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Beyond Technology: Towards Sustainability through Behavioral Transitions

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Abstract:
Globalization in the production process of consumer goods has led to the creation of complex global production networks (GPNs) whose early stages are often characterized by poor working conditions, leading to considerable reputational risk for brand-name firms. An extensive focus on social sustainability in GPNs is still rare. From a theoretical perspective, comprehensive approaches to enshrine social sustainability in GPNs can be seen as niche social innovations, while a shift from current operational practices to more socially sustainable ones can be considered a transition, in the sense of the Multi-Level Perspective (MLP). Transition theories, like the MLP approach, have to date had a strong focus on technological transitions. However, sustainability transitions often require a change in behavior rather than in technology, so that technological innovations are not necessarily an effective approach to achieving greater sustainability. This is particularly true in the context of social sustainability, where the focus of transitions needs to be first and foremost on changing attitudes and the criteria used for decision-making, rather than on changing the technology employed.

This paper presents a heterodox and heuristic approach to analyze what we will call behavioral transitions to sustainability (BTS). We suggest that an analysis of BTS using the birds-eye view approach of the MLP can lead to valuable insights both for the BTS and for further advancing the study of sustainability transitions in general. However, as "an abstract analytical framework that identifies relations between general theoretical principles and mechanisms," (Geels, Schot 2010, p. 19) the MLP cannot be used to study specific details of the processes and interactions taking place during a transition. Complementary theories are needed to operationalize the MLP, which has already been done for the study of more traditional (technological) applications of the MLP, but to a far lesser degree for the analysis of BTS. This paper seeks to address this gap in the current literature by introducing an operationalizable heuristic model for the study of BTS using a combination of the MLP, the Dialectic Issue Lifecycles model (Geels, Penna 2015) and two models of behavioral change. In a future step, this new model will then be applied to case studies of transitions towards greater social sustainability in global production networks.

Keywords: multi-level perspective, sustainability transitions, issue lifecycles, behavioral models

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1 Introduction

The process of globalization has increased the complexity of global production networks (GPNs) significantly. The working conditions, especially in those developing countries that make up the beginning of GPNs, are often precarious at best. As a result of social problems, some argue that the global division of labor often may not lead to development and progress, but rather to an increase in the gap between the rich and the poor (Bhatia 2013).

From a long-term perspective, this approach to production is problematic not only with regards to the social, but also the economic dimension of sustainability. Already in 2006, the Harvard Business Review described corporate social responsibility (CSR) both as an "inescapable priority for business leaders in every country" (Porter, Kramer 2006, p. 78) and as a source of innovation potential and competitive advantage. Likewise, the European Commission sees CSR as "behaviour by businesses over and above legal requirements, voluntarily adopted because businesses deem it to be in their long-term interest" (COM(2002)347, p. 5). While CSR activities are normally aimed at those areas of society that are directly affected by the conduct of a particular business, social sustainability in the business context is here defined as a broader concept. Savitz and Weber describe a sustainable corporation as

> "one that creates profit for its shareholders while protecting the environment and improving the lives of those with whom it interacts. It operates so that its business interests and the interests of the environment and society intersect. [Corporate social sustainability includes] a wide array of business concerns about the natural environment, workers' rights, consumer protection, and corporate governance, as well as the impact of business behavior on broader social issues, such as hunger, poverty, education, healthcare and human rights - and the relationship of all these to profit" (2006, pp. x–xii).

To achieve the degree of sustainability described here, it is not enough to focus only on the corporation itself; rather, both its entire value chain and customer base must be examined. Kaplinsky and Morris argue that taking into consideration the "dynamic flow of economic, organisational and coercive activities between producers within different sectors […] on a global scale" (2001, p. 2) is key to accurately portraying and understanding the power asymmetries that characterize many of the supplier-buyer relationships along the chain. These dynamics lead not only to a "process of unequalization" (Kaplinsky 2004, p. 1, as cited in; Bhatia 2013, p. 316), in which gains are distributed unequally among the participants,[1] but often also to significant short-comings with re-

[1] Most value capture in GVCs takes place during pre- and postproduction phases (design and marketing, in particular), which are often situated in industrial countries, rather than during production, which frequently takes place in developing countries.

gard to social sustainability that go far beyond the distribution of income (Kaplinsky, Morris 2001).

The implementation of Savitz and Weber's ambitious definition presents a number of significant challenges, particularly in the context of GPNs. Due to their transnational nature, they cannot be fully regulated on a national or even supranational (i.e. EU) basis, since the laws of any given state or organization always touch on only a small portion of the entire chain. Moreover, the complexity of most GPNs leads to a lack of transparency regarding its members, so that final product manufacturers often do not know who participates in their value chain beyond the first or second tier. This obscurity is becoming increasingly problematic for brand-name manufacturers, since supply chains are "sticky", meaning that the final manufacturer is often held publicly accountable for problems in the production network, even if he/she was completely unaware of them (Lessard 2013, p. 213).

This leads to considerable reputational risk for all firms with a complex and global production network. It also indicates that both consumers, using their demands as an instrument to put pressure on companies, and suppliers of alternative products with a strong orientation towards sustainability can play an important role in furthering a transition towards greater sustainability in global production and consumption networks. Since the trend towards greater media attention not only on environmental, but also on social risks in production is likely to continue increasing (Rathke 2016a, 2016b), it is advisable for all companies to begin proactively anticipating (and preventing) such problems, rather than only reacting to them after the fact (Leitschuh-Fecht, Bergius 2007). This means firmly embedding aspects of social sustainability in their management, sourcing, and marketing practices and striving for continuous improvement in their compliance with sustainability criteria, both internally and throughout the entire production network.

While a few approaches have been tried on a small scale, an extensive focus on social sustainability in global production chains is still rare. Studies predict, however, that the demand for "fair" products will continue to rise (BMBF 2014b; The Nielsen Company 2015) and thus it is key for such socially sustainable approaches to disseminate so that firms can continue to stay competitive. While this transition process may initially be met with resistance, meeting the challenge early on will likely open up valuable opportunities in the future (BMBF 2014a; Henderson 2015).

From a theoretical perspective, comprehensive approaches to enshrine social sustainability in GPNs can be seen as a social innovation, which Howaldt and Schwarz define as follows:

> "The substantive distinction between social and technical innovations can be found in their immaterial intangible structure. The innovation does not occur in the medium of technical artifact but at the level of social practice. A social innovation is [a] new combination and/or new configuration of social practices in certain areas of action or social contexts prompted by certain actors or constellations of actors in an intentional targeted manner with the goal of better satisfying or answering needs and problems than is possible on the basis of established practices" ((2010, p. 21)).

Furthermore, a shift from current operational practices in GPNs to more socially sustainable ones can be seen as a transition. These types of transitions are described in theories such as Technological Innovation Systems, Transition Management, Strategic Niche Management and the Multi-Level Perspective (Lachman 2013), of which we will focus primarily on the last of these.

More specifically, the aim of this paper is to present a heterodox and heuristic model to analyze what we will call behavioral transitions to sustainability (BTS), using a combination of the Multi-Level Perspective (MLP), Dialectic Issue Lifecycles (DILC) and two behavioral models. With strong roots in science and technology studies, transition theories like the MLP approach have to date had a strong focus on technological transitions. However, in the context of sustainability transitions, which often require a change in behavior (Kemp, van Lente 2011), technological innovations are not always an effective solution (Lachman 2013). Particularly in the context of social sustainability, which so far has been neglected in the field of sustainability transitions, the focus of transitions needs to be first and foremost on changing attitudes, behaviors and the criteria used for decision-making, rather than on changing the technology employed, both on the part of producers and consumers (Lachman 2013). The focus in BTS is therefore on social innovations that involve changing existing behaviors to address specific sustainability issues.

We suggest that an analysis using the birds-eye view approach provided by the MLP can lead to valuable insights for behavioral transitions to sustainability. However, as "an abstract analytical framework that identifies relations between general theoretical principles and mechanisms," (Geels, Schot 2010, p. 19) it cannot be used to study specific details of the processes and interactions taking place during a transition: complementary theories are needed to operationalize the MLP (Geels 2011). However, while a number of authors have applied Strategic Niche Management and/or Transition Management to concepts akin to BTS as they will be defined in Chapter 3.1 (Morris et al. 2014; Rotmans, Fischer-Kowalski 2009), few studies have used the MLP for this purpose (Elzen et al. 2011 being a notable exception). This paper seeks to address this gap in the current literature by introducing a heterodox approach based on the MLP, the DILC model and two models of behavioral change to operationalize the analysis of behavioral transitions to sustainability.

The paper is structured as follows: Chapter 2 provides an overview of the relevant theoretical background on the MLP, the DILC model and two models of behavioral change. Chapter 3 defines behavioral transitions to sustainability in greater depth and presents a Behavioral Model of Sustainability Transitions. Finally, Chapter 4 concludes and discusses further planned research.

2 Theoretical Background

This chapter will review the state of the art of those three theoretical constructs that form the foundation of the Behavioral Model of Sustainability Transitions. Section 2.1 focuses on socio-technical transitions, the MLP, sustainability transitions and transition pathways. Section 2.2 shows the evolution from Public to Dialectic Issue Lifecycles, including their recent empirical applications. Finally, Section 2.3 introduces two related models of behavioral change, the stage model of self-regulated behavioral change (focusing on individuals) and the corporate comprehensive action determination model (focusing on companies).

