure may play a crucial role in the success of a transition and therefore largely influences just acceleration. Arranging the infrastructure in such a way that it stimulates equitable geographical distribution of the niche product, stimulates both acceleration and accessibility due to increased availability and exposure of the niche product to end users.

4.3. Speed of (system) change

In accordance with the literature, speed of (system) change reflects the temporal aspect of sustainability transitions. While the theoretically derived indicators *time in years* and *growth of market share* reflect the reality of the expected transition, *transition goals* appeared as a way to influence the duration of the transition ex-ante by formulating a desired stage of transition at a certain point in time. Recent vocalisations of transition goals have largely influenced the course of the transition and will broaden sectoral interest in the transition. This is described in 4.3.1. As expected, time was implicitly the biggest determinant of just acceleration and acceleration specifically according to the respondents. While this might be the case, it was difficult for the interviewees to quantify the definitions of ‘fast’ and ‘slow’ and also found it difficult to determine how long the transition would take (4.3.2.). Lastly, growth of market share was seen as a tangible criterion upon which the course of transitions could be

predicted as well as a tool to compare progress within the transition and between different sustainability transitions.

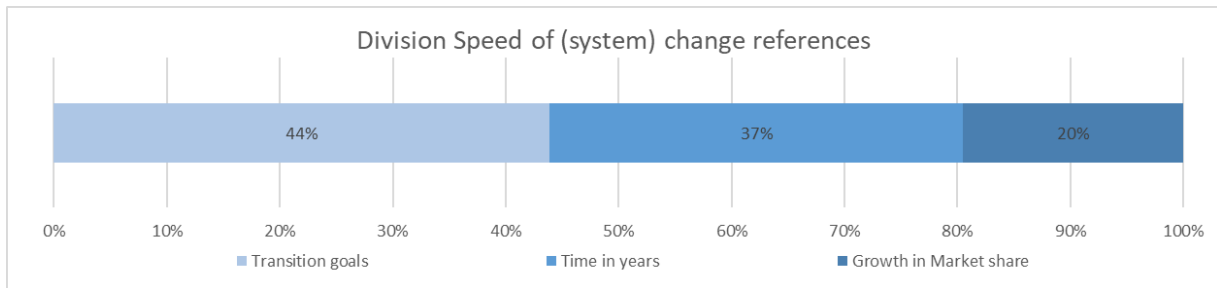


Fig. 7. Visualisation of division percentile references of indicators Speed of system change by respondents

4.3.1. Transition goals

Transition goals was one of the indicators that derived from the case study and appeared to be closely linked to sectoral policy and industrial networks. Multiple respondents pointed to the importance of transition goals for the course of transitions and recognised it as having a large positive effect on acceleration (NA1, NA2, NA3, NA4, R1, Cu1, R12). Transition goals pronounce the ambition of actors or actor groups to achieve a certain desired state at a particular moment in time. This builds a foundation upon which actors can be held accountable in the case of non-action towards this desired state through monitoring. Often, the proclamation of goals is accompanied by the allocation of funds, the building of a network and the rise of new actor groups.

In 2022, the Ministry of Agriculture, Nature and Food Quality (LNV) announced its participation in a transition goal stimulating plant-based protein consumption. This transition goal aims to achieve a 50/50 ratio between animal and plant-based protein consumption by 2030 (Transitiecoalitie Voedsel, 2022). Currently, the ratio seems to fluctuate around 60/40. Respondents claim that this could even be taken further to 40/60, but that this current goal is already said to be ambitious and expected to have a positive effect on the acceleration of the protein transition (NA4, NA3, R1). As a result, network actors are using vocalisation as a way to hold actors accountable: *“He (Piet Adema, minister of agriculture, nature and food quality) has claimed to put effort in the 50/50 ambition, so that is now a very strong lobby instrument for us”* (NA2). Besides lobbying, it has resulted in the participation of supermarkets targeting the same goals and even the formation of industrial networks that involve retailers to collectively reach these goals (NA1, NA2, R1, NA3). In that sense, transition goals stimulate the acceleration of transitions. Accessibility is increased when these transition goals include targeting all social groups, ultimately reinforcing acceleration.

4.3.2. Time in years

As expected, generally all interviewees associated acceleration with the reduction of time necessary to achieve desired transition goals. While not necessarily the most mentioned indicator of just acceleration, it was implicitly the expected result of the influence of the other indicators. Few respondents also considered that the improvement of accessibility of the transition was an important indicator of just acceleration (R11, Co1). *“Acceleration sounds like time, but I would say that it is also really about reaching as many people as possible and increasing accessibility.”* (R11). Nevertheless, time was seen as the most important determinant of just acceleration and especially acceleration in general.

4.3.3. Growth of market share

Growth of market share was not seen as a direct indicator of speed of system change, but rather as an ex-post way of measuring the rate of the transition or a tool to determine the business strategies. Regarding the second, a great deal of investments was made in the protein transition based on the expected market share in 2025. However, due to Covid-19, market growth occurred a lot slower. *“We have decreased our assortment of plant-based meat alternatives because we saw a decline in sales of those products.”* (R1). While the expected market share initially had a positive influence on the protein transition, it is difficult to determine the exact effect due to external factors. Nevertheless, this indicator has a strong relation to transition goals, as they are formulated

according to expected market growth, and time in years as it makes a tangible criterion upon which acceleration can be measured and compared to other markets. Therefore, it is an important determinant for the speed of system change.

4.4. Diffusion

The division of the number of references is notable as there were no mentions of net market growth by the respondents. As this indicator was not validated by both sources, 4.4.2. argues the exclusion of this element from the table of just acceleration. On the other hand, diversity of brand availability appeared to play a large role in both the acceleration and accessibility of the protein transition, as can be read in 4.4.1.

