Societal problems and industry reorientation: Elaborating the Dialectic Issue LifeCycle (DILC) model and a case study of car safety in the USA (1900–1995)

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**Abstract**

Addressing societal problems requires the reorientation of firms-in-industries, including changes in technology, belief systems, and mission. The paper aims to make two contributions to the Dialectic Issue LifeCycle (DILC) model, which captures the dynamics of socio-political mobilization around societal problems and industry responses. First, the five phases in the DILC-model are elaborated with insights from social movement theory, political science, public attention, issue management, corporate political strategy, and innovation management. Second, a ‘cyclical’ lifecycle pattern is explored, in which a social problem does not linearly progress through successive phases, but can also move ‘backwards’ if public attention or political will decrease. We explore these contributions with a longitudinal study of the car-safety problem and responses from American automakers (1900–1995). We use a combined quantitative-qualitative method that employs coupled time-series analyses as support for an in-depth case study. The case study showed that the industry long denied the influence of car design on fatalities, and reluctantly changed its position in the mid-1960s (under pressure from public opinion and policymakers). In the late-1980s, when markets emerged because safety became part of consumer preferences, the industry implemented comprehensive changes in technology, beliefs and mission.

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1. Introduction

This paper deals with societal problems and the reorientation of firms-in-industries to address these problems through changes in technology, belief systems, and industry mission. This topic has been under-studied in innovation studies, as Morlacchi and Martin (2009: p. 575) note in an evaluation of progress in the field: “We still don’t have a very satisfactory theory of social change. Our ability to improve social problems remains rather limited, and we do not know why we appear to have only modest gains in relation to many societal problems”. This relative knowledge gap is becoming increasingly pertinent with the rise of the new agenda of grand societal challenges such as climate change, energy security, food safety, and obesity.

While Foray et al. (2012) made an important step by addressing the topic of societal problems from the perspective of innovation systems and mission-oriented R&D, we aim to further develop the Dialectic Issue LifeCycle (DILC) model (Penna and Geels, 2012), which focuses on the strategic decisions of firms-in-industries to develop and deploy technical solutions to societal problems, and highlights the dynamics of societal problems in terms of social, political, and cultural mobilization. So, the DILC-model warns against the reification of societal problems and the assumption that we all agree about the definition and importance of societal problems. It also warns against the idea that addressing them is merely an engineering or managerial challenge of developing and implementing solutions. Instead, the DILC-model 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.

Penna and Geels (2012) developed the DILC-model as an outline framework in the context of greening of industry debates, providing a brief description of the model’s five phases and an illustrative case study of interactions between the air pollution
problem and strategic responses from the American car industry (1943–1985). The model’s core logic is that social, cultural and political mobilization processes around a problem gradually lead to increasing pressures on an industry and that firms-in-industries reluctantly reorient towards more substantive technical solutions. Firms initially resist substantial reorientation, because they are ‘locked in’ by industry regimes which contain four core elements (Geels, 2014): (a) technical capabilities and routines (i.e. technological regimes), (b) industry beliefs and mindsets, (c) mission and identity, and (d) formal policies and regulations. Because of various lock-in mechanisms, firms-in-industries initially tend to downplay the importance of societal problems or resist substantial technical changes. The ‘un-locking’ of firms and the move towards reorientation therefore tends to require increases in socio-political pressures, resulting from mobilization processes.

To capture the temporal dynamics (‘lifecycle’) of societal problems and industry responses, the DILC-model distinguishes five phases. Societal problems (or ‘issues’) first emerge in civil society (with activists, disadvantaged groups or researchers articulating criticisms), then spill over to wider publics, and then enter policy debates. While mobilization in the first three phases mainly occurs in the socio-political environment, the societal problem affects the industry’s economic environment in the fourth and fifth phase, first via substantive legislation that affects economic frame conditions, followed by changes in consumer preferences and market demand. With regard to industry responses, the DILC-model suggests that firms initially ignore or deny the societal problem, then use various tactics to defend the existing industry regime, and adopt hedging strategies in the third phase. In the first three phases, firms are mainly defensive. Only when increasing pressures begin to affect the economic environment do industry actors move towards diversification and reorientation in phases 4 and 5. Reorientation implies substantial change in the industry regime, i.e., not only in technical capabilities, but also in belief systems, identities, and industry mission.

Penna and Geels (2012) qualified their issue lifecycle model as dialectic to highlight the struggles between the build-up of problem-related pressures and responses from incumbent industry actors. Addressing societal problems should therefore not be seen as a consensual managerial challenge, but rather as a deeply contested process with multi-dimensional struggles between many stakeholders (firms, policymakers, consumers, wider publics, social movements, activists). Firms-in-industries can be part of the solution to societal problems. But they are also likely to protect their assets, vested interests, and positions for long periods of time, which is why industry reorientation tends to involve increasing problem-related pressures.

The case study of air pollution and the American car industry had a relatively good fit with the DILC-model, particularly in the earlier periods. But Penna and Geels (2012) also identified some deviations, particularly in the two later periods: (a) industry fight-back delayed and watered down implementation of the 1970 Clean Air Act, (b) consumer demand for low-emission cars did not materialize, (c) automakers did not accommodate addressing air pollution problems in their core beliefs or mission.

This paper aims to elaborate the DILC-model in two ways. The initial brief description of the five phases in the DILC-model stayed close to issue lifecycle theory, which Mahon and Waddock (1992: p. 22) criticized for “failing to provide an understanding of what happens within each stage”. The first contribution is therefore to further elaborate core dynamics in each phase by mobilizing insights from other literatures such as social movement theory, political science, public attention, issue management, corporate political strategy, and innovation management.

As a second contribution, we propose that issue lifecycles may follow more complex patterns, which do not move linearly and teleologically from problem emergence (phase 1) to resolution (phase 5). More complex patterns can arise if public and political concerns are not assumed to increase linearly, but can go up and down and up again. So, while the ‘normal’ issue lifecycle pattern is that actors address a societal problem by introducing a substantive solution in the last phase, we aim to further explore the implications of two other possible outcomes in Fig. 1: (a) the proposed solution fails, leading to intensified concern and renewed activism, media interest, and legislative interest, (b) return to apathy: the proposed solution does not work, but the public loses interest in the problem. More specifically, the paper aims to explore a ‘cyclical’ issue lifecycle pattern, in which a problem moves backwards and forwards between phases as problem-related pressures go up and down and up again.