2.1 The Multi-Level Perspective on Socio-Technical Transitions (MLP)

Socio-technical transitions "are seen as co-evolutionary processes, which take decades to unfold and involve many actors and social groups" (Geels 2012, p. 471). The Multi-Level Perspective on socio-technical transitions shown in Figure 1 shows a visual representation of these processes and consists of a three-tiered framework made up of the landscape, regime, and niche levels, where each level represents a "heterogeneous socio-technical configuration" (Geels, Schot 2010, p. 18).

Socio-Technical Regimes

At the center of the three levels is the socio-technical regime. As originally developed in the context of engineering, a regime is "the rule-set or grammar embedded in a complex of engineering practices, production process technologies, product characteristics, skills and procedures, ways of handling relevant artifacts and persons, ways of defining problems – all of them embedded in institutions and infrastructures" (Rip, Kemp 1998, p. 338). While technological regimes primarily involve engineers, socio-technical regimes can involve a much larger set of actors, including researchers, regulators, users and consumers, lobbyists and civil society. These groups interact based on clear and articulated rules and are, in various configurations, mutually dependent upon each other within the regime (Geels, Schot 2010, pp. 18–20). Because regimes are often complex constructs whose individual components have to be well-coordinated in order to function, they tend to be fairly stable. Their harmonization and continuity leads to path dependencies, so that the selection environment within the regime is strongly shaped by "webs of interdependent relationships with buyers, suppliers, and financial backers … and patterns of culture, norms and ideology" (Tushman, Romanelli 1985, p. 177). This does not imply, however, that regimes cannot change; rather, they are character-

ized by a dynamic stability that allows for incremental adjustments, but is strongly resistant to major changes (Geels, Schot 2007, 2010).

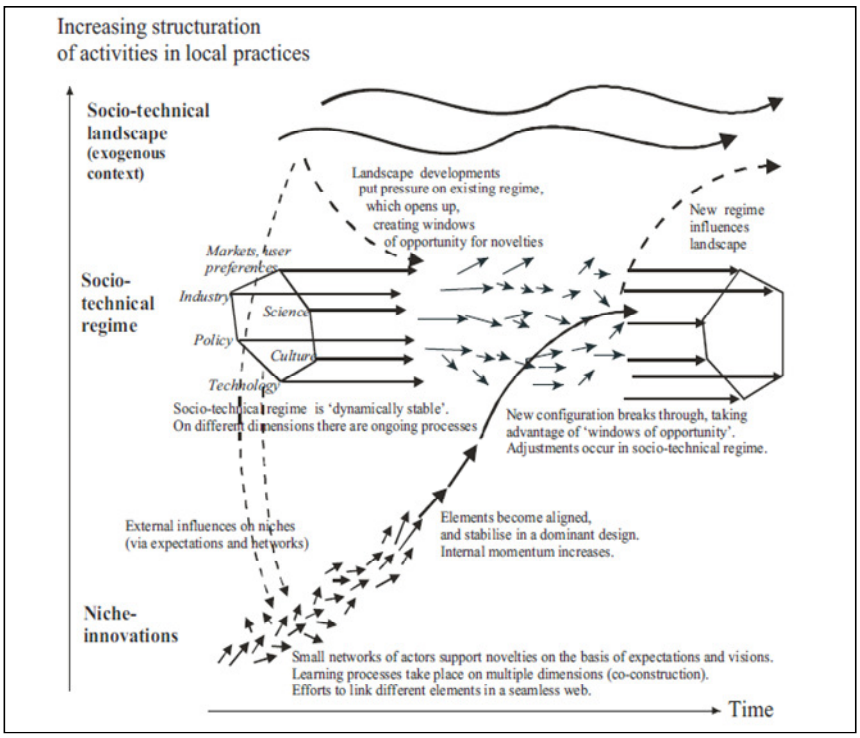

Figure 1: Multi-Level Perspective on Transitions (Geels, Schot 2010, p. 25)

Niches

Radical innovations, in turn, usually develop in niches that form at the bottom of the framework. Niches are spaces that "are protected or insulated from 'normal' market selection in the regime [and can thus] act as 'incubation rooms' for radical novelties" (Schot 1998; as cited in Geels 2002, p. 1261). They are not inherently part of the world, but rather come (and go) based on the creation and acceptance (or failure) of innovative ideas and activities: "niches do not pre-exist, waiting to be filled, they materialize as the product of organizational activity. Organizations do not … fortuitously fit into predefined sets of niche constraints; rather, they opportunistically enact their own operating domains" (Astley 1985, p. 234). Consequently, whether a niche will be successful or not cannot be predicted ahead of time, since the process is heavily actor-centric (Sarasvathy, Dew 2005): first, early niches are strongly shaped by the objectives, skills, values and identity of the entrepreneurs involved; second, success depends in no small part on the willingness of various (external) stakeholder groups to support a new idea or process, commit to it for a potentially long period of uncertainty and accept the possibility of changes in the concept along the path of development.

Novelties that develop in niches are often suboptimal and not yet ready for large-scale deployment; instead, they are tested and improved within the safe confines of the niche until they are ready to be introduced to the market at large. This phase can last a long time – Geels and Schot suggest that two to three decades are quite realistic (2010) – and only a small number of these "hopeful monstrosities" (Goldschmidt 1933; as cited in Mokyr 1990) ever makes it out of the niche.

The Role of Co-Evolution in the MLP

However, the difficulty of leaving the niche is not based only on characteristics of niche innovations. Regimes in the MLP are considered to be co-evolutionary, which means that there are reciprocal effects between the evolution of technologies and corresponding institutions and infrastructures in society, contributing significantly to the stability of existing regimes. Path dependencies are created and niche innovations are forced to compete not only against a mature technology, but also against the entire set of institutional rules, practices and organizational norms that are associated with it. Thus, "[t]he regime's cognitive, normative, and regulative institutions act to establish and reinforce stability and cohesion of societal systems" (Rotmans, Fischer-Kowalski 2009, p. 9), making it particularly difficult for niche innovations to break into the regime. In fact, such a development often requires that a number of factors outside of the niche and regime align, which is where the landscape level comes into play.

Landscapes

The 'socio-technical landscape' is "an external structure or context for interactions of actors" (Geels 2002, p. 1260) located above the regime. It consists of all of the factors that make up the environment within which a regime and niche exist, but that are not part of these levels. Examples of landscape factors can include the political environment, culture, and global grand challenges, such as climate change (Köhler 2011).

As can be seen in Figure 1, the landscape exerts an influence both on regimes and niches and can, after a transition to a new regime, likewise be influenced by the new regime. However, the landscape changes much more slowly than regimes and niches, due to its size and internal interrelatedness: "Fluctuations in one trajectory (e.g. political cycles, business cycles, cultural movements, lifecycle of industries) are usually dampened by linkages with trajectories" (Geels, Schot 2010, p. 21). But when one change is particularly extreme or multiple related changes come together at the same time, these "changes in trajectories [can be] so powerful that they result in mal-adjustments, tensions, and lack of synchronicities" (Geels, Schot 2010, p. 21). These tensions can put pressure on the existing regime, leading to a ‚window of opportunity', through which

niche innovations can diffuse more widely. Often, this is the necessary external assistance that niche innovations require to break out of the niche.

Sustainability Transitions

The MLP originated in the realm of historical-technological analysis, most famously to analyze the transition from sailing ships to steamships (Geels 2002). More recently, scholars have begun to distinguish between historical transitions and sustainability transitions (Geels 2010; Smith et al. 2010; Lachman 2013). In contrast to historical transitions, which use hindsight to analyze transitions that have already taken place, sustainability transitions are more "purposive" (Geels 2011, p. 25) and forward-looking (Lachman 2013; Geels 2011; Kemp, van Lente 2011). They are also clearly goal-oriented: a concrete objective is set from the beginning and attempts are made to steer the transition towards that end.

Like all transitions, sustainability transitions usually encounter resistance from the existing regime, which is "stabilized by lock-in mechanisms" like previous investments, production processes, infrastructure systems, skill sets, built-up tacit knowledge and laws and regulations (Geels 2010, p. 495). Many realms where questions of sustainability are particularly pressing are dominated by large firms with corresponding economies of scale and complementary assets, such as advanced skills and extensive networks. Moreover, since sustainability is a collective good, achieving it often does not bring immediate individual benefits, meaning that sustainable products often perform worse on price/performance aspects than do conventional products. All of these factors combine to give the proponents of a stable regime a significant advantage over those actors who create niche innovations (Geels 2011). The path dependence that results from these lock-in mechanisms thus makes sustainability transitions complex and multi-dimensional processes whose success depends on a large number of interrelated factors being just so at the right time.

Transition pathways

To clarify the process of diffusion when a window of opportunity opens up, Geels and Schot have defined four different transition pathways: transformation, de-alignment and re-alignment, technological substitution and reconfiguration (2007). This is to say that not all transitions take place identically. Geels and Schot have identified two key variables that determine which transition pathway is expected to apply in a given scenario: the timing and nature of interactions between the three MLP-levels.

As described above, when the regime experiences enough pressure from the landscape, a window of opportunity opens up for niche innovations. The level of maturity

attained by a niche innovation at this point in time plays a key role in determining the course of the remaining transition. While innovation maturity is a subjective concept,

> "the following proxies [have been suggested] as reasonable indicators for the stabilisation of viable niche-innovations that are ready to break through more widely: (a) learning processes have stabilised in a dominant design, (b) powerful actors have joined the support network, (c) price/performance improvements have improved and there are strong expectations of further improvement (e.g. learning curves) and (d) the innovation is used in market niches, which cumulatively amount to more than 5% market share" (Geels, Schot 2007, p. 405).