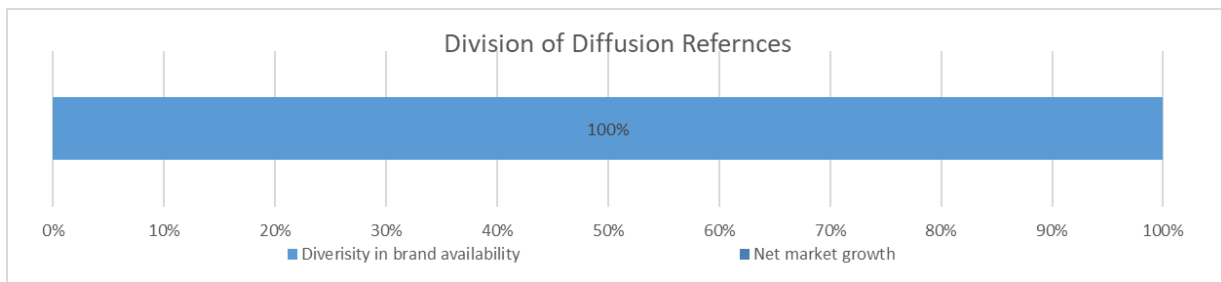


Fig. 8. Visualisation of division percentile references of indicators Diffusion by respondents

4.4.1. Diversity in Brand Availability

As established in the literature and confirmed by the empirical case study, brand diversity has a positive effect on both the accessibility and acceleration of transitions. In the case of the protein transition in the Netherlands, this aspect is closely linked to price parity. As a result of the growing number of brands producing plant-based meat alternatives, price competition was sparked that made the products more accessible for consumers to try. In particular, the increased accessibility caused by the introduction of store brand plant-based alternatives was found to largely increase the adoption rate (Pr5). This is because they were generally lower in price as well as having a large variety of products as retail owned products do not compete with private labels for shelf space in the supermarkets (Pr2, Pr5). However, an important nuance was made by multiple respondents, saying that while the quantity of available products generally has a positive effect on the demand of consumers, the quality of these products forms quite a large threat, as the perceived negative experiences with plant-based products were said to largely influence the recurring sales. While this contrast may have been more present in earlier years, it has become less evident in recent years due to an increase in technological developments. Naturally, as diffusion regards the sectoral uptake of the transition, brand diversity also largely affects acceleration. In short, generally, the increased accessibility through the price competition and the diversity of products caused by a wide variety of available brands has a positive effect on just acceleration.

4.4.2. Net Market growth

Net market growth was recognised by none of the respondents as an important determinant for diffusion or just acceleration. As the growth of the market is already covered in 4.3.3. and the fact that the net market growth does not necessarily reflect the diversity of the adopters or the distribution of benefits thereof, as it is solely measured in a total amount of money and not its equal distribution, this indicator does not fit the framework correctly. Besides this, it also does not directly stimulate the accessibility and acceleration of the transition. Therefore, it will not be included in the final conceptualisation.

4.5. Scale

Regarding scale in general, it became clear that the majority of the respondents were unaware or at least not directly involved or acting upon the expected inequalities resulting from the protein transition. When asked, most respondents recognised the differences in accessibility of plant-based products across nations, and recognised the

general wealth division in the Netherlands, but did not link that to possible additional inequalities as a result of the protein transition in the Netherlands (Pr5, Pr4, Cu1, Pr1). *“With social inequality, you certainly have a topic that is very important to act upon, but I would say that we have to keep this separate. With the current context of society, it is difficult for us to pursue all the desired social inclusivity standards.”* (Cu1). Alternatively, few respondents did recognise the necessity to ease the system transition and argued the importance of facilitating the expected disappearance of jobs due to decreasing animal meat demand. This issue is especially pressing in the Netherlands due to the high number of livestock farmers and the amount of animal meat exported.

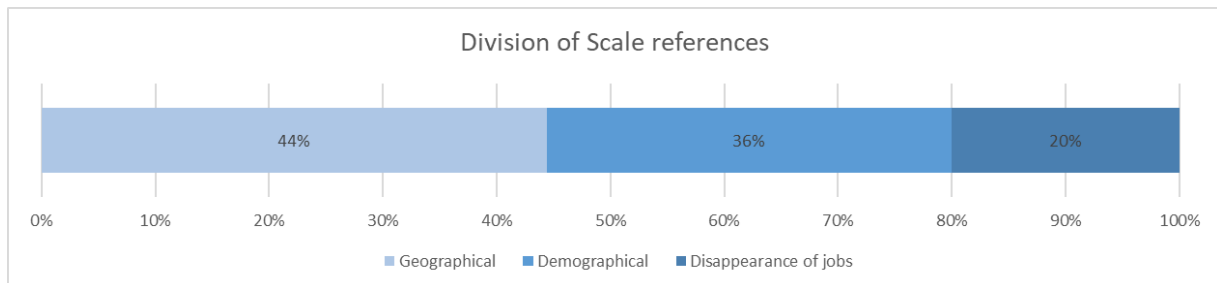


Fig. 9. Visualisation of division percentile references of indicator Scale by respondents

4.5.1. Demographic characteristics

The respondents recognised multiple demographic characteristics influencing adoption decisions within the protein transition in the Netherlands. The most frequently used criteria to distinguish consumers of plant-based products were *level of education, generation and income*. In line with these criteria, a clear demographic was sketched as being the initial and most willing target group of the protein transition: the eco-elites. Generally, this entails the highly educated, rich, young and middle aged and often white Dutch citizen who has access to the necessary resources to adopt these products. This has contributed to the stigmatisation of plant-based diets causing counterincentives for other demographical groups to participate in the transition. The eco-elitist stigmatisation and the association with the urban agglomeration in the Netherlands, is causing conscious non-adoption due to social distancing from those societal groups and with that deceleration of the protein transition (R11, R1). If the products would be perceived as less elitist, it could have a positive effect on just acceleration.