We illustrate these elaborations with a new historical case study: car-safety and the American car industry (1900–1995). This case differs in several respects from the previous air pollution case. First, while air-pollution innovation focused on one component (catalytic converters), safety problems required redesign of multiple components (e.g., windows, body, instrument panels, steering column, seatbelts, airbags, brakes). Addressing safety also required automakers to acquire new capabilities in crash-testing, crash-worthiness engineering, gas transfer (for airbag inflation), and electronics (e.g., collision sensors in airbags). These new bodies of knowledge were not radical, however, in terms of disrupting existing competencies, but additional. Second, while public attention for air pollution followed a single ‘up-and-down’ curve (which peaked in 1970), public attention to auto-safety shows many more

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1 The DILC-model draws on concepts from the triple embeddedness framework (TEF) of industries (Geels, 2014), which conceptualises firms-in-industries as operating simultaneously in two external environments (socio-political and economic) and in the context of an industry regime (which enables and constrains industry actors). Operating in multi-dimensional environments, the TEF suggests that firms-in-industries can use multiple strategies: innovation strategies, economic positioning strategies, political strategies and socio-cultural strategies (e.g. framing strategies, public relations, information campaigns).

2 The latter changes may be more difficult, because they concern changes in ‘ways of being’, while changes in technological and regulatory regime elements relate to ‘ways of doing things’ (Turnheim and Geels, 2013).

3 While Penna and Geels (2012) play on the dialectic notion of thesis (i.e. problem-related pressures), anti-thesis (industry resistance), and synthesis, they do not suggest a strict analogy. Rather than reaching synthesis, they suggest that escalating interactions between thesis and anti-thesis drive the lifecycle to a next phase in the DILC-model.

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Fig. 1. Temporal dynamics of issue lifecycles (Rivoli and Waddock, 2011: p. 91).
‘ups-and-downs’ (see Section 4). Third, contrary to air pollution, safety concerns did (eventually) spill over to consumer demand, which created economic opportunities for safety-innovations. This difference relates, at least partly, to the fact that local air pollution was a collective good problem, whereas car-safety improvements offer private benefits. Fourth, contrary to air pollution, American automakers did (eventually) incorporate safety in their mission and core beliefs, which entailed a cognitive shift from the view that ‘safety does not sell’ to ‘safety as strategic battleground’. Industry reorientation was therefore more comprehensive in the case of auto-safety.

The paper is structured as follows. Section 2 develops the conceptual contributions to the DILC-model. Section 3 discusses case-selection, methodology and data sources. Section 4 presents results of the quantitative analysis. Section 5 presents the in-depth qualitative case study. Section 6 provides a pattern-matching analysis and discussion. Section 7 draws conclusions.

2. Conceptual elaborations of the DILC-model

With regard to the existing issue lifecycle literature, which focuses primarily on civil society and policy, the initial DILC-model (Penna and Geels, 2012) made two contributions. First, it suggested that firms and industries can be part of the solution to societal problems, but that this tends to involve lengthy struggles (hence the ‘dialectical’ prefix) between firms-in-industries and groups mobilizing around societal problems. Second, it suggested that (some) societal problems can be addressed with technical solutions, something that the issue lifecycle literature pays relatively little attention to. With regard to the innovation studies literature, the initial DILC-model suggested that problems have dynamics of their own and that the pressuring pressures influence the willingness of firms-in-industries to develop and implement (technical) solutions. Penna and Geels (2012) developed some initial ideas about the co-evolution between problem-related pressures and strategic industry responses. This paper aims to elaborate and systematize these ideas by mobilizing and integrating insights from various sociological, political science and business literatures. Section 2.1 summarises general principles from these literatures with regard to problem-dynamics in three important domains: civil society, politics and business. Section 2.2 then articulates more specific mechanisms for the different phases in the DILC-model, which relate, amongst others, to: (a) the role of ‘drama’ in attracting public attention and creating credibility pressure on policymakers, (b) the roles of social movements in generating drama and shaping policymaking, (c) the shift of problems from policy sub-systems to macro-political arenas, (d) the creation of closed industry fronts and the emergence of cracks in them, (e) the role of various issue management strategies (e.g. ignoring, symbolic action, substantive action) when problems affect primary or secondary involvement arenas of firms, (f) the scope for industry resistance in policy implementation. The articulation of these mechanisms elaborates the initial DILC-model. Section 2.3 develops the paper’s second contribution by discussing a ‘cyclical’ issue lifecycle pattern.

2.1. General insights from various literatures

2.1.1. Civil society

The sociological literature on public arenas suggests that public attention is an important driver for social problems, because it creates a sense of urgency and credibility pressure on policymakers (Newig, 2004). But social problems need to be defined, interpreted and articulated in order to have social effects (Blumer, 1971), which is why problem definition and framing strategies are important in early phases. Furthermore, public attention is a scarce resource for which multiple problems compete in public arenas such as mass media, parliament and courts (Hilgartner and Bosk, 1988). Public attention to a social problem varies over time and is influenced by drama (associated with scandals, shocks, protests, and framing strategies): ‘The huge number of competing solicitations places a high premium on ‘drama’, encouraging operatives to cast social problems in dramatic and persuasive terms. (…) Operatives and interest groups constantly look for new images and new ways to capitalize on current events to inject urgency into their presentations’ (Hilgartner and Bosk, 1988: p. 61). At any point in time, there are a range of competing social problems which receive different amounts of attention. Hilgartner and Bosk (1988) propose the following problem hierarchy: (1) a few social problems achieve ‘celebrity status’, attracting much attention, (2) a larger number of problems command some public attention; communities of professionals, activists, and interest groups work to keep these problems alive; (3) the majority of social problems remains on the margins of public discourse. Protagonists of social problems aim to move their problem up this hierarchy by attracting more attention.

The creation of organized social movements is an important step in the social mobilization around problems (Elzen et al., 2011). Social movement theory suggests that social movement organizations (SMOs) engage in three kinds of activities to drive problems forward (McAdam et al., 1996). First, SMOs mobilize resources (money, members, expertise) and draw attention to problems through public demonstrations, media campaigns, educational efforts, boycotts, and petitions. These activities aim to imbue social problems with drama and urgency. Second, SMOs aim to shape public debates around social issues by advancing certain frames, discourses and problem definitions that convey urgency and drama (Benford and Snow, 2000). Third, SMOs engage in political activities to push problems onto political agendas. The success of these activities is shaped by (changes in) political opportunity structures, such as shifts in political coalitions, the rise of new political parties, and elections (McAdam et al., 1996).

2.1.2. Politics

Public policies are important to address societal problems, because private actors have few immediate reasons to address them (because of ‘public goods’ considerations). The development and implementation of new substantial policies is a deeply political process, for which political science approaches provide relevant conceptualizations. Punctuated equilibrium theory (True et al., 1999), for instance, distinguishes between macro-politics (associated with Parliament, Congress, and the government) and policy sub-systems (associated with specialists in the bureaucracy, congressional subgroups, interest groups and stakeholders). Most policymaking happens in policy sub-systems, which operate outside the public spotlight. The advocacy coalition framework (ACF) (Sabatier and Jenkins-Smith, 1999) suggests that policy sub-systems are populated by multiple advocacy coalitions, which are networks of actors (agency officials, legislators, interest groups, applied researchers, think tanks) that share a set of policy core beliefs, which include “value priorities and basic perceptions concerning the general seriousness of the problem and its principal causes” (Sabatier and Jenkins-Smith, 1999: p. 122). When one advocacy coalition dominates the sub-system, it has a monopoly on policy agendas. Sub-system policymaking is characterized by incremental change resulting from bargaining among members of (dominant) advocacy coalitions, marginal moves in response to changing circumstances, and first-order learning processes.
Reorientation is a highly strategic process, which top-level managers will only undertake in response to externally imposed regulations (‘compliance’) or if they see possible economic opportunities (e.g. positions in new markets). Radical reorientation is a gradual process progressing through stages: (a) defensive hedging: exploiting existing capabilities and exploring new ones (March, 1991), (b) diversification: milking sunk investments, while introducing new technologies in (small) markets, (c) reorientation, which involves changes in core beliefs, mission, and business models.