If the innovation is ready to be rolled out to a larger and more competitive market, it can take advantage of the window of opportunity and diffuse more widely. On the other hand, if the innovation is still in the early stages of development and still dependent on the protective nature of the niche, the window of opportunity may close prior to successful diffusion.

In either scenario, the second important factor in determining the transition pathway is the nature of the interaction between niche innovations and the current regime: "Niche-innovations have a *competitive* relationship with the existing regime, when they aim to replace it. Niche-innovations have *symbiotic* relationships if they can be adopted as competence-enhancing add-on in the existing regime to solve problems and improve performance" (Geels, Schot 2007, p. 406, sic, emphasis in the original).

Table 1: Overview of transition pathways

		Nature of interaction	
		Symbiotic	Competitive
Status of niche innovation	Immature	Transformation pathway	De-alignment and re-alignment pathway
	Mature	Reconfiguration pathway	Technological substitution pathway

Using the different possible manifestations of these two variables, four distinct transition pathways emerge, as can be seen in Table 1.

2.2 Dialectic Issue Lifecycle (DILC) Model

The Dialectic Issue Lifecycle Model arose out of the Public Issue Lifecycle, which examines the development of public responses to a specific trigger event or issue. In this context, 'issues' are defined as "social problems that may exist objectively but become 'issues' requiring managerial attention when they are defined as being problematic to society […] by a group of actors or stakeholders […] capable of influencing either gov-

ernmental action or company policies" (Mahon, Waddock 1992, p. 20). This implies that, first, social problems can exist without becoming issues and second, there is a developmental process necessary to turn social problems into issues.

This process is represented by the Public Issue Lifecycle (Figure 2), which shows changes in public awareness and concern with regard to a particular issue over a period of time. The cycle, as it is shown here, consists of four phases, beginning with a trigger event that leads to an expectational gap (Gap Phase) and ending either in a resolution of the issue (Litigation Phase) or, in the case of failure to resolve the issue, alternately in intensified concern or apathy amongst the public (Coping Phase).

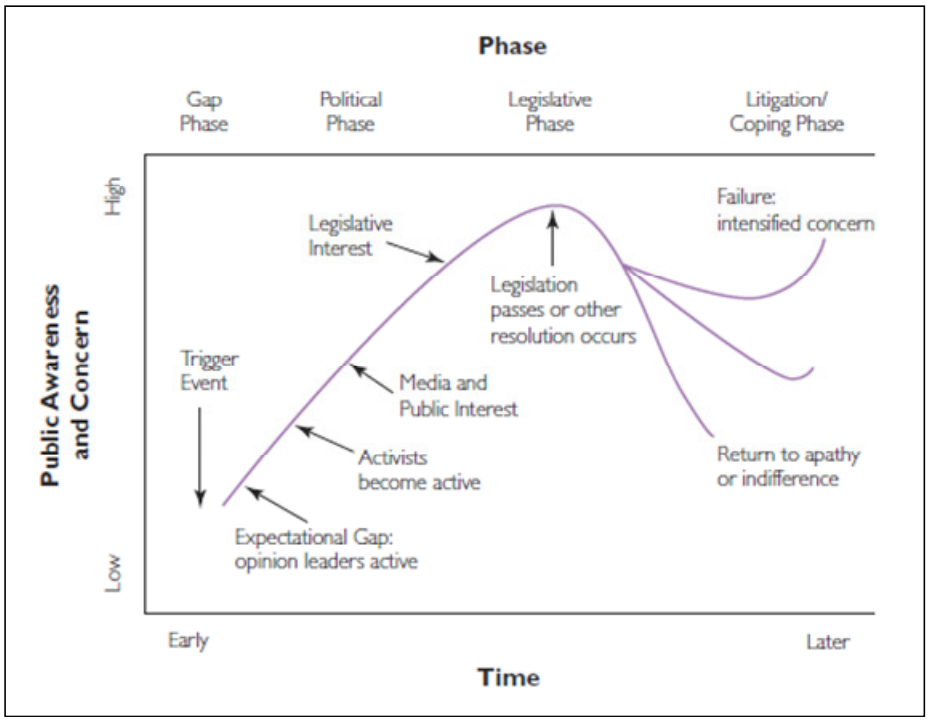

Figure 2: Public Issue Lifecycle (Waddock, Rivoli 2011, p. 91)

To describe company reactions to a particular issue throughout the lifecycle, Waddock and Rivoli cite a quotation by Gandhi: "First they ignore you, then they laugh at you, then they fight you, then you win" (Mahatma Gandhi, as cited in Waddock, Rivoli 2011, p. 87). Thus, in the first two phases, companies try to downplay an issue, in the third phase they become defensive, and in the final phase, they acquiesce and change their behavior in accordance with the issue of concern, perhaps even discovering new business opportunities in the process (Henderson 2015).

Building upon this Public Issue Lifecycle, Geels and Penna have created the Dialectic Issue Lifecycle (DILC) model, which "conceptualizes the co-evolution between the dy-

namics of a societal problem ('issue lifecycle'), in terms of social and political mobilization processes leading to pressures on an industry, and the dynamics of industry responses, including technical innovation and broader corporate strategies" (Penna, Geels 2015, p. 1030). The authors elaborate the model in a series of case studies analyzing corporate behavioral changes that result from public 'issue pressures' (Penna, Geels 2012, 2015; Geels, Penna 2015). They first introduce the descriptor 'dialectic' to the name to draw attention to the pressures in the model resulting from opposing views and opinions held by various actors involved in the issue lifecycle (Penna, Geels 2012). This conflict is further illustrated by the structure of their five phases, which each include 'problem-related pressures' and corresponding 'industry responses' (Geels, Penna 2015). A summary of the five phases can be found in Figure 3.

Phases	Dynamics of societal 'problems' and associated 'pressures'		Dynamics of 'solutions' and strategies of incumbent industries	
	Socio-political pressures	Economic pressures	Socio-cultural, and political strategies	Technology and innovation strategies
1: Problem emergence, and industry neglect	The problem first emerges when activist groups articulate concerns. Uncertainty about causes and consequences gives rise to sense-making.	No specific pressure from task environment.	Incumbent firms do not recognize the problem, or downplay its importance.	No technology strategy is deployed in response to the issue.
2: Rising public concerns, and defensive industry responses	Activists create a social movement that pushes the issue onto public agendas. Increasing public worries create pressures on policymakers who express concerns and create committees (symbolic actions).	Relative regime outsiders (e.g. suppliers, foreign firms, new entrants) begin to develop technical solutions.	If further denial of the problem damages reputations, firms defend themselves by creating a closed industry front that contests claims from social movements and lobbies policymakers.	Firms may develop incremental technologies that stay within the bounds of the existing regime.
3: Political debates/controversies, and defensive hedging	Rising public attention pushes the problem onto policy sub-system agendas, leading to formal hearings and investigations.	Alternatives may find a foothold in small market niches linked to 'moral consumers'.	Industry actors argue that regulations are not necessary, because they will 'voluntarily' implement (incremental) solutions. They may also emphasize costs or technical complexity.	Incumbents *publicly* portray radical solutions as unfeasible. For defensive reasons, however, industry actors may hedge and privately explore radical solutions in laboratories.
4: Formation and implementation of substantive policy, and industry diversification	Escalating public concerns pushes the problem onto macro-political agendas where politicians may introduce radical legislation. This is followed by policy implementation by administrative agencies.	Regime outsiders lead developments targeted at the growing (but limited) 'moral consumer' market segment. However, concerns do not (yet) spill over to mainstream markets.	Firms and industry associations contest the formation and implementation of radical policies. First-mover firms may, however, argue for tougher regulations to raise costs for competitors.	Firms diversify and increase R&D investments in radical alternatives. Individual firms embrace the new technology more enthusiastically to 'jockey for position' in the expectation of growing markets. This could cause cracks in the closed industry front and lead to an 'innovation race'.
5: Spillovers to the task environment, and strategic reorientation	The problem may lead to new markets when public discourses lead to changes in mainstream consumer preferences or when regulators substantially change economic frame conditions (through taxes, incentives, legislation).		To take advantage of economic *opportunities*, incumbents reorient towards the new technology and markets. Addressing the problem also becomes part of the industry's core beliefs and mission, leading to further transformation of the industry regime.	

Figure 3: Summary of DILC phases (Penna, Geels 2015, p. 1032)

In their second elaboration of the model, the authors argue that the lifecycle, as previously described, is too linear and that many issue lifecycles are of a more cyclical nature, where issues can move back and forth between different phases repeatedly before any type of end point (resolution or failure of the issue) is reached (Geels, Penna 2015).

In their final elaboration of the model, Penna and Geels introduce a combined quantitative/qualitative approach. Four proxies are used to measure issue awareness for various actor groups:

- public attention is measured through a media analysis (keyword-based *LexisNexis* searches);
- similarly, political attention is assessed using *HeinOnline* searches in the *Congressional Record* and *Federal Register*;[2]
- industry attention is measured twofold: first, through a keyword-based article count in an industry magazine, and
- second, technical developments are taken into account through patent analysis (Penna, Geels 2015, p. 1033).

The quantitative data is used to identify sub-periods in the 33-year period of the case study, which are matched with major events identified from literature (both specific to the issue at hand (internal) and tangentially relevant (external)). Causality is then examined more closely using a longitudinal qualitative case study that aims to create a "comprehensive multi-dimensional analysis" of the issue and corporate responses (Penna, Geels 2015, p. 1034) that is in part based on the Triple Embeddedness Framework (TEF) shown in Figure 4.