Besides the stigmatisation, the difference in the price of plant-based products was another possible cause for expected inequality by the protein transition. Due to the higher prices of plant-based products, lower accessibility is expected for low-income groups. However, respondents did not necessarily share this vision as they pointed out the decreasing prices of plant-based meat alternatives and that the prices of animal meat products are rising (see 4.6). Besides this, even though prices are generally higher, they are still not high enough to reject occasional consumption (Pr6, Pr5, NA3). *“We don’t really sense that people’s spending budget really influences the consumption choice of vegetarian products.”* (R1). Therefore, income difference is not expected to cause inequality in relation to plant-based meat alternatives.

Level of education, however, seems to have a more direct effect on the adoption choices as this is more closely linked to access to information and communication, as was seen in 4.2.1. Low educated social groups are less likely to adopt plant-based meat alternatives as they generally have less awareness of the negative effects of meat products and the positive health and ecological benefits of plant-based meat alternatives (NA3, R12). As they also do not meet the target group of plant-based producers, little is done to fill this awareness gap. *“We have no idea what the wishes of these social groups are and we don’t really engage them in conversations. If we want a fair transition, we need to start involving these societal groups.”* (NA3). Concluding, lack of information due to the level of education is the main demographical element causing inequality from the protein transition. This was also confirmed by Charlebois, McCormick and Juhasz (2016), who researched the significance of democratic factors on the consumption of beef, and found the only significant determining factor to be level of education. Conscious non-adoption caused by polarisation of the consumer groups is not necessarily a cause of inequality, but rather a hindering factor for acceleration as it causes the exclusion of certain social groups from the benefits of the transition, and thus should still be considered in just acceleration.

4.5.2. Geographic characteristics

As was briefly hinted upon in the demographical characteristics, respondents depicted a clear difference between urban agglomerated and more rural areas in the Netherlands. While the difference in demographics seems to be partly related to consumer choices, the difference in accessibility in relation to location seems to be deliberately upheld by retailers. There are large differences in the availability and accessibility of plant-based products within regions in the Netherlands. Specifically, the percentage of plant-based meat alternatives is significantly lower in the eastern, more rural parts of the Netherlands as opposed to more western urban areas, generally known as 'de Randstad' (R1). *"There is definitely a difference in the availability of products. Consumers in 'de Randstad' are more conscious of the products are more change driven."* (R1). This is recognised by the respondents as an important aspect causing inequalities within the transition (RI1, R1, RI2, Pr6, Co1). As was seen in 4.4.1, diversity in brand availability has a positive influence on adoption choices and with that just acceleration as a whole. This is inherently linked to cultural aspects as these seem to be more present in eastern Holland. This makes the transition motivation in those areas smaller. Another aspect reinforcing this is the fact that the negative externalities of this transition are more apparent in rural areas. This is because the rural areas produce a large portion of the animal meat and thus are more threatened by the protein transition due to the possible disappearance of jobs. Therefore, it is important to consider these actor groups in transitions as their participation and acceptance largely influence the course of the transition.

4.5.3. Disappearance of jobs

While this indicator was not mentioned often, it did become apparent as an important hindering factor when not considered in the transition. As seen 4.5.2., the threat of the disappearance of jobs by the protein transition is contributing to the polarisation of the population and causing resistance to change. Considering the recent provincial elections in the Netherlands, the support for the farming community is growing rapidly and with that a growing resistance to change. This potentially forms a huge threat to the just acceleration of the protein transition when not dealt with carefully. *"The people dependent on the meat industry need to receive a place in the new system. They cannot just be left out."* (Co1). To achieve this, there needs to be an incentive to change as well as positive reinforcement for the change. *"There is a possibility to welcome these farmers in the new system with open arms, as they are now being portrayed as the problem in the current system. I think including farmers as part of the solution and providing them with the proper appreciation would help a lot."* (Cu1). The generally shared opinion by the respondents was the responsibility of the government to provide these incentives and provide a solution for disappearance of jobs.

While this thesis generally takes a more consumer perspective, this element was not expected to be of great influence on the just acceleration of the protein transition. However, as farmers form a large portion of possible adopters in the Netherlands, and they potentially threaten the course of the protein transition in the Netherlands due to their contribution to the polarisation, it became clear that it is important to add this element to the framework.

4.6. Price parity

Closely related to sectoral policy and unequal price competition lies the influence of price in general. Price parity specifically was seen as the third most mentioned concept of just acceleration. Price parity refers to the price level that values two or more assets as equals (Asche, 2002). As a result, consumers consider the prices of both assets or products to be comparable and of the same value. As consumers of meat products inherently substitute animal products for plant-based alternatives and animal products already being quite pricy, price in itself seems to matter less, but the prices in comparison to each other tend to have more influence on adoption choices (Pr1, Pr2, R1).

When plant-based meat alternatives were first introduced to the market, they entered at a relatively high price point, especially compared to animal meat products (Consumentenbond, 2021). However, over recent years the price gap between animal meat and plant-based alternatives has decreased significantly (ProVeg, 2022a & 2022b). This changed even more in 2022 when a majority of the plant-based meat alternatives in the Netherlands were cheaper than their animal meat counterparts. ProVeg analysed different animal and meat products and concluded that plant-based burgers, minced meat and chicken were cheaper in 66% of the cases in June of 2022 in comparison to February of that same year (Nijpjes et al., 2022). This is the result of the steep inflation that largely

affected the prices of animal meat products, whilst almost not affecting plant-based meat alternatives (Nijpjes et al., 2022). Nonetheless, the perception of the price by the consumer has not changed much from the market entry years ago, and plant-based products are therefore still perceived as being expensive (NA4, R1, Co1). Despite the inflation, the prices of plant-based meat alternatives remain high due to R&D costs, and lack of direct financial support from the government (ProVeg, 2022b).