Firms are not just economic entities, but also political actors, who can use various strategies to shape the policy process and hinder the progress of issue lifecycles. In the corporate political strategy literature (Yoffie, 1988; Hillman and Hitt, 1999) we can find the following strategies: (1) Information and framing strategies, e.g. setting up research institutes to investigate the problem; using expertise to contest scientific reports about the problem; publishing reports to influence problem framing; testify as expert witnesses in policy hearings. (2) Financial incentives strategies, e.g. making contributions to politicians or political parties; offering politicians lucrative jobs at the end of their career. (3) Direct lobbying strategies, e.g. hiring lobbyists; mobilizing CEOs to speak with politicians. (4) Confrontational strategies, e.g. opposing laws through litigation; threatening policy makers with plant closures, layoffs, or relocation; refusing to obey laws.

When firms-in-industries recognize that shared interests are at stake, they may also create ‘closed industry fronts’ and ‘political coalitions’ (Fligstein and McAdam, 2012: p. 15) that act on behalf of the entire industry. Front organizations or industry associations “can be expected to serve as defenders of the status quo and are a generally conservative force during periods of conflict” (Fligstein and McAdam, 2012: p. 14).

2.2. Towards an elaborated phase-model

Building on the literatures discussed above, this section elaborates the DILC-model by positioning specific insights about causal mechanisms in the five different phases. For each phase, the discussion addresses: (a) the dynamics of societal problems and pressures emanating from activities of social groups, (b) responses from firms-in-industries.

2.2.1. Phase 1: Problem emergence and industry neglect

**Problem-related pressures:** (1) Social problems need to be articulated, as Blumer (1971: p. 301) highlights: “Social problems are not the result of an intrinsic malfunctioning of a society but are the result of a process of definition in which a given condition is picked out and identified as a social problem”. Early problem articulation tends to occur in civil society, e.g. by disadvantaged citizens, researchers or activists, who express concerns about a problem or situation. (2) The wider public, consumers, and policymakers remain unaware or indifferent to the issue.

**Industry responses:** Firms pay limited attention to societal problems, because these do not affect their ‘primary’ or ‘secondary involvement arenas’ (Mahon and Waddock, 1992). When activists are small, scattered and relatively powerless, firms-in-industries tend to downplay their demands. “Corporations can easily ignore demands by a small number of ‘fringe’ activists whose views are not widely shared and who are without power” (Rivoli and Waddock, 2011: p. 90). Early activists have urgent claims but neither power nor legitimacy. Mitchell et al. (1997: p. 875) characterize them as

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5 Tushman and Romanelli (1985) label these last two stages ‘strategic reorientation’ and more fundamental ‘strategic recreation’.
“the ‘mosquitoes buzzing in the ears’ of managers: irksome, but not dangerous”.

2.2.2. Phase 2: Rising public attention and defensive industry responses

Problem-related pressures: (1) The emergence of social movement organizations (SMOs) is an important dynamic in the second phase. SMOs engage in resource mobilization, the articulation of appealing frames and discourses, and public protest activities, which strengthen the urgency of demands and increase media attention. “The emergence of interest groups represents a significant stage in the lifecycle of an issue and can determine whether it will die a quiet death or will be catapulted into public awareness” (Greening and Gray, 1994: p. 476). SMO activities (demonstrations, protests, petitions) also add ‘drama’ to the issue, which increases public attention. (2) Public attention may also rise because of new findings, media reports or shocks that act as ‘trigger events’: “Media play a major role in assigning importance to issues and exposing gaps between business practices and society’s expectations” (Greening and Gray, 1994: p. 475). (3) In response to rising public attention policymakers may engage in symbolic action, e.g. express concerns, organize conferences or create committees to investigate the problem.

Industry responses: (1) Firms-in-industries begin to defend themselves against criticisms when media and public attention affect their ‘secondary involvement arena’. They are likely to engage in symbolic action, which “involves attempts to ‘frame’ an issue” (Mahon and Waddock, 1992: p. 27). They may use “de-dramatizing strategies” (Hilgartner and Bosk, 1988: p. 62) such as denying the existence of the problem, asserting that other matters are more urgent, highlighting uncertainties in the causality of the problem, dismissing the opposing camp as uninformed or irrational, suggesting that the situation or condition is natural, acceptable, or inevitable. (2) Firms may also form a ‘closed industry front’ and create associations to protect collective interests of an entire industry (Fligstein and McAdam, 2012). (3) When further denial of problems damages their credibility, industry actors may accept the existence of a problem and allocate some R&D resources towards incremental innovations that stay within the bounds of the existing regime. Firms may also use these innovation strategies for political purposes, arguing that regulations are not needed because they are already working on solutions. (4) In response to rising public concerns, relative outsiders (new entrants, fringe actors, firms diversifying from other sectors, entrepreneurs) may start exploring radical technical alternatives.

2.2.3. Phase 3: Political debates, controversies and defensive hedging

Problem-related pressures: (1) On-going SMO activities and media reports further increase public attention in the third phase in which policymakers become more seriously involved: “As activism continues, the media tends to take more notice, raising it in public awareness and increasing the likelihood that institutional processes will be set in place” (Rivoli and Waddock, 2011: p. 92). (2) Rising public attention creates credibility pressures on policymakers who may set up investigative committees, hold hearing and organize debates. Participants in these discussions include activists, SMOs and actors from policy sub-systems (e.g. agency officials, bureaucrats, researchers, industry representatives). The debates are not just fact-finding endeavours, but also arenas for framing struggles. “The problem now becomes the object of discussion, of controversy, of differing depictions, and of diverse claims. Those who seek changes in the area of the problem clash with those who endeavour to protect vested interests” (Blumer, 1971: p. 303). Sub-system policymakers tend to address the problem in terms of existing policy beliefs, advancing incremental policy proposals that stay close to interests of the existing advocacy coalition. Problems may remain contained in policy sub-systems if public attention remains below a certain threshold (Newig, 2004). (3) Public concerns may lead to the emergence of small niche markets for radical alternatives, constituted by demand from ‘moral consumers’.