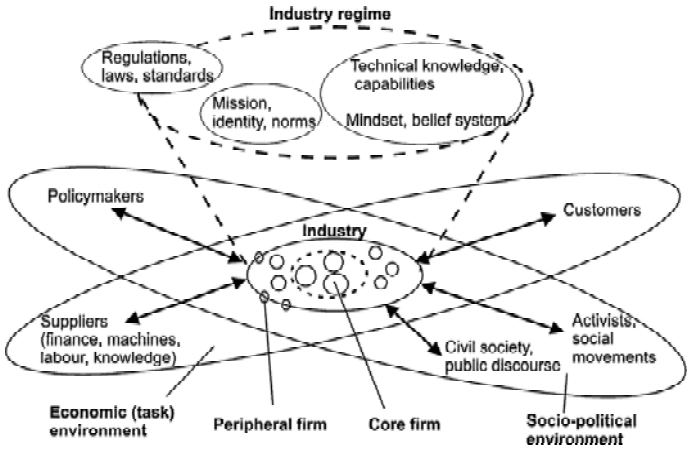

Figure 4: Triple Embeddedness Framework (TEF) (Geels 2014, p. 266)

While the TEF is related to the MLP, it focuses primarily on the industry regime and includes niche and landscape actors only indirectly insofar as they impact this industry regime at the center of the model. It thus takes on a meso-perspective, whereas the

[2] The paper specifically focuses on the American automobile market.

MLP allows for both a macro-perspective (landscape level) and a micro-perspective (niche level).

2.3 Models of Behavioral Change: SSBC and Corporate CADM

An increase in sustainability necessarily requires a change in behavior, both on the part of individuals and corporations. While corporations are made up of individuals, their collective structure and internal routines and processes must be taken into consideration when analyzing behavioral changes, which is why two separate – but closely related – behavioral models will be discussed below, one for individuals and one for corporations. Both models build upon foundations from the psychology of environmental decision-making and behavior, including Ajzen's theory of planned behavior (TPB) (Ajzen 1991) and Schwartz and Howard's norm-activation model (NAM) (Schwartz, Howard 1981; see Klöckner 2013 for a detailed review). The TPB assumes that an intention leads to a behavior and that this intention is based on attitude, norms and perceived behavioral control (PBC).[3] The NAM extends the TPB and specifically models helping behavior, which takes place when pre-existing norms become 'activated'. This activation process requires the following four conditions to be met:

> "(1) a person needs to be aware of the need for help […](2) a person needs to be aware of the consequences [of] a certain behaviour […] (3) a person needs to accept responsibility for his or her actions […] and (4) a person has to perceive him- or herself as capable of performing the helping action, which is a construct comparable to perceived behavioural control" (Klöckner 2013, p. 1030),

which then lead to the activation of the personal norm and consequently a specific (change in) behavior. These and other similar theories thus focus primarily on the process of forming an intention (or activating the personal norm) and assume that the corresponding behavior then follows automatically. However, a number of studies have shown that this assumption does not reliably hold true and "that intervention techniques targeting the intention determinants attitude and [perceived behavioral control (PBC) have] negligible effects on actual behavior" (Bamberg 2013, p. 151).

3 PBC is defined as „people's perception of the ease or difficulty of performing the behavior of interest" (Ajzen 1991, p. 183).

2.3.1 Stage model of self-regulated behavioral change (SSBC)

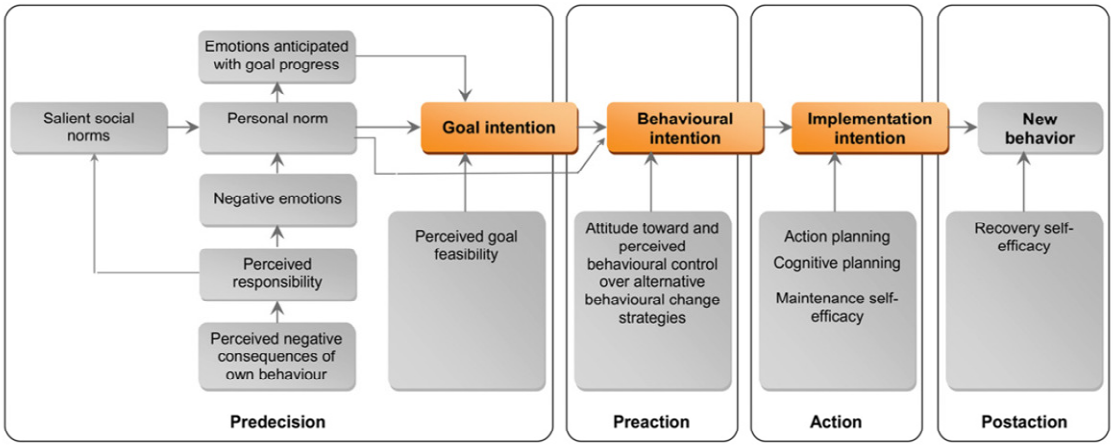

Figure 5: Stage model of self-regulated behavioral change (Bamberg 2013, p. 153)

With regard to individuals, one suggested explanation for this discrepancy is that "events like unforeseen barriers/temptations or simply forgetting the intention may interrupt the intention-behavior relation," so that an actual change in behavior requires an individual to pass through a series of sequential steps or stages, from the recognition of a problem through the identification of a possible solution and finally the implementation of said solution in the form of an action (Bamberg 2013, pp. 151–152). Along the way, various factors influence the success or failure of this undertaking: Figure 5 shows the stage model of self-regulated behavioral change (SSBC model), including four different stages (predecision, preaction, action and postaction) and the processes that take place within each stage.

The basic assumption of the stage model is that people generally act in a habitual manner and only change their behavior if such a change is specifically motivated (Bamberg 2013). Since the predecisional stage is closely modeled on the NAM, which is a model of altruistic behavior (Schwartz, Howard 1981), the motivation in this case is that a person realizes that his/her personal behavior has or may have negative consequences on others (development of problem awareness) and assigns herself responsibility for it. This assignment of responsibility leads both to negative emotions (such as guilt) and/or reputational concerns if the behavior or negative consequences are seen to break with accepted social norms. Either of these responses can activate a 'personal norm', which is a perceived moral obligation to help others in a given situation (Klöckner 2013). The activation of the personal norm leads to the formation of a goal intention and, if the goal appears feasible, the person commits herself fully to it. If, on the other hand, the accomplishment of the goal seems unlikely, she "will probably

choose 'escape' as the best strategy to reduce negative feelings, for example, by denying personal responsibility" (Bamberg 2013, p. 153).

Once a goal intention has been formed, the person must decide how to accomplish this goal. This process takes place in the preactional stage, where advantages and disadvantages of different behavioral options, including perceived behavioral control, are weighed against each other. When a behavioral intention has been set, the action can be performed in the appropriate situation (action stage). In the postaction stage, the individual evaluates the action and its outcomes and decides how to handle the given situation in the future.

2.3.2 Corporate comprehensive action determination model (C-CADM)

With regard to organizational behavioral change, only the TPB had been applied to corporations up until recently, thus neglecting both the role of personal norms and other relevant factors, such as habits and routines that are essential in structuring a firm's day-to-day operations. To address this gap in the literature, Lülfs and Hahn modified Klöckner's comprehensive action determination model (CADM) (Klöckner 2013), which is quite similar to the SSBC, to create a corporate version that will be referred to as the C-CADM here (corporate comprehensive action determination model) and can be seen in Figure 6 (Lülfs, Hahn 2014).

The C-CADM is not shown as a stage model,[4] meaning that unlike in the SSBC, time is not shown as an explicit component. Instead, however, the C-CADM includes habitual processes and organizational routines. Habits are an implicit part of the underlying assumptions of the SSBC, but do not show up explicitly in the model. Organizational routines, on the other hand, exist only in corporations: Lülfs and Hahn posit that

> in the corporate context, […] individual habits are molded by organizational routines […]. These routines are included in organizational culture as they are linked to "higher order" corporate assumptions and values […]. They can have a fundamental impact on sustainable behavior in companies because they determine and require (interdependent) individual routines and habits (carried out by multiple actors)" (Lülfs, Hahn 2014, p. 54).

Another subtle difference between the two models is that between PBC and perceived sustainability-related climate: "We propose to include […] "perceived sustainability-related climate" […] as a specific form of perceived behavioral control in the model, as it covers more overt, observable attributes of the organization […] than organizational

4 Note that the numbers in Figure 5 do not indicate an order of steps, but are rather references to the textual explanations in the work of Lülfs and Hahn.

(sub)culture" (Lülfs, Hahn 2014, p. 53). As examples of such attributes, they cite "*objective* constituencies at the organizational level, such as incentive systems or company codes of conduct [, which have…] an influence on the employee's perception of the company's sustainability-related climate" (Lülfs, Hahn 2014, p. 53, emphasis in original).