Price parity is considered a huge determinant for the initial willingness of individual consumers to try plant-based meat alternatives as well as the acceptance of these products as repeated substitutes for meat products, ultimately enhancing acceleration. It was described as a direct driver and incentive for change by the respondents and with that a very influential concept of just acceleration. In sustainability transitions where the niche product typically aims to pose a direct alternative to an established product, price parity influences the way people perceive the product and converges these perceptions to alternatives of similar value. It is important to note that price parity is not the only determinant of this perception but does largely influence it.

Price parity is strongly influenced by the current regime, as in essence, the niche product aims to resemble the regime prices. On top of that the price of a product is a big determinant of the regime system. Besides this, the price changes in relation to the development of the niche product. For these reasons, price parity would best fit as an extra dimension of regime dimension change.

4.7. Conceptualisation of just acceleration

Through the combined theoretical and empirical approach to conceptualising just acceleration, aspects of just acceleration as well as possible hindering factors came to light. It became apparent that all concepts related to not only the acceleration of the transition but also to the degree of accessibility of the transition. Regarding the acceleration aspect of just acceleration, it was generally accepted that acceleration of the transition entailed the shortening of the perceived timeframe to reach a desired state, the scale and pace of changes in the system to facilitate this, as well as the rapid uptake of products by end users. Regarding the just aspect of just acceleration, it became clear that at least partial participation of all actor groups was important, and that this should be facilitated by increasing the accessibility of the niche products by targeting all social groups, including the most marginalised. Besides this, it became apparent that the distribution of externalities of the transition needs to be spread wide and evenly to achieve a fair transition and to create the least amount of resistance and polarisation amongst the population. By reducing these resistances, the amount of adopter groups is expected to grow more rapidly and evenly. As accelerated adoption by end users is linked to the apparent definition of acceleration, by striving for acceleration in a just manner, the transition might transpire even more rapidly as opposed to merely undertaking action to invoke acceleration. What this entails is that a focus on increasing accessibility of the transition has the potential to enhance acceleration in transitions. This illustrates that there is an intrinsic link between the two concepts and that this relation should be manifested in sustainability transition pathways. Generally, just acceleration refers to the mechanism to enhance the pace of systemic change in sustainability transitions while diffusing the innovation and forthcoming benefits to a broad scale. This is summarised in the following conceptualisation of just acceleration:

Just acceleration refers to the rapid and just achievement of sustainability goals and the necessary systemic changes to reach and maintain these just goals, while targeting and providing accessibility to all actor groups evenly and safeguarding the equal distribution of forthcoming positive and negative externalities.

The results of the empirical case study show what relationships, interactions, and dynamics were evident when it came to the operationalised concepts and how the relationship between accessibility and acceleration is apparent within the indicators. This essentially created a dialogue between the literature and the case study. This can be seen within the indicator descriptions throughout the results. This ultimately led to the incorporation of the found relations between accessibility and acceleration deriving from the case study in the conceptual framework.

In the following I explain how the original framework presented in *Chapter 2.4* has been adjusted to reflect the justice requirements that demonstrate the apparent relation between acceleration and accessibility, which are depicted bold in *Table 7*. Besides this, the novel indicators that emerged from the empirical case study are displayed in bold in the table as well.

Regime dimension change

What became clear from the analysis of regime dimension change, which was derived from the key theoretical model the *Multi-level perspective* (Geels, 2002), it deemed necessary to not only achieve but also maintain the systemic changes necessary to foster both acceleration and accessibility. As acceleration was defined as a phase within the MLP and other transitions literature, transitions eventually reach a state of maturation, essentially decreasing accelerated change once a certain goal was realised. However, due to fast changing environments, and to prevent lock-ins to new system states, it is important to maintain momentum and stimulation of continued change that concerns all social groups equally. This became clear from the analysis of the indicators of regime dimension change that demonstrated threats and opportunities for just acceleration in the transition. The relation between acceleration and accessibility became clear throughout these indicators and demonstrated the possibility to synergize transitions and just transitions literature by adding direction and aspects of justice to the indicator operationalisations.

Speed of (system) change

What this concept demonstrated was the necessity to incorporate justice aspects in the core intention of the transition. While the definition of this concept remains closely linked to the definitions that became apparent from the theoretical models, the empirical case study added an indicator that incorporated the manageability of just acceleration, namely transition goals. This indicator demonstrated the effect of vocalisation of transition goals on the acceleration of the transition, as was seen with the 50/50 consumption goal of the protein transition. Relatedly, incorporating aspects of justice within these goals enhances both acceleration and accessibility and ultimately just acceleration as a desired transition pathway. It also demonstrated the intention of just acceleration, which entails the minimalization of negative externalities on both climate change and marginalised groups and equally distribute forthcoming benefits.

Diffusion

The concept diffusion embodied the consumer perspective of the transition and demonstrated the effect of increasing accessibility for end users. It highlighted that brand diversity not only increases the accessibility of the products to wider geographical and demographical groups, but also increased acceleration due to increased adoption, which was found as one of the definitions of acceleration. Ultimately, it contrasted the bias of retailers that deliberately hinder just acceleration through selective exposure of the niche products.

Scale

The aspects of scale exposed the current threats of exclusion of justice aspects in sustainability transitions, but also demonstrated the potential accelerating effect when properly incorporated. Here, the notion of equal distribution to all demographic and geographic social groups is considered a necessity for just acceleration. Also, the fair conversion of job purpose and equal distribution of forthcoming externalities to groups dependent on carbon intensive industries was emphasized, as a means to overcome polarisation of the population and way to evenly distribute the benefits of the transition.