Industry responses: (1) In this phase, industry actors adopt hedging strategies. Their main strategy remains the defence of the existing regime, both through incremental technical innovations and through political strategies such as: (a) downplaying the problem and the need for public policies, (b) claiming that certain solutions are too costly or technologically infeasible, (c) exploiting policymakers’ lack of technical knowledge (‘information asymmetry’) and purposively withholding relevant information. (2) But, recognizing the possibility that the problem may affect primary involvement arenas’ (Mahon and Waddock, 1992), firms invest some money in radical innovation. To prepare for future eventualities, firms thus begin to explore alternatives (March, 1991), either through internal R&D activities or through alliances (with specialist firms, new entrants, outsiders). (3) These hedging strategies may create tensions between efforts to keep the industry together (‘closed industry front’) and the desire of firms to distinguish themselves (e.g. boost reputations with new technologies), (4) Outside engineers, new entrants, fringe firms or suppliers continue to work on alternative technologies and may introduce these into small market niches. They may also use their experiences with new technologies to contest the ‘high cost’ or ‘technical infeasibility’ claims from incumbent firms.

2.2.4. Phase 4: Formation and implementation of substantive policy and industry diversification

Problem-related pressures: (1) Public attention increases rapidly in the fourth phase, leading the issue to acquire ‘celebrity status’ and moving into macro-political arenas. (2) Increasing public attention makes the problem area attractive to policy entrepreneurs and politicians in macro-political arenas (e.g. Parliament, government). “When, public attention poses such political pressure that politicians see themselves forced to act, unless they wish to risk a severe loss of popularity, then political action will be taken” (Newig, 2004: p. 168). (3) High-level policymakers may introduce radical policies to address the problem, which often requires changes in policy beliefs, problem-definitions and issue framing (Sabatier and Jenkins-Smith, 1999). Other actors (SMOs, industry associations, firms, professional groups) may engage in highly visible struggles to shape the policy plans. “The official plan is almost always a product of bargaining, in which diverse views and interests are accommodated. Compromise, concessions, tradeoffs, deference to influence, response to power, and judgments of what may be workable all play part in the final formulation” (Blumer, 1971: p. 304). (4) When a radical policy has been introduced, policy action shifts towards implementation, which is often delegated to agencies and actors in less visible policy sub-systems. Strategies may ensue about detailed technical issues or legal ambiguities, which provide opportunities to oppose: “Legal formalist imagery is at best an abstract ideal and, in reality, the regulatory legal environment is often ambiguous, contested and riddled with loopholes. (…) the overall picture is one of non-compliance, subversion, and evasion” (Edelman and Suchman, 1996: p. 487). Policy implementation may be slow or result in delays and deadlocks.

Industry responses: (1) Because the new policies affect ‘primary involvement arenas’ (e.g. requiring firms to meet new standards), firms engage in substantive action (Mahon and Waddock, 1992). On the one hand, industry actors use political strategies to oppose policies and hinder implementation. On the other hand, their technological strategies move towards diversification and increasing R&D investments in new technologies, partly to comply with regulations, partly in response to possible economic threats (from
outsiders) and opportunities (increasing market demand). (2) This dual strategic orientation causes major tensions in the industry. The closed industry front may begin to crack when existing firms break ranks or when new entrants (or firms from other sectors or countries) move in to ‘jockey for position’. (3) New capabilities and regulations begin to transform parts of the industry regime.

2.2.5. Phase 5: Spillovers to the task environment and industry ‘recreation’

Problem-related pressures: (1) In this phase, the problem begins to affect consumer preferences, which creates markets for radical alternatives and economic opportunities towards which firms can reorient. Consumer preferences may change because public debates alter views about appropriate behaviour. (2) Public policies (e.g. adoption subsidies, taxes, regulations) may also incentivize consumers to change practices and adopt new technologies.

Industry responses: (1) The emergence of new markets changes the economic (task) environment and incentivizes firms to reorient more wholeheartedly. Firms change economic positioning strategies towards the new technology, possibly giving rise to innovation races. (2) The problem becomes part of the industry’s core beliefs and mission, leading to further transformation of the industry regime (Tushman and Romanelli, 1985). These changes are unlikely, however, unless it also makes economic sense to address the social problem.

2.3. Towards a cyclical issue lifecycle pattern

The ‘linear’ DILC-model described above assumes that public concerns and problem-related pressures steadily accumulate in one direction (schematically represented in Table 1).

This assumption may not always be correct, because problem-related pressures like public attention can also decrease when publics realize the high costs of solutions or “become bored by the issue” (Downs, 1972: p. 40). As a second elaboration of the DILC-model, we therefore follow the advice from Bigelow et al. (1993) that it is worth exploring more complex patterns that deviate from the ‘normal’ linear-progression lifecycle, discussed above. In particular, this paper will empirically explore their suggestion that issue lifecycles may follow a cyclical path, in which a problem moves backwards and forwards between phases until it finally reaches resolution. Following the logic of the DILC-model, we suggest that this pattern, in particular the notion that issues may move backwards to previous phases, is related to: (a) weakening problem-related pressures (e.g. decreasing public attention, decreasing political attention, or decreasing political will to address a problem), (b) successful industry resistance (e.g. political lobbying, socio-cultural framing strategies), (c) changing macro-contexts (e.g. economic recessions or changes in political ideology). So, rather than a linear progression through phases (as represented in Fig. 1), we propose that problems may follow a cyclical pathway when struggles between issue-proponents and opponents experience more ups and downs, depending on variations in strategies, coalitions, and external contexts. As far as we know, the notion of a cyclical issue-lifecycle pattern and the proposed causal mechanisms have not yet been empirically explored.

3. Methodology

3.1. Explanation, process tracing, and pattern-matching

The DILC-model can be characterized as a ‘modular explanatory framework’ (Héretier, 2008), which acknowledges that outcomes are related to a multiplicity of factors and actors and that a framework therefore needs to accommodate multiple partial theories or limited causal mechanisms. The elaborated DILC-model in Section 2.2 describes a causal chain, divided into five phases which contain different causal mechanisms, which were drawn from different theories, discussed in Section 2.1. In terms of Hall’s (2006) typology, which distinguishes three kinds of explanation (historically specific, multivariate, and theory-oriented), the DILC-model offers theory-oriented explanation that can “elucidate and test a theory that identifies the main outcomes and attaches special importance to specifying the mechanisms whereby those determinants bear on the outcome” (Hall, 2006: p. 25). For longitudinal phenomena, Hall (2006: p. 25) particularly advocates ‘systematic process tracing’ which he characterizes as follows. “In contrast to historically specific explanation, the object is not to provide a complete explanation for why one outcome occurs at a particular time and place, but to identify the most important elements in the causal chain generating this class of outcomes. In contrast to multivariate explanation, this approach attaches less value to securing precise parameter estimates for a few key variables seen as the ‘ultimate causes’ of the outcome and more value to identifying regularities in the causal chain through which the relevant outcome is generated. The focus is on elucidating the process whereby the relevant variables have effects”. Other scholars have proposed similar ideas under headings such as ‘analytical narratives’ (Bates et al., 1998) or ‘process tracing’ (Vennesson, 2008). So, the DILC-model is a modular explanatory framework that can guide process tracing which is a form of within-case analysis that identifies steps in a causal process leading to certain outcomes. Because process tracing in empirical cases is theory-guided and focused, it deals selectively with only certain aspects of the phenomenon, meaning that some information of unique characteristics is lost (Vennesson, 2008).