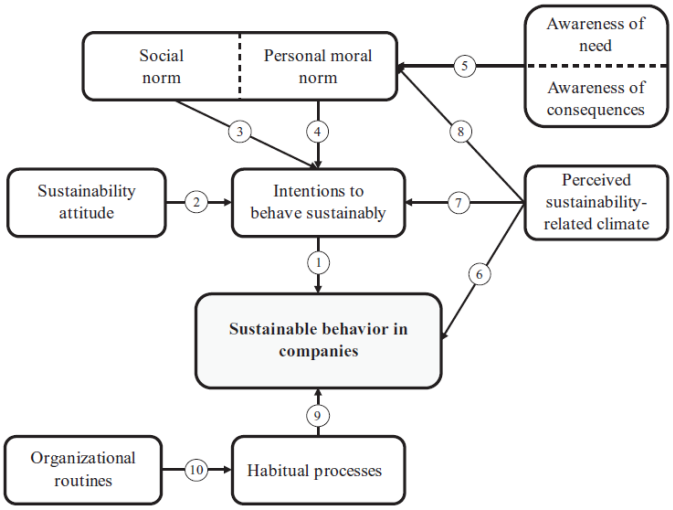

Figure 6: Determinants of sustainable behavior in companies (Lülfs, Hahn 2014, p. 49)

It thus follows that a person's perception of behavioral control varies depending on whether he/she is acting as an individual – which generally implies both a greater degree of independence, but also a smaller degree of power and financial means – or as an employee of a larger organization, expected to conform (to some degree) to the firm's values, but also able to make use of its larger influence and resources. These differences should be kept in mind when comparing behavioral changes in individuals with those in corporations.

3 A Behavioral Model of Sustainability Transitions

The prior chapter described the relevant existing literature on the MLP, DILC and SSBC. In order to apply this existing work to questions of social innovation, such as global production networks oriented toward social sustainability, a few modifications need to be made. In this chapter, we therefore propose a heuristic and heterodox approach to analyzing sustainability transitions that places a stronger emphasis on behavioral aspects than has been done in most transitions studies to date. Traditionally, MLP studies focus on transitions that take place on the supply side (Shove, Walker 2010). Furthermore, supply and demand are often treated as abstract variables on the macro-level of an economic model. Here, instead, the goal is to provide better insight into the decision-making and behavioral processes that take place on the micro-level, looking at transitions in behavior both inside individual corporations (on the supply side) and in individual consumers (on the demand side) along global production networks.

Some work has been done in this area. Particularly the contributions by Penna and Geels (2015; 2015; 2012) on Dialectic Issue Lifecycles provide important foundations for the model presented here. In contrast to the prior work on the DILC model, the approach presented in this paper uses the MLP, rather than the TEF, as a framework for transition and to explain the stability of the regime through co-evolutionary processes. Furthermore, the DILC model will be modified to better illustrate the *cyclical* nature of the issue lifecycle and the process of change over time. It will also be combined with two behavioral models: the C-CADM to show and analyze changes in corporate behavior, and the SSBC to incorporate the same processes for consumers.

The Behavioral Model of Sustainability Transitions that results from these modifications is a single, integrated approach that can be operationalized for an empirical analysis of behavioral transitions to sustainability. As such, it lends itself better to the analysis of transitions towards greater *social* sustainability, which tend to be less technology-focused and therefore arguably more subtle and harder to grasp than transitions involving technological innovations. Nevertheless, we believe that the approach can likewise be applied to corresponding questions of ecological sustainability and behavioral transitions in the adoption of new technologies.

3.1 Behavioral Transitions to Sustainability

3.1.1 Defining Characteristics

To date, sustainability transition scholars have primarily focused on technological solutions to sustainability problems, i.e. socio-*technical* transitions with a focus on tech-

nical, rather than social, innovations. As a result, they have defined concepts and analyzed transitions from a very technology-centric point of view. As Shove and Walker point out,

> "the *socio* element of *socio*technical change typically refers to the fact that innovations are shaped by social processes rather than to the ways in which technical systems are implicated in defining and reproducing daily life. Partly because of this tendency to focus on questions of supply, somewhat less attention has been paid to patterns of demand inscribed in what remain largely technological templates for the future. Where the *socio*- of sociotechnical does refer to forms of practical know-how and to routines and expectations that sustain and are part of incumbent regimes, the driving interest is in how these arrangements configure the conditions of future innovation: not in how they evolve themselves" (Shove, Walker 2010, p. 471, emphasis in original).

However, regardless of whether the solution to a sustainability issue involves technological innovations or not, it almost always requires adjustments in people's behaviors in order to be effective. Kemp and van Lente remind us that "[c]atering to people's desire for comfort, convenience and low costs may not lead to sustainability transitions. [… S]ustainability transitions require that people accept constraints and are willing to live and behave differently" (2011, p. 124). In order to assess whether such a transition in behavior is taking place, several characteristics of both the MLP and transitions need to be redefined. First, in the context of behavioral transitions to sustainability, a regime is made up of structure, culture, and practices (SCP):

> "By structure, we mean physical infrastructure (physical stocks and flows), economic infrastructure (market, consumption, production), and institutions (rules, regulations, collective actors such as organizations, and individual actors). By culture, we mean the collective set of values, norms, perspective (in terms of coherent, shared orientation), and paradigm (in terms of way of defining problems and solutions). And by practices we mean, collectively, production routines, behavior, ways of handling, and implementation at the individual level, including self-reflection and reflexive dialog." (Rotmans, Fischer-Kowalski 2009, p. 8)

In BTS, therefore, regimes are characterized not by the employment of a particular set of technologies, but rather by a particular set of norms and values (culture) that manifest themselves in a certain type of behavior (practice) and are supported by corresponding infrastructures and institutions (structure). In the context of GPNs for consumer products, the current regime is primarily oriented towards profit-maximization, and concerns regarding sustainability, particularly social aspects early in the production process, are still the exception. The corresponding niches, in turn, differentiate themselves from the regime not primarily through the use of innovative technologies, but rather through innovative practices, i.e. social innovations, based on novel underlying structures and norms. With regard to consumer products, there are various niches that promote possible solutions, from independently certified products to those produced locally in Europe or the US under corresponding labor laws. Note that traditional socio-

technical transitions can include behavioral transitions to sustainability as well: as described above, a move towards sustainability almost always requires a corresponding change in behavior. The primary difference between socio-technical transitions and BTS, then, is one of focus. Recalling the statement by Shove and Walker above, the primary interest of BTS is in the evolution of structure, culture, and practices, and not "in how these arrangements configure the conditions of future innovation" (2010, p. 471). It therefore also becomes easier to analyze non-technological, or purely social, innovations using BTS, because the emphasis is not specifically or necessarily placed on technological innovation.

Second, if we continue with the assumption that sustainability transitions require a change not only in technological systems and structures, but also in attitudes, behaviors, and the "*criteria* that actors use to judge the appropriateness of products, services and systems" (Kemp, van Lente 2011, p. 122, emphasis in original), it quickly becomes evident that such transitions are inherently normative. The idea of an "explicitly normative orientation" as a driver for socio-technical transitions has previously been explored by Elzen et al. in the context of animal welfare concerns in pig husbandry, "where the initial impulse for change consist[ed] of normative contestation from regime outsiders" (2011, p. 263), rather than commercial or environmental motivations.

Having a normative orientation as a central driver has a number of important implications. It means that questions of "power, legitimacy, responsibility, [and] governance" (Pettigrew 2012, p. 1325; as cited in Geels 2014, p. 262) become centrally defining characteristics of the transition. In the context of (global) sustainability, moreover, these questions are often directly connected to the sphere of economic decision-making: When a consumer product is purchased, who is responsible for the social, environmental and economic impacts of its production (and eventual destruction)? The brand that commissioned its creation or the owners of the factories where it was manufactured? What about the governments of the countries where it was made, or the consumers purchasing it? The answers to these questions are necessarily complex and can lead to far-reaching implications, which makes BTS particularly challenging.

Finally, as pointed out by Shove and Walker, socio-technical transitions traditionally have a "focus on questions of supply" (2010, p. 471), thus paying significant attention to industrial and governmental actors. While these groups continue to be important in the analysis of BTS, the range of actors that must be taken into consideration when examining the questions of power, legitimacy and responsibility that arise when considering questions both of supply *and* demand (as described in the consumer product example above) must be expanded using a more holistic perspective. All types of actor groups that may have an influence on or be involved in the transition, including but not

limited to firms, consumers, social movements, civil society organizations and social enterprises (see also Geels 2010, p. 506) should be incorporated in the analysis. Moreover, each of these actor groups should be able to occupy any of the three levels of the MLP, depending on the role it plays with regard to the issue under examination.

3.1.2 Co-Evolution in Behavioral Transitions to Sustainability

As described in Chapter 2.1, co-evolution plays a significant role in creating the stability of regimes. Speaking of socio-technical transitions, Geels states that "[t]he MLP has a focus on technology-in-context and emphasises [sic] co-evolution of technology and society" (2005, p. 682). The DILC-model, in turn, "emphasizes the co-evolution between the dynamics of societal problems and the emergence and application of (technical) solutions, and the struggles, disagreements, and conflicts involved in this co-evolution process" (Geels, Penna 2015, p. 67). Behavioral transitions to sustainability, similar to the DILC model, focus on the dynamics of societal problems specifically in combination with the emergence of alternative behaviors as solutions, including, as above, the conflicts that result from this process. Examples of behavioral niches that might lead to such transitions with regard to social sustainability in GPNs include the production and consumption of fair trade products, certain aspects of the sharing economy and the use of the so-called Common Good Balance.[5]

3.2 Operationalization of BTS

The contributions by Penna and Geels (2015; 2015; 2012) on Dialectic Issue Lifecycles are strongly intertwined with the Triple Embeddedness Framework (TEF) rather than the MLP. As previously explained in Chapter 2.2, the TEF represents a meso-perspective with a strong focus on the industry regime, while the MLP incorporates both a micro (niche level) and macro (landscape level) perspective. Since cultural changes must be situated at the macro-level and behavioral/normative changes ultimately take place on the micro-level, the micro- and macro-perspectives are key components of behavioral transitions to sustainability, making the MLP the more appropriate approach for BTS. However, the micro-perspective of the MLP with its focus on niches is still not detailed enough to show changes on an individual level and will therefore be combined with the SSBC.