Predominantly, the changes made to the framework of just acceleration entailed specifying the direction and scope of transition dynamics towards the intention to include all social groups equitably. These alterations embody the synergy and integration of both literature fields and with that demonstrate the theoretical contribution of this thesis. These findings were translated into adjustments of the framework for just acceleration, and are visible in bold in the table below.

Table 7. Final formulation of concepts and indicators of just acceleration. Here the bold concepts are those identified through the empirical case study and incorporates the dynamic relationship between acceleration and accessibility

	Concept	Definition	Indicators	Operationalisations
Just Acceleration	Regime dimension change	<i>Changes in regime dimensions that are nested in the current socio-technical regime that are necessary to facilitate and maintain the accessibility and acceleration of the transition</i>	Industrial Networks	Formation of industrial networks aimed at enhancing niche developments and increasing the accessibility for end users, including marginalised groups .
			Techno-scientific knowledge	Shift in knowledge creation that benefits society at large towards niche developments and forthcoming societal effects.
			Sectoral policy	Policy interventions in favour of the niche product and focussed on the equal distribution of positive and negative externalities to all social groups, as well as compensation for the disappearance of jobs .
			Markets, user practices	Users from all social groups are able to adopt.
			Technology	Technological enhancements of niche products and simplification of the production process aimed at local adaption of the niche technology intended to increase accessibility .
			Infrastructure	Increase in necessary infrastructure for fair distribution of the niche product to all social groups.
			Culture	Shift in cultural aspects in favour of the niche product, where adoption enhancing interventions occur on the lower levels of the social complexity mechanism and are aimed at social equity .
	Price parity	Striving for a price level that values the current and niche technologies as equals .		
	Speed of (system) change	<i>Rate at which the niche dominant design gains market share</i>	Growth of market share	Tool that can be used to determine ambitious goals and related business strategies. Also used for measuring and comparing a timeframe of transition that can be just .
			<i>The duration of the transition that manifests rapid and just change</i>	Time in years
<i>Vocalisation of the desired transition state at a certain point in time</i>			Transition goals	Aimed at both ambitious transition targets and targeting wide adopter groups, including the most marginal .
Diffusion	<i>Widening sectoral scope through increased adoption by brands to increase accessibility for end users of all social groups</i>	Diversity in brand availability	Either through diversification by incumbents or the introduction by new entrants resulting in price competition and product diversification, ultimately increasing the accessibility of the products to all social groups equally .	
Scale	<i>The demographic and geographical scope to which the benefits of the transition reach</i>	Demographic characteristics	Level of education - adopters from all levels of education are targeted equally .	
		Geographic characteristics	Equal distribution of products in geographical area under investigation.	
		Disappearance of jobs	Fair conversion of job purpose and equal distribution of forthcoming externalities .	

5. Discussion

5.1. Theoretical implications

The introductory chapter presented theoretical shortcomings of transitions and just transitions literature. Here, it was recognised that the absence of a widely accepted definition of acceleration that considers both societal and technical domains, along with insufficient integration and synergy between just transitions literature and transitions literature, on top of the marginalisation of justice aspects in transitions literature resulted in the lack of necessary direction for researching and achieving rapid widespread sustainability transitions. This thesis aimed to address this by building up the concept of 'just acceleration'. The literature review exposed the different conceptualisations of acceleration in both literature streams, as well as insights into the inclusion of aspects of justice. This resulted in the integration of relevant conceptualisations from both literature streams and steered this research towards conceptualisation of just acceleration. By adding aspects of scale to the relevant concepts of just acceleration, the social equality aspect was included. As previous transitions literature predominantly focused on technical domains, a socially centred case study highlighted an alternative perspective angle. The findings of the case study accentuated the importance of certain concepts found in the literature as well as adding novel concepts that did not become apparent from the literature streams. Combining the insights from both data sources, led to the realisation of the essence of just acceleration, namely the dynamic relation between acceleration and accessibility.

This realisation led to the formulation of the conceptual definition of just acceleration as seen in 4.7. This conceptualisation provides theoretical directionality for future sustainability research as well as eliminating misconceptions. Besides the conceptualisation of just acceleration, this thesis proposed a table of relevant theoretical concepts that influence the occurrence of just acceleration (*Table 4*). Theoretically, the framework provides conceptual clarity and structure to the understanding, analysis and application of just acceleration in the sustainability domain. By defining the relevant concepts and their indicators, the framework can be used to guide research on sustainability transitions to recognise just acceleration and proposing intervention points to better achieve this. In addition, the conceptualisation forms the basis upon which scholars can further develop theory on just acceleration, as a key set of interrelated concepts and their relationships have been identified. It also stimulates the merging of two literature streams that display many similarities but would benefit from synergising its key concepts. Alternatively, the framework can be used as a managerial tool to evaluate and steer growth strategies of firms, policymakers, or other stakeholders. In that sense, it can be used to understand and evaluate just acceleration within their practices. For this, the concepts of clear transition goals, distributional status and plans, price point and determining its surrounding environment through the regime dimension changes can be assessed through the framework to ensure accessibility and acceleration. Also, progress can be measured through the comparison of growth rates. Lastly, the aspects of scale can be used to determine where acts of familiarisation, communication and nudging are appropriate.

It became clear that there were significant differences between the case study on the protein transition and energy and mobility transitions cases from the literature. Firstly, the strong cultural dependence and emotional connection influencing food habits presented a large hindering factor for the transition. Besides this, the deliberate non-adoption due to polarisation as opposed to lack of necessary resources added social complexity for acceleration. Also, the lesser dependency on a technological push and infrastructure showed to be different from the energy sector where there appeared to be a strong dependence on those factors. Lastly, in the case of the Netherlands, there was a perceived threat to the disappearance of jobs due to the high number of livestock farmers, causing the polarisation of the population. Consequently, this demonstrated perceived differences in the relevance of the theoretically determined concepts. The empirical case study demonstrated that when tackling a socially centred sustainability transition, it is essential to focus efforts on dealing with the social dynamics and forthcoming social complexity, rather than solely stimulating technological push.