The procedure to assess the validity of a conceptual framework is ‘pattern-matching’ which ‘compares an empirically based pattern with a predicted one’ (Yin, 1994: p. 106). Hall (2006) further adds that: “The observations drawn from the cases are compared with the predictions from the theory to reach a judgement about the merits of the theory, on the basis of congruence between the predictions and the observations. This is a matter of judgment, rather than one of tallying points of congruence” (p. 28). Yin (1994: p. 110), too, remarks that pattern matching has elements of interpretive analysis, because it “involves no precise comparisons. (…) This lack of precision can allow for some interpretative discretion on the part of the investigator.” To provide more guidance, our pattern-matching in the analysis (Section 6) will focus on comparing the predicted causal mechanisms in each phase of the DILC-model with the case descriptions (Section 5). A possible risk in pattern-matching is ‘confirmation bias’ with the researcher only selecting information that fits the model (‘cherry picking’). To alleviate this risk our pattern-matching analysis pays special attention to deviations between the DILC-model and the case. Such deviations may actually be productive in terms of stimulating further conceptual reflections.

3.2. Case-selection

To test the elaborations of the DILC-model (Section 2.2) and explore the cyclical issue lifecycle pattern (Section 2.3), we perform a longitudinal case study of the American car industry and the safety-problem (1900–1995). We have chosen a historical case because this enables a study of the entire lifecycle of a societal problem, which is not possible for contemporary problems. Car accidents and fatalities, which in America peaked at 55,000 deaths per year in 1970 (Fig. 2), became a ‘celebrity issue’ in the 1960s when it was seen as a major societal problem by macro-political actors (including the President), public opinion, media, medical professionals, and automakers.

We have chosen the American car industry because we expect struggle and contestation to be particularly present in this
country, due to confrontational relations between industry and policy/society. A complication of this choice is that the car industry globalized during the case study period, implying that foreign-owned car companies also came to operate and sell in the U.S. market. However, the Big Three (GM, Chrysler, Ford) dominated the U.S. market until the mid-1990s, accounting for more than 70% of sales (Fig. 3). Japanese companies, which entered U.S. markets via the small-car segment, did not lead in safety-innovations. German companies, particularly Mercedes (owned by Daimler), did pioneer safety-innovations, but their sales remained limited to the high-end market (Mercedes had 0.69% of market share in 1984 and 0.96% in 1995). Because of this particular position, the case study will discuss them as relative regime outsiders, whose safety-strategies exerted pressures on the focal ‘domestic’ firms and contributed to opening up the industry regime.

The case study not only entailed socio-political mobilization around the safety-problem, but also resistance and (eventually) substantial industry reorientation and technical change. American automakers long denied the role of car design in fatalities, but gradually changed their position, initially reluctantly under pressure from public opinion and regulation (mid-1960s), but more wholeheartedly when safety became part of consumer preferences (late-1980s). We bound the case study in 1995, not because the problem was solved, but because industry actors had by then reoriented and included safety in their mission, beliefs and innovation strategies. The case study also entailed ‘ups and downs’ in public attention and a shift in problem-framing, which changed from an emphasis on road Engineering, law Enforcement, and driver Education (‘3E-framing’) to an emphasis on car design and injury-prevention. So, the case is suited to explore more complex issue lifecycle pathways.

3.3. Methods and data sources

We use a mixed-methods approach, in which a quantitative analysis supports an in-depth qualitative case study. The quantitative method uses four proxies (for public attention, political attention, policy, and innovative activity) to develop longitudinal time-series representations as a first approach to the case. Through an exploratory visual examination (Keim, 2002) and bivariate correlation analysis we aim to find overall patterns. We also use the time-series representations to divide the longitudinal case study

| Table 1 | Accumulation of problem-related pressures in the ‘linear’ DILC-model (the increase in coloured areas indicates the crescendo of pressures related to activities from different social groups). |

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<th>ACTIVISTS, SOCIAL MOVEMENTS</th>
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Fig. 2. Automobile-related fatalities in the United States (based on data from USDOT/FHWA, 2010).

Fig. 3. U.S. total vehicle sales market, 1946–2012 (Sources: until 1960, White (1971); after, Ward’s Automotive).
into shorter periods. We will introduce the four proxies and discuss data sources and limitations.

For public attention, we use newspaper counts as proxy. While this indicator says little about how issues are discussed, this is the best quantitative indicator for public attention, because in modern societies mass media coverage “constitutes by far the most important vehicle for shared attention and political communication” (Newig, 2004: p. 159). Specifically, we searched the electronic databases of the Chicago Tribune, Los Angeles Times, Wall Street Journal, New York Times, and Washington Post with the keywords “auto safety” and “highway safety” (using the boolean operator “OR”). We collected all the articles and plotted the average per year. Methodological caveats that we do not account for are changes in the length of newspaper or changes in editorial styles.

For political attention, we searched the Congressional Record (HeinOnline database) using a set of auto-safety-related keywords. The political attention chart plots the yearly number of relevant publications (outcomes of public hearings, bills proposals, reports). This indicator does not address content, but does indicate the evolving attention for topics. We do not account for temporal changes in the political meaning of hearings and bills.

For policy implementation activity, we searched the Federal Register (HeinOnline database) for the number of publications per year by executive agencies. This proxy does not account for other non-published types of policy action.

As a proxy for technical innovation, we searched the U.S. Patent and Trademark Office database for auto-safety related patents, organized along different types (according to patent classes under which auto-safety features are classified). This proxy indicates general areas of innovative interest in the industry. A drawback is that patents are not necessarily translated into products.

Because the proxies are relatively rough and aggregated, they can only provide general patterns and correlations, but not identify causation. To generate more fine-grained analysis and investigate causation, we therefore perform a qualitative longitudinal case study of the co-evolution of the auto-safety problem and car industry responses. The case study, which will be guided by the DILC-model’s conceptual categories, draws on primary and secondary sources. Primary sources for public protests and discursive framings are articles from newspapers and magazines. For industry views, we draw on industry journals (Ward’s: Automotive News) and advertisements. Additionally, we used secondary addresses that address different aspects of auto-safety: legal and political aspects (Weingroff and Seabron, 2003), public criticisms and discursive struggles (Eastman, 1981, 1984), medical perspective (MacLennan, 1988), insurance industry perspective (O’Neill, 2009), seatbelt and airbag technologies (Miller, 1988; Waters et al., 1998; Strubie, 1998; Strother et al., 2003; Nilsson et al., 2003; Abeles, 2004); organizational, advertising and corporate safety strategies (Stevenson, 2008; Albaum, 2005). By combining these focused studies, we aimed to develop a comprehensive multi-dimensional analysis.