The general dynamics of the transition process as shown in Figure 1 and described in Chapter 2.1 are the same for BTS as for socio-technical transitions. The MLP thus pro-

[5] See https://www.ecogood.org/en

vides a useful birds-eye-view perspective also for BTS, but it is missing a key element: a method to operationalize the insights provided by the approach. For socio-technical transitions, it may often be possible to quantify the maturity and diffusion of a technological innovation by looking at indicators of efficiency, production volumes, cost, etc. Still, even for technology-focused transitions, the missing operationalizability of the approach has been criticized repeatedly (Lachman 2013; Genus, Coles 2008; Genus, Nor 2007). For BTS, quantification is considerably more difficult as there are few measurable indicators and much of the transition itself takes place on a subjective (normative) level. In order to enable empirical analysis of BTS nevertheless, the MLP must therefore be combined with other approaches that are more readily operationalizable, as has been suggested numerous times before (Geels 2011; Geels, Schot 2010). The remainder of this chapter will present a heterodox approach to BTS that combines the MLP with both the DILC model and the SSBC in order to increase its operationalizability.

3.2.1 Combining the MLP and DILC

Both the MLP and the DILC model show a transformation taking place over time, where time is on the x-axis. However, because the y-axis in the two models cannot be matched up – the MLP uses it to illustrate multiple levels, while the DILC model presents a measure of public awareness and concern – the two models cannot simply be overlaid. But mapping the five DILC phases described by Penna and Geels (2015, p. 1032) onto each of the models begins to illustrate their relationship, as can be seen in Figure 7. To clarify it further, Table 2 describes the characteristics of each DILC phase as they apply to the three MLP levels, based on the problem-related pressures and industry responses described in Geels and Penna (2015).

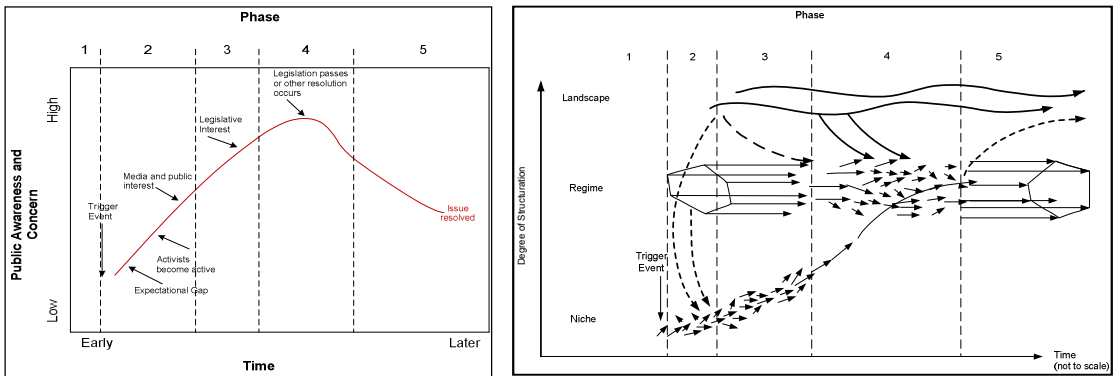

Figure 7: Mapping the DILC phases onto the Issue Lifecycle (a) and MLP (b)

The landscape level of the MLP has sometimes been criticized as being too vague (Genus, Coles 2008; Genus, Nor 2007); while the DILC phases in Table 2 include all

three levels, the actual curve in the DILC model can be seen as representing primarily landscape pressures, where the peak in Phase 4 is the window of opportunity for niche innovations to break into the regime. This means that in the context of transitions, issues are often resolved through 'other resolutions' (regime transition) rather than legislation, although particularly in the context of (social) sustainability, issues do usually include a political component.

Table 2: Characteristics of each DILC Phase by MLP Level (based on Geels, Penna 2015)

DILC Phase	MLP Level	Characteristics
Phase 1	Niche	- Issue identification & articulation
	Landscape	- General public, policymakers unaware/indifferent
	Regime	- Corporations can safely ignore the issue
Phase 2/ Trigger Event	Niche	- Social movement emerges, resource mobilization
		- New entrants explore radical alternatives
	Landscape	- Trigger event increases media reporting & public awareness
	Regime	- Politicians take symbolic action
		- Companies downplay issue (framing)
		- Industry invests in early incremental R&D attempts
Phase 3	Niche	- Niche markets form and sell to 'moral consumers'
	Landscape	- Media reporting & public attention increase further
		- Issue framing and negotiations take place in public debate
	Regime	- Companies defend status quo, threaten economic decline
		- Some companies begin to invest in R&D of radical alternatives
		- Policymakers are under pressure to take a stand
Phase 4	Landscape	- Public attention rises dramatically - issue attains "celebrity status"
	Niche/Regime	- Strategic competition for power: early-mover incumbents & new entrants
	Regime	- Policymakers forced to take action
		- Infrastructure emerges to address the issue
		- Companies change status quo at varying speeds
		- Dual approach: fighting changes, investing heavily in new alternatives
		- Changing expectations create both economic threats and opportunities
Phase 5	New Regime	- Option 1: Alternatives become commonplace, accepted, expected
		- Option 2: Alternatives become mandated by law
		- Consumer preferences reflect issue resolution
		- Firms reorient and the regime transforms

3.2.2 The Cyclical Dialectic Issue Lifecycle Model (C-DILC)

Note that the DILC model in Figure 7a is limited to the curve showing a successful issue resolution, since this is the outcome that most closely resembles the complete transition process of the MLP (Figure 7b). However, both models leave room for alternative outcomes in theory, but while these alternatives are worked out in detail through the various transition pathways of the MLP, for the DILC model, they have only been discussed rather vaguely. Figure 8 therefore shows some modifications to Waddock and Rivoli's PILC model, including the implementation of Geels and Penna's suggestion that issue lifecycles are often more cyclical than linear (2015).

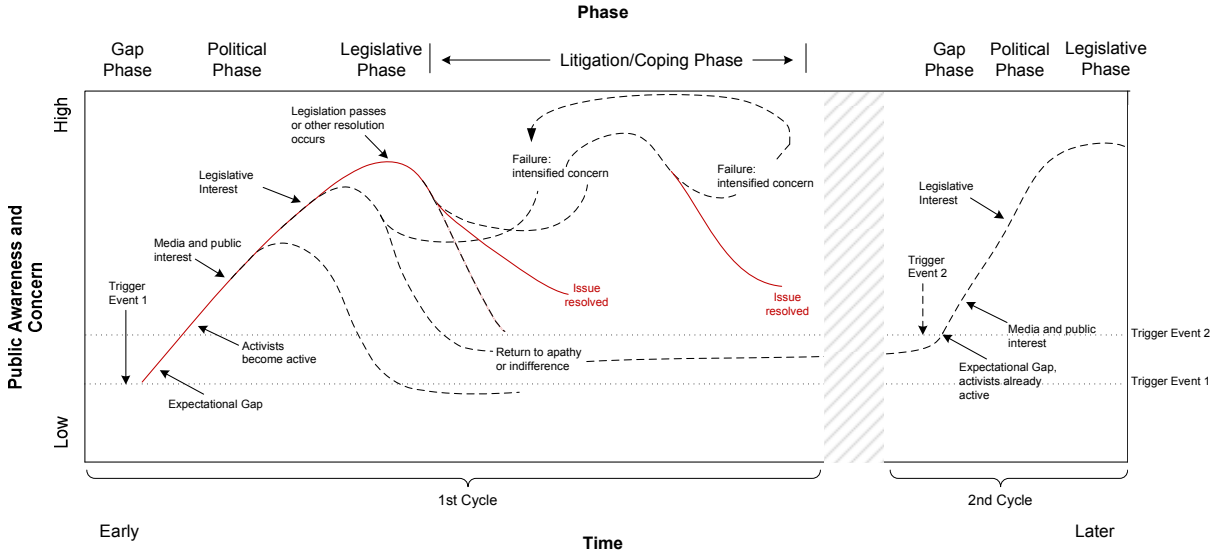

Figure 8: Cyclical dialectic issue lifecycle (C-DILC) model (adapted from Waddock, Rivoli 2011, p. 91)

First, the complete lifecycle ('1st Cycle') has been branched out further, beginning with a return to apathy or indifference shortly after the start of media and public interest. The previous representation of the lifecycle from the PILC model seems to imply that all public issues follow the same path to (and eventually reach) the legislative phase. In reality, however, many issues that are discussed publicly never reach the point of legislation. Instead, public attention often decreases after a short 'hot phase' and stays minimal unless another trigger event rekindles concern for the issue. Because the vertical axis shows *public* awareness and concern, a problem must at least have reached the stage 'media and public interest' in order to fit the definition of an 'issue' given in Section 2.2.

The next curve (after legislative interest) reflects a similar branching as in the original model: once public awareness has increased enough to peak political interest, a failure to reach the legislative phase may, in addition to a return to apathy, also already lead to intensified concern.