When looking at the placement of this research in current literature developments, a clear shift towards accelerating sustainability transitions can be seen (see chapter 2). This was visible in both the transitions literature and the just transitions literature. Even though these literature streams developed alongside each other and appear to be heading in the same theoretical direction, little overlap thus far was observed. This thesis has

demonstrated a reinforcing relationship between accessibility and acceleration that illustrates the potential to speed up sustainability transitions while considering social equality. With that, this thesis steers research in a new direction which integrates and synergises both literature streams heading for a similar goal of achieving wide-scale sustainable transitions. On a more practical side, the empirical case study has both confirmed and contradicted recent research on factors influencing the speed of adoption and diffusion, which are inherently linked to acceleration dynamics. As such, similarities between the case study and recent literature on accelerating factors can be seen in concepts such as price parity (Michel et al., 2021; Szenderák et al., 2022), level of education (Boukid, 2021; Charlebois et al., 2016; Michel et al., 2021) brand availability (Charlebois et al., 2016), information and communication (Van Loo et al., 2020) and incremental acceleration approaches such as nudging (Scoones et al., 2020). Also, similarities in the threats of cultural dependence, and stigmatization were recognised (Charlebois et al., 2016; Michel et al., 2021). Contradictions were seen in authors who claim the level of income to be most influential (Boukid, 2021; Szenderák et al., 2022) and other democratic determinants, such as gender, age and even claiming health reasons to be a demotivator of change (Boukid, 2021). This research has expanded on these papers by broadening the scope of relevant concepts and examining their influence on both acceleration and accessibility.

A theoretical paradox of the results presented itself. Due to degrading climate conditions, Reitzenstein (2018) claims that transitions are inherently only just if they intend to keep up with the 1,5 degrees Celsius goals. He states that there are time limited opportunities to shape social and economic changes. He discusses the inherent connection between acceleration and justice, and the fact that justice accelerations naturally include a time perspective, making a conceptualisation of just acceleration essentially obsolete. While this school of thought is in line with what this thesis aims to represent, there seems to be a misconception that striving for justice will naturally lead to acceleration. This is due to the fact that just transitions literature does not include all relevant transition dynamics as described by transitions literature and that justice is not intrinsically similar to accessibility, as described here. Justice forms a far larger concept, focussing not only on accessibility but also on inclusion and restoration, as described by the different forms of justice. Relatedly, Tscherisch and Kok (2022), argue that striving for total justice, by way of democratization and inclusion, could slow down sustainability transformations, especially when actor groups disagree on transition pathways and/or interventions. They further demonstrate the need to link democratization and urgency with transition dynamics, better fostering the three forms of justice and call for future exploration of the dynamics between the forms of justice and especially the role of procedural justice. This thesis played into this gap by ensuring equality through striving to create equal accessibility to the transition and the necessary resources to participate in the transition, such as information and experimentation while fostering urgency through the stimulation of acceleration. Besides this, the conceptualisation of just acceleration bridges two literature streams, as opposed to building further on just transitions literature.

Another theoretical paradox can be seen in the conceptual differences between the concepts of transitions and transformations. In *section 2.4*. it was argued that the theoretical concept of transitions better fit the aim of this thesis as opposed to transformations. The argumentation for this was based on the slight differences in definitions between the concepts. As transitions tended to focus on shifts in sub-systems from unsustainable practices to sustainable practices and aimed at providing intervention points for multiple actors, this concept seemed favourable. While this argumentation still stands and matches the context of the final conceptualisation, transformations are tended to have a more large-scale effect on systemic change and present a way of avoiding undesirable practices (Hölscher et al., 2018). Essentially, this is the essence of the 'just' aspect in just accelerations, where it is advocated that ex-ante action addressing accessibility leads to acceleration in transitions. Also, transformations are generally characterised to define and facilitate safe and just operating spaces for humankind (Hölscher et al., 2018; Olsson et al., 2014). This demonstrates that the conceptual definition of just acceleration presents overlapping elements with both transitions and transformation concepts. When looking at the empirical case study selected for this thesis, the transition from animal meat products to plant-based meat alternatives, it rather illustrates a system optimization as opposed to the structural paradigm shift that it tends to be perceived as. This can also be observed in the mobility sector, where electric cars present a mere optimization for the way of transportation as opposed to a large-scale societal change. As optimisation appears to be inherently linked to the concept of transitions as opposed to transformations, it is argued that transitions would remain the better conceptual choice here. However, men could argue if striving for transitions is the desired course of action for future systemic change. This poses a compelling paradox for future sustainability acceleration research.

5.2. Societal implications

Besides the described theoretical implications of the proposed conceptualisation and framework, they also presents societal relevance. The conceptualisation and framework of just acceleration can be used by policy-makers to identify and strive for just acceleration in the sustainability domain. Accordingly, the framework could be used to analyse the course of current sustainability transitions and identify where intervention points are best suited. As an example, sectoral policy can focus on the equal geographical accessibility of products, contribute to the equalisation of information and communication distribution and focus on the reintegration of people into jobs as a consequence of expected job loss. Besides this, this thesis has demonstrated a large role of sectoral policy to destabilise current unsustainable regime practices through taxes and/or budget cuts. Moreover, the framework and conceptualisation could assist in formulating sustainability policy.

Another added societal benefit of researching socio-cultural transitions as opposed to technological ones, comes from the differences in perceived lengths of the transitions. Loorbach et al. (2015) recognise that socio-cultural transitions generally tend to transpire in a longer time frame than technological ones. Efforts in accelerating socio-cultural transitions therefore hold more benefits than technological transitions. As this thesis has demonstrated the effects of social complexity of socio-cultural sustainability transitions on the acceleration and accessibility thereof, it provides added societal benefits.