4. Quantitative results

Figs. 4–6, respectively, show the public attention to auto-safety, political attention and implementation activity, and safety patents. Although these graphs should be treated with caution, they show interesting correlations (all significant at the 0.01 level):

- Until 1966, public/media attention (Fig. 4) was strongly correlated with the number of fatalities in Fig. 2 (Spearman’s rho=0.7153). After 1966, the two series show negative correlation: public attention increases while fatalities decline. This discrepancy between public attention and ‘objective’ size of the
problem may be related to increasing cultural sensitivity to safety, which we will investigate in the case study.

- Until 1966, political attention in Congress (Fig. 5) is medially correlated to public attention (Spearman’s rho = 0.5410). Both proxies show similar patterns: some (small) peaks in the mid-1920s and mid-1930s, and a steep rise in 1966 (when the National Traffic and Motor Vehicle Safety Act (NTMVSA) was introduced). After 1966 public and political attention decoupled (Spearman’s rho = −0.6947). But implementation activity increased steeply after 1965 and was strongly correlated with public attention (Spearman’s rho = 0.5728). This points to a shift from the macro-political agenda to policy sub-systems, where struggles over the implementation of NTMVSA continued to attract attention.

- Technical safety-oriented innovation shows ups and downs (Fig. 6). A small peak in safety-patenting (1955–1960) significantly correlates to political attention in Fig. 5 (Spearman’s rho = 0.7882). A larger up and down pattern (1966–1981) strongly correlates to implementation action and struggles over NTMVSA (Spearman’s rho = 0.8674). A third peak (1990–onwards) strongly correlates both with policy activity and public attention (Spearman’s rho = 0.8273 and 0.7563, respectively). We will investigate the relative causal influence of both factors in the case study.

Fig. 6 also shows how attention for specific technical options changed over time. Before the 1950s, safety innovations concentrated on accident-avoidance technologies (e.g. brakes, lights, steering, horns). In the 1970s and 1980s, innovative attention also came to focus on seatbelts and airbags, which related to the new injury-prevention framing. In the 1990s, airbags gained prominence in safety-innovation strategies (in response to market demand as the case study will show).

These basic correlations suggest some patterns that resonate reasonably well with the DILC model: (a) public attention precedes political and innovative action (phase 1 and 2), (b) increasing public attention is likely to lead to more political attention (phase 3), (c) substantial laws can (to some extent) force firms to markedly increase innovative activity (phase 4), (d) major innovative efforts occurred in the 1990s (phase 5). But we need the qualitative case study to complement the correlation analysis in order to unravel causality.

The time-series (especially for public attention and technology patenting) also show various ups and downs, which is indicative of a cyclical issue lifecycle pattern. To further explore this cyclical pattern, and the notion that an issue may move backwards to previous phases in the DILC-model, the next section makes an in-depth qualitative analysis.


Through a visual-inspection of the time-series (Keim, 2002), complemented with qualitative knowledge, we divide the longitudinal case into shorter periods: 1900–1924 (emerging public attention), 1924–1942 (rising public attention), 1942–1946 (disruption by Second World War), 1946–1955 (relatively low, but gradually rising public and political attention), 1955–1965 (decreasing public attention, but rising political attention), 1965–1976 (steep increase in public and political attention, and substantial increase in industry innovation), 1976–1984 (decreasing innovation, due to implementation controversies), 1984–1995 (emerging market for safety innovations accelerates patenting activity). For each period, the case study will address: (1) problem-related pressures (from social movements, public attention, policymakers), (2) response strategies from American automakers and initiatives from new entrants or foreign companies.

5.1. Problem emergence and industry neglect (1900–1924)

5.1.1. Problem-related pressures

Activists: The diffusion of cars was accompanied by rising fatalities (Fig. 2). Safety activists, newspapers and periodicals expressed concerns about careless driving and speeding (Eastman, 1984). In 1915, a safety activist (Julian Harvey) coined ‘the triple E’ (3E) slogan, which emphasized driver/pedestrian Education, law Enforcement, and road Engineering. By the 1920s, the 3E-framing was “almost universally held by the public, private safety organizations and government” (Eastman, 1984: p. 127). The National Safety Council (NSC) included highway accidents in its remit. And automobile clubs lobbied policymakers for legislation, because safety concerns negatively affected the legitimacy of cars.

Policymakers: The 3E-framing guided local authorities in the introduction of various regulations, e.g. car registration, driving schools, driver’s licenses, speed limits, and traffic police (Geels, 2005). Road expansion programmes led engineers to focus on the influence of road design in accidents.

Consumers: Cars were ‘toys for the rich’, who engaged in racing, touring, and promenading (Geels, 2005). Consumers were more interested in fun than safety. In the 1910s, cars also came to be used for practical purposes (e.g. commuting to work, travelling salesmen, doctors, farmers, taxis), but interest in safety remained limited.

5.1.2. Car industry responses

Car-related fatalities were not high on the agenda of the emerging car industry, which faced many other issue (Geels, 2005), e.g. industry shake-out, creation of dealer networks and supply chains, product and process innovations (assembly lines, mass production methods). Nevertheless, industry actors directed some attention to safety concerns. They created the Safety First Committee (1916), which supported the 3E-framing, arguing that people – not cars – caused accidents. Trade journals coined metaphors such as ‘the reckless driver’ or ‘the nut behind the wheel’, and automakers supported educational efforts. Because accidents were seen as ‘abnormal events’, automakers saw no obligation to design cars for this ‘unlikely circumstance’ (Eastman, 1984).

5.2. Increasing public concerns and creation of industry front (1924–1942)

5.2.1. Problem-related pressures

Public attention and activists: Public attention increased rapidly in the mid–1920s, following national conferences in 1924 and 1926, and in the mid–1930s, following a 1935 article in Reader’s Digest (Fig. 7), which acted as ‘trigger event’ (Luger, 2000), drawing attention to rising fatalities, and vividly describing how doorknobs and sharp edges in dashboards caused serious injuries. Nevertheless, the article reproduced the 3E-framing, advocating safe driving, not design changes.

An alternative to the 3E-framing was advanced by some professionals such as Dr. Straith, a plastic surgeon, who urged industry officials to redesign cars to minimize injuries in case of crashes (Eastman, 1981), and DeHaven, a pioneer in crash-injury research and crash-survival engineering (Hasbrook, 1956), who showed that windshield structures and instrument panels caused specific injuries. This alternative approach to auto-safety remained marginal and was ignored by established safety groups (Weingroff and Seabron, 2003).

Policymakers: In 1924 and 1926, the federal government organized National Conferences on Street and Highway Safety, which were mainly symbolic in that they expressed concerns but left safety legislation to state and local governments (Eastman, 1984). The conferences acknowledged accident-avoidance features (brakes,
steering gears, lighting, horns), but otherwise embraced the 3E-framing and called for education, enforcement and better roads (MacLennan, 1988).