The two solid red lines in the first cycle lead to issue resolution, making them the only paths that end the issue lifecycle completely. For all other paths leading either to apathy/indifference or to intensified concern, future cycles are possible. If failure leads to intensified concern, a return to apathy is unlikely, so that concern will stay high until the issue is resolved ('intensified concern cycle').

A return to apathy or indifference, in turn, becomes the new status quo until a new trigger event resurrects the issue and the initial cycle repeats itself, albeit at a more ad-

vanced rate. Note that the level of public awareness and concern stays somewhat higher during the apathy phase than it was prior to the first trigger event. Consequently, the level of public attention also starts at a higher level after a subsequent trigger event and the further 'milestones', i.e. activist involvement, media reporting and legislative interest are reached more quickly in future cycles, since the public, media and political apparatus have all been primed for the issue already. While only the start of the second cycle is shown here, *n* future cycles can follow according to the same pattern, subject only to the development of a particular issue.

Expanding the DILC model in this way to create a *cyclical* dialectic issue lifecycle (C-DILC) model is important for the application to the MLP, because transitions often take place over two to three decades and tend to be anything but linearly continuous. Landscape pressure on the regime is unlikely to increase so dramatically as to open up a window of opportunity for niche innovations as a result of a single trigger event. Thus, it is key to have a clearer understanding of what happens at the end of each cycle in the C-DILC model, as most transitions probably require a significant number of cycles before being completed.

3.2.3 The Role of the SSBC and C-CADM in BTS

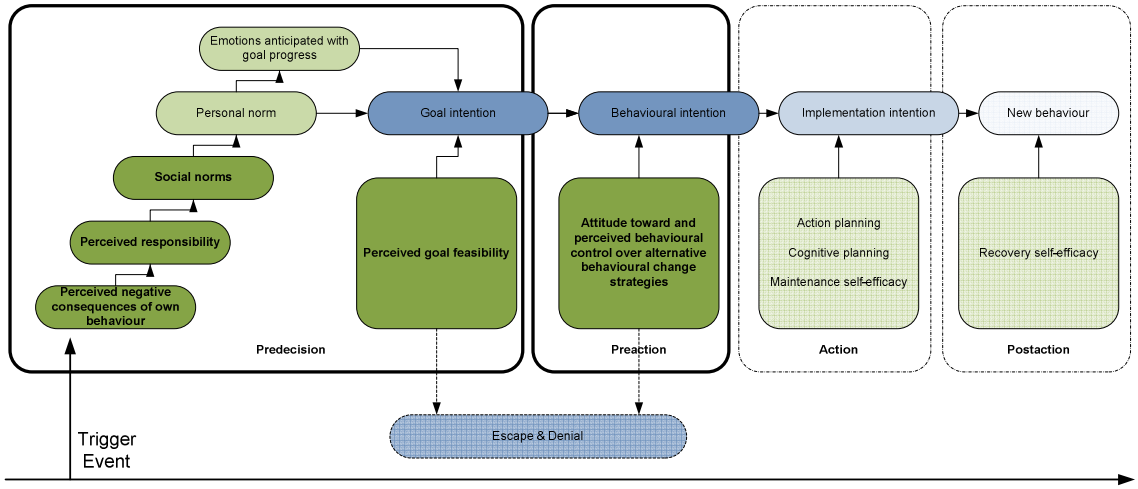

Figure 9: SSBC model highlighting points of relevance for BTS (adapted from Bamberg 2013)

There are several points in time in the C-DILC model where, if issue resolution is not achieved, the curve of public awareness either drops to apathy or rises to intensified concern. While the model accounts for these turning points descriptively, it does not explain how each outcome is determined. In the context of BTS, the SSBC and C-CADM models can provide valuable insights into this process. Note that the 'public' in

the C-DILC model can consist both of individuals as consumers and individuals as corporate employees. Since decision-making in a corporation continues to be a process carried out by individuals, albeit with added constraints in the preaction and action stages (see Figure 10), the following description will explain the turning points in the public awareness curve using the SSBC model of individual behavioral change. The developments are quite similar in the corporate context, with the main difference being that individuals are not making decisions for themselves, but rather in the context of their organization, meaning that there are additional constraints, such as the attitudes, habits and routines of coworkers and the expectations of supervisors. While these are quite relevant when behavioral changes are put into action, they do not much impact the process being described here.

From the perspective of BTS, the first two stages of the SSBC model are of particular interest, since they are most strongly dependent on external influences. First, in order for individuals to become aware of the negative consequences of their actions and their personal responsibility in the matter, they need to understand the impacts of their own behavior. For questions of sustainability, these impacts are often far removed, either in time or in geography. An understanding of the complex relations between individual decision-making and sustainability-related outcomes thus requires extensive research (usually by experts), the results of which must be communicated to the public via the media or in awareness-raising campaigns before individuals can be expected to commit to behavioral change.

Moreover, in addition to awareness, the SSBC model shows that individuals must also perceive their goal intentions to be feasible and their behavioral change to lie within their control. If, then, an individual becomes aware of the negative consequences of his/her behavior but sees no readily-available and adequate solutions in society or on the market, he/she will abandon the goal intention and instead choose escape and denial, thus returning to apathy or indifference. Here, niche alternatives can play a critical role: for individual consumers, buying more sustainably produced niche products can represent a feasible alternative to their previous behavior, i.e. consumption habits. For corporate employees, the availability of sustainability consultants, trainings, software, labels, NGO partners, etc. could represent a viable alternative that can support the firm in its attempt to adjust its behavior without having to first perform extensive research on questions of sustainability.

This still leaves the question of when the public awareness curve turns to intensified concern. If, at the time of increased public awareness, there is a niche available that can provide an adequate solution to the issue, this availability allows concerned individuals to follow through on their behavioral change intentions. However, a stable re-

gime will likely become defensive rather than changing immediately, which then leads to intensified concern among the public, assuming that enough individuals have already changed their behavior and continue to uphold public concern.

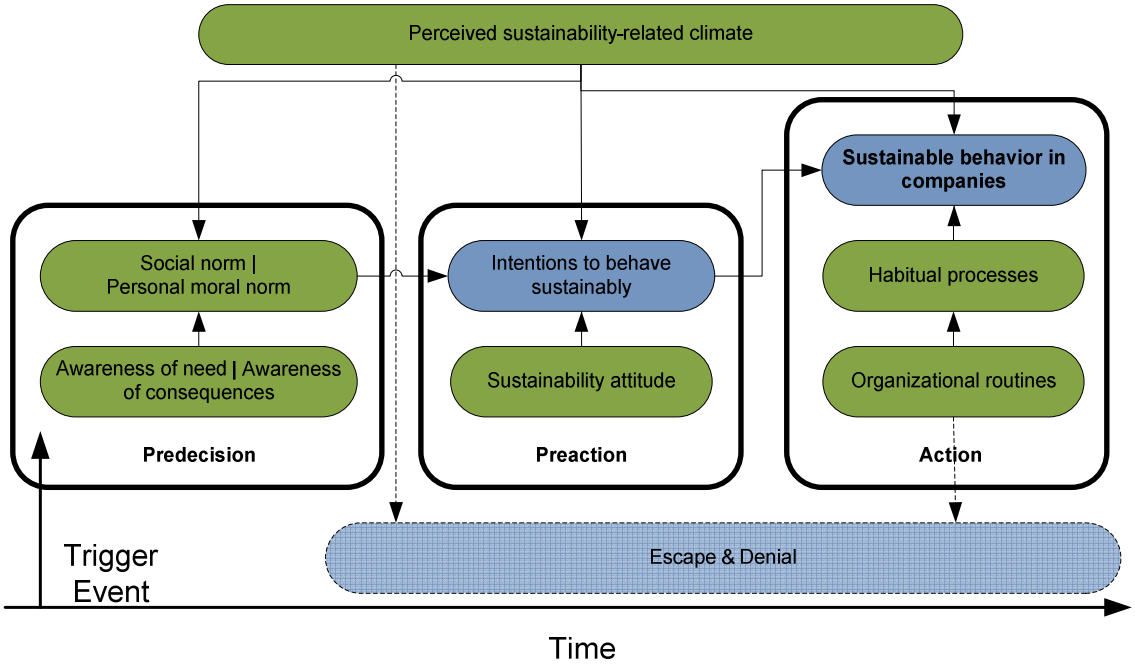

Figure 10: C-CADM presented as a stage model, including a trigger event (adapted from Lülfs, Hahn 2014)

To illustrate these processes more clearly, we first modified the C-CADM to reflect the stage approach of the SSBC to ease comparison between the two models. We do not believe that this change impacts its validity, as it is primarily cosmetic. Thereafter, we adapted both the SSBC (Figure 9) and C-CADM (Figure 10) models to more clearly indicate the passage of time and the trigger event using a superimposed x-axis. Lastly, we explicitly show the option of "escape & denial" in the models (as explained in Chapter 2.3), which individuals would likely choose if the perceived goal feasibility, behavioral control or sustainability-related climate are too low.

As can be seen in Figure 11, which finally combines the MLP, C-DILC, and SSBC/C-CADM into a single Behavioral Model of Sustainability Transitions, if a niche fails to grow adequately after a trigger event because too many actors choose escape & denial rather than changing their behavior towards greater sustainability, the BTS process breaks down, leading to a return to apathy. In this case, the old regime is unaffected. If, on the other hand, a significant number of actors engage in behavioral change – thus becoming part of the niche – at the same time as public awareness and concern increase landscape pressure on the regime, a window of opportunity opens up. If the

BTS succeeds and the regime undergoes transition, the issue is resolved and a new regime forms.