Related to this, it was recognised that both transitions and just transitions literature employed a narrow focus on technological transitions such as the energy and mobility transitions. By selecting a socially centred case study, societal relevance is provided as the findings can be used to tackle a broader scale of grand societal challenges. Additionally, the societal contribution increases as a result of the incorporation of justice aspects in just acceleration aiming to increase the accessibility of transitions to all social groups. Also, this thesis has made empirical contributions to society as the protein transition is a novel research topic (Bilali, 2019; Mylan et al., 2019). On top of that, the choice of this specific case study, seemed especially relevant due to the large amount of associated green house gas emissions that could be avoided, the prevention of social polarisation and the positive health benefits of consuming less red meat, all adding additional societal relevance.

5.3. Limitations

First, this thesis combined theoretical concepts from transitions and just transitions literature, both dating back to the 1990s. As this was not a full document analysis, it was impossible to incorporate all relevant theoretical models and conceptualisations. Because of this, the most relevant and influential literature contributions were selected, as can be seen in the heuristic scheme. While these are expected to reflect the generally shared vision of the literature streams, as much work builds forth on the selected models, this thesis did not include all relevant theoretical models. Therefore, it is not possible to claim that this conceptualisation and framework reflects all possible relevant concepts.

Secondly, this thesis employed a consumer perspective, as described in *chapter 3*. This was done deliberately because of the expected large influence of cultural elements on the transition, which generally overlapped more with the consumer perspective as opposed to the producer perspective, and the fact that this transition is predominantly consumer initiated as opposed to producer initiated. Therefore, less focus on the disappearance of jobs and the social consequences of the depletion of the old system is given. This does not fully represent the just transitions literature stream, which also largely focusses on the disappearance of jobs as a cause of inequality. This can be illustrated by the fact that not all forms of justice were considered in this thesis. There are generally three forms of justice discussed in just transitions literature: *distributional, procedural and restorative*. This thesis predominantly applies distributional justice, which deals with distributional injustices of sustainability transitions, as was seen with accessibility. Procedural justice, referring to the wide scale and continuous involvement of all relevant social groups was expected to be less relevant here due to natural market dynamics and the fact that ensuring equality was largely ascribed to the government. Also, restorative justice, which aims to repair the harm done by the transition, was partly included in the aspect of scale through the equal distribution of benefits, but presented a rather large ex-post angle, while the conceptualisation and framework employ a more ex-ante perspective. All in all, this thesis also does not consider all conceptual differences of the just transitions literature stream but rather reflects the general intentions of the literature stream.

Related to the consumer perspective of the protein transition, is the underrepresentation of the consumers amongst the interviewees. While there seemed to be enough data saturation on the opinion of the consumers, there was no direct consultation with adopters or deliberate non-adopters. Only indirect connections to consumers through consumer representatives and through results of market research by retailers, producers and network actors were employed. Achieving a representative consumer perspective would entail a quantitative analysis, which did not fit the boundaries and time constraints of this research.

On a more methodological side, the boundaries of the Netherlands form another shortcoming of this thesis. The unique factors that make up the context of the Netherlands cause low external validity. These factors include the general progressive character of the people and unique cultural factors, which are generally not that strongly influential, the relatively large interest of the government and the unique economic context, which resulted in level of income being less influential than level of education. Besides this, the strong European influence on the protein transition in the Netherlands is not adequately reflected. Sectoral policy and pressure from the European Union are not specifically considered in this thesis, besides economic contributions to the current regime. Besides this, large differences in equality can be expected to occur between countries. As an example, national boundaries resulted in the respondents to only slightly recognise the expected inequality caused by accessibility of the transition, while few respondents did mention the large differences in accessibility between countries. Thus, inequality as a result of the protein transition, and presumably other socially centred sustainability transitions are expected to be more visible between countries rather than within. This largely influences international law-making.

5.4. Future research

While this thesis holds theoretical and societal implications, its approach, i.e., it being a starting point for future sustainability research and its limitations call for further research. Generally, this thesis has demonstrated the relation between transitions literature and just transitions literature and the benefits of synergising these literature streams. This thesis does not aim to invalidate previous theoretical models on transition pathways, but proposes an additional aspect that could be incorporated in previous theoretical models to account for both social and transition dynamics. Therefore, a suggestion for further research would entail the integration and expansion of the just acceleration concept in existing transitions and just transitions literature models.

More specifically, future research should build further on the conceptualisation of just acceleration and examine the framework and the concepts that can be used for analysing just acceleration. In this thesis, besides showing the difference in perceived relevance through number of references, no further distinction was made within the different indicators and their relevance to just acceleration. Related to this, further research on the inclusion of all forms of justice would be necessary to better reflect the just transitions literature stream. Besides this, the protein transition possessed rather case specific characterisations, such as cultural dependency, disappearance of jobs and diversity in brand availability. It would therefore be beneficial to determine the relevance of the framework on other socially centred sustainability transitions, such as the textile transition. Lastly, it would be beneficial to test the framework in its ability to serve as both a managerial and theoretical tool as described in 5.1.

6. Conclusion

This thesis intended to synergise transitions and just transitions literature streams and overcome the conceptual differences within and between these literature streams and with that provide clearance and directionality to future sustainability transitions. By doing so, this thesis attempted to contribute to developing solution pathways for tackling grand societal challenges. This was done by combining conceptualisations of acceleration from transitions and just transitions literature, as well as adding aspects of justice deriving from just transitions literature. Relevant concepts were categorised and operationalised based on the most influential theoretical models and into four overarching concepts *Regime Dimension Change*, *Speed of (system) change*, *Diffusion and Scale*. These concepts and their apparent connection to just acceleration were tested through an empirical case study of the protein transition in the Netherlands.