Consumers: Consumers were interested in fast, large, powerful and stylish cars. Amidst the Great Depression, mainstream consumers also wanted cheaper cars and exerted no effective demand for safety-related features (Eastman, 1984).

5.2.2. Car industry responses

In response to public concerns and policy debates, automakers created the Automobile Safety Foundation (ASF), which “took the lead in directing the issue of traffic safety, ensuring that the industry’s interests would be protected” (Luger, 2000: p. 58). The ASF collaborated with safety policy specialists and supported the 3E-framing, offering grants for the training of policemen and traffic engineers, and assisting education campaigns (Eastman, 1984). The ASF thus “deflected attention away from the dangerous characteristics of cars and trucks manufactured by the auto industry” (Farber, 2002: p. 182).

Technical innovation by the ‘Big Three’ (Ford, General Motors, Chrysler) was mostly guided by speed, engine performance, and style. When advertising practices, which emphasized speed and performance, received safety-related criticisms (Stevenson, 2008), automakers argued that drivers should be educated not to drive too fast (Eastman, 1984). Although safety was not a major design principle, car manufacturers did implement incremental design changes such as safety glass, which did not splinter into razor-edged glass pieces in case of accidents (Farber, 2002). They also implemented innovations that helped avoid accidents (e.g. hydraulic brakes, directional turn-signals).

5.3. Interruption by the Second World War (1942–1946)

The issue lifecycle was interrupted by World War II, which diminished social and political safety interests. Highway fatalities declined markedly (Fig. 2), because war policies restricted car driving through the rationing of gas and tires and the ‘Victory Speed’ limit of 35 MPH (Yates, 1983). The car industry’s contribution to the war effort consolidated Detroit’s legitimacy and reputation.

5.4. The high point of the safety establishment and 3-E framing (1946–1955)

5.4.1. Problem-related pressures

Policymakers: In the post-war decade, highway casualties rapidly increased (Fig. 2), causing high-level political concerns. The President organized Highway Safety Conferences (1946, 1949, 1951) to address the issue, and invited well-established actors such as automakers, industry associations, traditional safety organizations (NSC, ASF), and highway and traffic engineers (Weingroff and Seabron, 2003). This coalition succeeded in advancing their 3E-framing, leading the conferences to focus on education, enforcement and engineering (Eastman, 1984). The newly created (1954) President’s Action Committee on Traffic Safety was also dominated by established actors with the car industry appointing and paying the executive director (Luger, 2000). This committee institutionalized the 3E-framing at the highest political level and “symbolized the high point of the status and significance of the safety establishment and of the automobile industry influence on the highway safety movement” (Eastman, 1984: p. 147).

Social movements: The dominant 3E-framing was criticized, however, by two professional communities who articulated an alternative problem framing focused on car designs and injury-prevention. First, experimental investigations by crash-injury researchers showed the influence of car design features (dashboards, steering systems, doors, windshield structures) on injuries and deaths (Hasbrook, 1956). Second, the medical community began advocating design modifications to minimize injuries (Eastman, 1981), suggesting the removal of all knobs, cranks, drop-down ash trays, sharp edges, and advocating the introduction of collapsible steering columns, hinged windshields, and seatbelts (Eastman, 1984). By the mid-1950s, the American Medical Association regularly issued resolutions, urging automakers to change car designs (Luger, 2000).

Consumers and public attention: Consumer demand, which had been deferred during the war, preferred stylish, extravagant, high-performance cars (Yates, 1983). Safety was not a primary criterion for most consumers (Stevenson, 2008).

5.4.2. Car industry responses

The industry’s main political strategy was to support the 3E-framing through the NSC and ASF, which functioned as an “arm of the industry” (Luger, 2000: p. 58). This framing protected industry interests, because it kept car design off the agenda. Automakers also shaped high-level political agendas through the President’s Action Committee (Eastman, 1984).

Technologically, automakers continued to pay more attention to price, styling, gadgetry, and horsepower than to safety (Yates, 1983). Nevertheless, as a defensive hedging strategy, the industry set up safety departments (Chrysler in 1952, Ford in 1955, GM in 1956) to monitor developments in crash-injury research and crashworthiness engineering (Luger, 2000).

New entrants: Tucker Corporation and Kaiser-Frazer were two new companies that used safety to attract attention to their cars, respectively, the Tucker Torpedo with safety-oriented design features, and the ‘World’s First Safety-First Car’, which incorporated a crash-pad that extended throughout the instrument panel, recessed instruments, and a pop-out windshield (Stevenson, 2008). Their marketing activities, which played on the
contrast with the Big Three, stimulated (some) public attention to safety-design.

5.5. Political debates and erosion of the 3E-framing (1955–1965)

5.5.1. Problem-related pressures

Public attention, social movements and professionals: Increasing doubts about the 3E-approach weakened its appeal. The industry journal Automotive News (1958) identified a safety slogan fatigue, "brought on by an overdose of jingles, catchy phrases and righteous warnings asking us not to kill ourselves". By the early 1960s, criticism of safety education also appeared in general magazines (e.g. Consumer Reports, Nation) (Eastman, 1984).

Simultaneously, the design-oriented injury-prevention framing gathered strength as the crash engineering community organized annual conferences that institutionalized the field (Eastman, 1981). Insurance companies (e.g. Liberty-Mutual Insurance Company) also became interested in crash-injury engineering and sponsored the design of Survival Car I, which included sixty safety-innovations, e.g. safety belts, ‘extra-heavy’ padding, recessed buttons, passenger seats facing backwards, levers instead of steering wheels. And the medical community campaigned for seatbelt installation portraying seatbelts as the ‘medicine’ that was being withheld from patients), urging Congress to issue car-safety standards, and publishing journal articles on automobile crash injuries (Eastman, 1984).


5.5.2. Car industry responses

Automakers disliked the increasing attention for car design and used political strategies to hinder safety standards. The Automobile Manufacturers Association (AMA), for instance, lobbied against regulations in subcommittee hearings, highlighting the ‘lack of demand’ for safety-innovations (Weingroff and Seabron, 2003).

While the industry maintained a political front, early tensions emerged regarding safety-related design innovations. To counter declining market shares, Ford decided to develop and advertise cars with a ‘safety package’ (1956), which included safe door-latches, recessed hubs, steering wheel with energy absorbing capability, padded instrument panels, and optional (lap) seatbelts (Eastman, 1984). The consumer response was limited but positive. GM, however, “expressed its disapproval of the safety campaign directly to Ford’s top executives”, using “the weight of its enormous monopoly power to have it halted” (Luger, 2000: p. 63). Ford subsequently dropped its safety initiative (Stevenson, 2008), so GM succeeded in restoring a closed industry-front. Ford’s initiative was labelled a market failure, hardening the belief that ‘safety does not sell’. Technological strategies subsequently focused on accident-avoidance innovations (e.g. improved headlights, emergency flashing systems) instead of injury-prevention (Eastman, 1984).