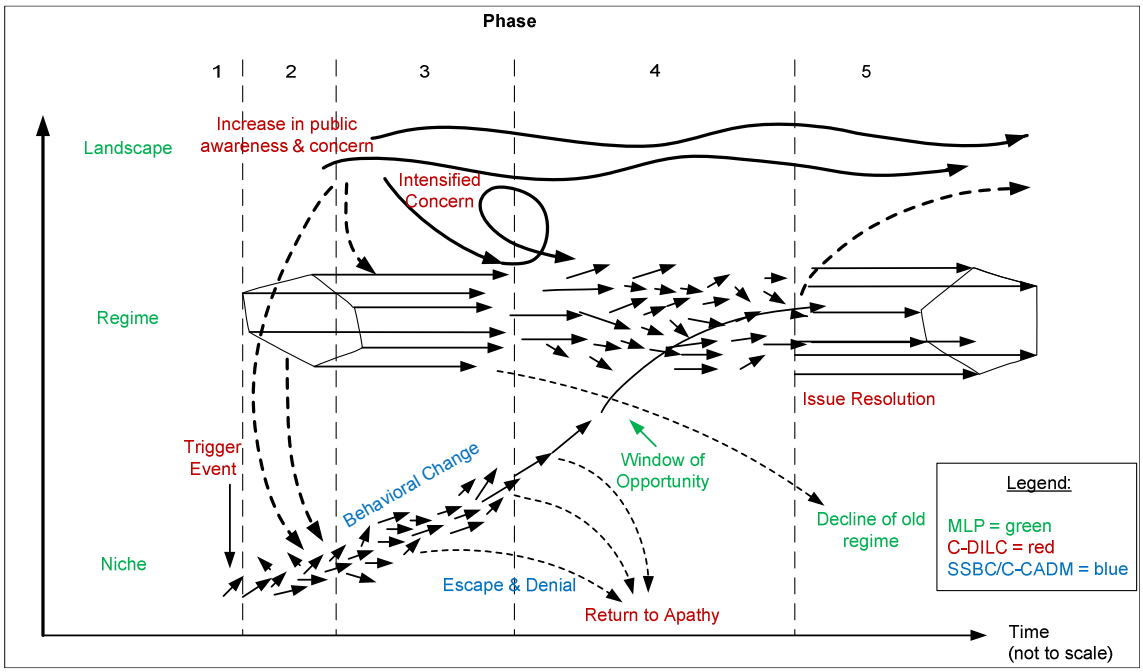

Figure 11: Behavioral Model of Sustainability Transitions

Since the MLP illustration shows a linear (and successful) process of transition, it is somewhat difficult to incorporate the path of intensified concern into the figure. The looping arrow in Phase 4 is nevertheless an attempt to include the intensified concern cycle already shown in Figure 8 in the Behavioral Model.

3.3 Empirical Application of BTS

Having described the theoretical operationalization of BTS in depth, we now turn to the empirical application of this heterodox model. Similar to the DILC model described in Section 2.2, the BTS model uses a combined quantitative and qualitative approach, described in detail below.

3.3.1 Quantitative Analysis

Quantitative data forms the basis of the C-DILC model analysis. As described by Penna and Geels (2015), the measurement of public awareness and concern requires the identification of relevant proxy variables. We likewise propose using the *LexisNexis* database to search through media reports. Penna and Geels limited their searches to four large newspapers and articles that included their search strings in the headlines. They report their findings on an aggregated-by-year basis.

Since the case studies that will be conducted in our research are quite recent (what Elzen et al. refer to as "transitions in the making" (2011, p. 263), we suggest using a more fine-grained search approach. Specifically, when looking at such an ongoing transition that may not yet have progressed to the later DILC-stages where public awareness rises significantly, it makes sense to first conduct searches on a daily basis,[6] including all sources, and allowing references to the search terms to be found anywhere in an article. This way, early references to the issue can be caught even before it has reached mainstream newspapers. Moreover, using the daily search approach, the data can also be used to more easily identify relevant events in the case study. Searches limited to large and representative newspapers can then be included in addition to the 'all-inclusive' search strategy to depict the progress of issues in mainstream news sources.

The data sources used to measure political and intra-industry attention must necessarily be tailored to the specific case study. For social innovations, patent analysis makes little sense; depending on the object of study, there may be other relevant proxies, such as the spread of specific initiatives (for example, transition towns or repair cafes) or the amount of national and international research funding that is available for a particular issue.

Particularly for a transition that is already fairly advanced, quantitative data may also be used to analyze the progression of a behavioral transition from niche to regime. Proxy indicators might include market shares of particular business models, such as car- or ride-sharing, or the number of active users of a socially innovative service model. Geels and Schot (2007) suggest a number of proxy indicators to judge when a niche innovation is mature enough to break into the regime, including a niche market share of 5%. To a lesser degree, the results of representative marketing or opinion surveys may be of interest, although these should be treated with caution, as research has repeatedly shown a gap between intention and behavior (Bamberg 2013).

Examining the data from appropriate sources for a particular case study can provide a general overview of the progression of the issue lifecycle and transition, including pinpointing the timing of specific trigger events (which should cause a spike in media attention) and indicating whether and when issue lifecycles have taken place. Through the combined analysis of media and political attention to a particular issue, it is possible to analyze the progress of these lifecycles to a certain degree: if the issue has not caught the attention of policymakers yet, the lifecycle cannot have progressed beyond

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6 Conducting daily searches over a lengthy period of time is too labor intensive to do manually, so we suggest the use of a simple automation script.

the early stage of phase 3; once politicians become aware of it, at least phase 3 has been reached, etc.

3.3.2 Qualitative Analysis

Once this general picture has been established, the quantitative analysis should be complemented by an in-depth qualitative case study. An evaluation of a transition using the DILC phases described in Figure 3 and Table 2 requires a detailed understanding of events related to the issue in question. The term 'event' should be defined broadly in this context; examples from the niche include civil society actions, such as the publication of investigative reports or the staging of protests, trigger events that catapult the issue into the media, as well as milestones (or failure) of niche projects that demonstrate alternative behaviors. Events from the regime can consist of press releases or official statements in response to the niche, symbolic actions to address rising concerns, or research and development of alternative behaviors. Depending on the issue in question, there may also be lawsuits and political investigations, hearings or debates. Note that in the early stages of a transition (primarily Phase 1), a regime's lack of acknowledgment (i.e. ignoring) of problem articulation by niche activists should also be included as an 'event', since it is an indicator of the regime's early behavioral pattern.

Since time is an important factor in all of the approaches that make up the BTS model, the list of relevant events should be organized chronologically and assigned to one of the five DILC phases and three MLP levels. Coding the events by DILC phase allows patterns to emerge that indicate the path of the lifecycle over time. Assigning events to the MLP levels and examining their development over time clearly shows the interactions between niche, regime and landscape. As Penna and Geels suggest, the aim of the qualitative approach is the development of "a comprehensive multi-dimensional analysis" of a niche-articulated problem and the corresponding regime response (2015, p. 1034).

Given this paper's focus on transitions in the making, our assumption is that the transition has not yet been completed. Once the qualitative analysis of events has been completed, it can be matched against the SSBC and C-CADM models to identify which stages of the behavioral models have been successful, resp. where escape and denial is taking place. More specifically, with regard to the BTS model described here, there are three milestones of particular relevance:

1. Perceived negative consequences: Has public awareness of an issue risen enough to make individuals aware of the negative consequences of their own actions?

2. Perceived goal feasibility: Have social innovations in the form of alternative behavior solutions been communicated sufficiently to make the goal appear manageable to an individual?
3. Perceived behavioral control over alternative behavioral change strategies: Are the necessary institutional and infrastructure prerequisites readily available for behavioral alternatives, so that these behaviors can actually be put into practice?

The qualitative analysis of events described above can give insight into the status of each of these milestones, which are prerequisites for a successful behavioral transition towards sustainability. Identification of the most likely points of escape and denial in the behavioral stage model allows actors pushing towards a sustainability transition to tailor their actions more clearly to the stage where behavioral change is most likely to break down and thus increases their chances of success.

4 Conclusion

The Behavioral Model of Sustainability Transitions advances previous scholarly work by expanding both the applicability and the operationalizability of the MLP approach. In contrast to the traditional analysis of socio-technical transitions, it focuses on behavioral transitions to sustainability, which are normatively driven changes in a conglomerate of structures, culture, norms and practices that are a key element of long-term transitions towards greater sustainability. This shift in perspective away from technology-driven solutions also allows the MLP approach to be applied more effectively to social aspects of a transition, making the analysis of social sustainability issues more feasible. By combining the MLP with the DILC model, specific empirical indicators can be derived as proxies for issue awareness, as was described in Sections 2.2 and 3.3. The expansion of the DILC model to the C-DILC model, in turn, allows for a long-term analysis of ongoing transitions of a cyclical nature. Finally, the incorporation of the SSBC and C-CADM models gives new insight into the processes that take place during a behavioral transition to sustainability and, of particular importance, the points where it is likely to fail or succeed.

As a next step, the Behavioral Model will be tested empirically according to the process described in Section 3.3 by applying it to two case studies on social sustainability in global production networks, one focusing on smartphones and the other on clothing. In both cases, it is hypothesized that a behavioral transition is in progress, but not yet complete. In future research, the Behavioral Model should further be tested and verified by applying it to historical developments in which the behavioral transition to sustainability being examined has already been completed. Furthermore, it would be interesting to incorporate the different transition pathways discussed in Chapter 2.1 into the Model.

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