The empirical case study demonstrated a strong relation between transition dynamics, and relatedly acceleration, and aspects of justice through the concept of accessibility. It showcased that acceleration and accessibility are implicitly linked and can be used to reinforce each other when transitioning in the sustainability domain. What this entails is that a focus on increasing accessibility of the transition has the potential to advance acceleration in transitions. This illustrates that there is an intrinsic link between the two concepts and that this relation should be manifested in sustainability transition pathways. The findings of the empirical case study further demonstrate what interactions, relations and dynamics regarding the operationalised concepts were visible and how the relation between acceleration and accessibility is noticeable within the indicators. This essentially created a dialogue between the literature and the case study. This ultimately led to the incorporation of the relation between accessibility and acceleration in the conceptual framework. This resulted in an answer to the research question *How can “just acceleration” be conceptualised in the sustainability domain?* Just acceleration can be defined as:

Just acceleration refers to the rapid achievement of sustainability goals and the necessary systemic changes to reach and maintain these goals, while targeting and providing accessibility to all actor groups evenly and safeguarding the equal distribution of forthcoming positive and negative externalities.

This definition embodies the synergy between two literature streams and aims to steer sustainability transition pathways intending to accelerate change in a fair and just direction. This definition includes two concepts that were frequently referred to by the respondents, acceleration and accessibility. Here, acceleration predominantly refers to the speed of changes required to reach certain transition goals and the speed and scale at which the products are diffused. Accessibility refers to the scale at which the products become accessible to all social groups through level playing fields related to necessary resources to adopt the products as well as the even distribution of forthcoming positive and negative externalities in terms of for example social, financial or health benefits. The conceptual framework entails a way of recognising, analysing and understanding just acceleration. It can be used to determine intervention points to invoke and maintain just acceleration. Ultimately, this thesis demonstrated the positively influencing relationship between justice and accelerating transitions and that accelerating change towards sustainability goals could and should transpire in a just and fair manner.

Concerning the two sub-questions regarding the added benefits of both theory and the empirical case study, it became clear that while both data streams had a different role in providing data, they were both significant for the conceptualisation. Where the literature streams provided a large part of the relevant concepts for just acceleration, the case study shed light on the social influence on transitions, by presenting significant differences to technological transitions. Besides that, it demonstrated that there is a perceived difference in relevance amongst the indicators recognised by the theory. Finally, the empirical case study also highlighted additional relevant concepts for the conceptualisation and framework of just acceleration and the relation between acceleration and accessibility.

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Appendix I – Interviewee information

No.	Actor type	Time Interview	location	Code
1.	Researcher & network actor	32:30	Online	RI1
2.	Producer	31:01	Online	Pr1
3.	Producer	32:30	Online	Pr2
4.	Network actor / NGO	32:54	Online	NA1
5.	Producer	-	Written	Pr3
6.	Consumer representative	1:15:00	Physical	Co1
7.	Network Actor / NGO	32:34	Online	NA2
8.	Retailer	29:39	Online	R1
9.	Network Actor / NGO	32:29	Online	NA3
10.	Producer	40:54	Online	Pr4
11.	Research Institute - specialised in consumer behaviour	31:37	Online	RI2
12.	Network Actor	29:32	Online	NA4
13.	Cultivation representative / NGO	30:00	Online	Cu1
14.	Producer	33:33	Online	Pr5
15.	Producer	34:10	Online	Pr6
16.	NGO	Written document	Coding report on the progress of supermarkets on providing plant-based meat alternatives.	NA5

Appendix II – Sample interview guide

As there were different actor groups interviewed, different interview guides were applied. Therefore, the aim of the different interviewed actor groups can be found here. Besides this, there were some general questions asked regarding acceleration, these are also presented here. All interviewees were asked approximately six questions, where the semi-constructed character of the interviews allowed for follow up questions and deviations.

Producers:

- Vision on developments of the market: consumer behaviour, brand diversity, technological developments
- The perceived influence of different factors: infrastructure, networks, culture, policy interventions
- Target audience and how they target them.
- Opinion on rate and direction of developments.

Retailers:

- Insights on consumer behaviour
- View on perceived difference in aspects of scale amongst customers/stores
- Collaborations
- Perceived changes in the market

Network actors:

- Development and influence of network collaborations
- Reaction of the market and policy to collaborations
- The effect of network actors
- Opinion on necessary interventions and by what actor groups

Research institute:

- Developments on the creation of knowledge and noticeable shifts
- Consumer behaviour developments
- Effects on inequality and social differences
- Hurdles in acceleration

Cultivation

- Opinion on cultivation shifts
- View on willingness to participate.
- Opinion on distribution of benefits and who carries that responsibility.
- Cultural influence of cultivators

Questions asked to all respondents:

- What do you think are important factors when accelerating the protein transition?
- Do you experience bottlenecks in the acceleration of the protein transition?
- Do you expect any negative externalities from the accelerating protein transition?

Appendix III – NVivo codes

Name	Files	References
Agency	11	28
Diffusion	11	40
Diversity in Brand	8	13
Nett market growth	6	7
Other	0	0
Price Parity	13	31
Regime Dimension Change	0	0
Cultural aspects	15	84
Awareness	0	0
Behavioural change	0	0
Culture	0	0
Information	2	3
Nudging	5	12
Industrial Networks	9	12
Infrastructure	0	0
Markets, user practices	4	5
Sectoral Policy	14	44
Technology	10	37
Local adaption of technology	4	6
Quality of alternative technology	6	22
Techno-scientific knowledge	6	7
Scale	0	0
Demographical	10	18
Dissapearance of Jobs	6	9
Geographical	12	22
Speed of system change	15	37
Growth in market share	3	4
Time in Years	10	15
Transition goals	8	18