New entrants and regime outsiders: Independent crash engineers developed radical ideas and solutions such as the airbag (1953) and three-point seatbelt system (1955). The airbag patent attracted some attention from Ford and GM, which both explored it in the late 1950s (Sherman, 1995). After a few years, they discontinued airbag activities because of two engineering challenges: (a) quickly, reliably, and accurately sensing a collision, (b) inflating the airbag in forty milliseconds (Sherman, 1995). The 21 airbag patents between 1953 and 1966 (Fig. 6) were all assigned to independent inventors or auto-industry outsiders.

5.6. Public escalation, radical legislation and policy implementation struggles (1965–1976)

5.6.1. Problem-related pressures

Public attention: Public attention exploded (Fig. 4), because of the 1965–1966 Ribicoff hearings (see below) and a scandal around Ralph Nader, who wrote the book Unsafe At Any Speed (1965) which synthesized crash-injury research and described the industry’s political opposition to safety standards. When Nader was called to testify in the Ribicoff hearings, GM hired a private investigator to look into his personal affairs, with the goal of blackmailing or discrediting him (Luger, 2000). When these investigations became public (Fig. 8), public outrage made Nader into a national figure and forced GM to apologize, which “sent shock waves throughout the industry and further diminished the credibility of the automakers among the public” (Luger, 2000: p. 70).

The scandal also catapulted auto-safety into the macro-political arena, where high public scrutiny exerted pressures on politicians to act. In the late 1960s, public attention declined somewhat (Fig. 4), as the safety issue moved into the administrative arena for implementation and became more technical.

Policymakers: In 1965–1966, Congress organized the Ribicoff hearings to investigate why traffic fatalities continued to rise, despite various safety policies. The hearings exposed “the industry’s disregard for vehicle safety” (Luger, 2000: p. 8), moving auto-safety into the national political spotlight. Senator Robert Kennedy, in particular, criticized the industry’s lack of investment, noting that GM spent less than 0.1% of profits on safety innovation (Luger, 2000: p. 68). The industry’s legitimacy was further undermined by the Nader-scandal and the discovery of 426 secret recall cases of faulty automobiles between 1960 and 1966. “Legislators now were inclined to see
the industry as not just uncooperative but as unreasonable” (Luger, 2000: p. 72). These developments represented a “turning point in creating a climate in Congress conducive to the passage of a meaningful automobile safety bill” (Eastman, 1984: p. 246).

In 1966, Congress adopted the National Traffic and Motor Vehicle Safety Act (NTMVSAA), which articulated safety-performance standards and established the National Highway Traffic Safety Agency (NHTSA) to implement them. The standards included crash-avoidance (lights, brakes, tires), crash-survival (padded instruments, head restraints, seatbelts, energy-absorbing steering columns) and post-crash (fuel systems integrity) specifications (Bollier and Claybrook, 1986).

In subsequent years, the safety issue moved back to the policy sub-system, where struggles focused on implementation of the standards (Luger, 2000). Standard 208 (seat-belt installation) in particular became the focus of a long-lasting controversy, when, in 1969, NHTSA upgraded it to a passive restraint standard. While regulators, safety-advocates, and insurance companies assumed this implied airbag systems, automakers preferred cheaper automatic seatbelts with an ignition-interlock system (Abeles, 2004). By 1974 this seatbelt-airbag controversy became deadlocked (Miller, 1988).

Consumers: Despite escalating public and political attention, consumer demand for safety-innovations remained limited. The 1973 oil shock and subsequent recession stimulated demand for cheaper, smaller, fuel-efficient cars.

5.6.2. Car industry responses

The Ribicoff hearings, where automakers argued against federal regulations, turned into a public relations disaster because executives responded poorly to critical questions (Eastman, 1984). The Wall Street Journal (July 20, 1965) ascertained that: “so dismal [was] the auto industry’s performance at the Senate’s safety hearings that the chances of Federal legislation in the field have markedly increased”.

Once the NTMVSAA (1966) was passed, automakers reluctantly complied and introduced some safety-innovations as standard equipment, e.g. energy-absorbing armrests, collapsible steering columns, energy-absorbing bumpers, roll-over safety structures (Abernathy et al., 1983). But automakers also resisted the implementation of certain standards, claiming that these were technically unfeasible or required expensive retooling (Bollier and Claybrook, 1986). They attacked the original Standard 208, claiming that Americans would not wear seatbelts (Luger, 2000). Automakers then installed cumbersome belts, with shoulder belts separated from lap harnesses. “If people wanted an excuse for not taking the trouble to buckle their seatbelts, the manufacturers gave it to them” (Waters et al., 1998: p. 1338). The industry litigation against the upgraded Standard 208 on the basis of technical details regarding airbags. The U.S. Court of Appeals extended the compliance deadline and, meanwhile, allowed automakers to comply with ignition-interlock systems (Bollier and Claybrook, 1986). These systems, which sounded an alarm if the driver did not buckle up, annoyed drivers, many of whom disconnected the system and wrote complaint letters to policymakers (Abeles, 2004). In 1974, Congress repealed the requirement of interlock systems, causing Standard 208 to reach a stalemate.

While automakers publicly resisted airbags, they privately restarted airbag innovation programs in the late 1960s taking advantage of new technologies such as detonating valves for very rapid gas transfer, solid propellant (sodium azide) for airbag inflation, and reliable collision sensors (Sherman, 1995; Strother et al., 2003). These R&D activities caused a peak in airbag patenting activities in the mid-1970s (Fig. 6). In 1974, the industry’s front against airbags seemed to crack when GM announced plans for a sales program and tool up to produce 100,000 airbag-equipped cars (Struble, 1998). Despite GM subsidies, consumers bought only 10,000 of these cars (Albaum, 2005). In 1976, GM dropped its airbag strategy. Others followed, causing a decline in airbag patenting (Fig. 6).

New entrants and regime outsiders: Foreign companies (Mercedes-Benz, Volvo) began to use safety advertising as an entry point into the American market, which helped build consumer awareness. After 1976, Mercedes became the only carmaker working on airbags (Nilsson et al., 2003).

5.7. Moving backwards because of weakening political pressure (1976–1984)

5.7.1. Problem-related pressures

Public attention: As the safety issue moved to the administrative arena and implementation debates became more technical, public attention declined in the mid-1970s (Fig. 4). Attention increased again in the late 1970s, partially triggered by 500 crashes with the Ford Pinto subcompact car, in which people had burned to death because of a flawed fuel-tank design. The scandal was that Ford allegedly knew of the hazard, but decided not to fix it because cost-benefit analysis showed the change was not profitable. The public was shocked that Ford placed a dollar value on human life. “For the public, the case came to stand for Detroit’s disregard for vehicle safety” (Luger, 2000: p. 83).

Policymakers: In the late 1970s, political pressure weakened because of concerns about the industry’s economic problems. Shrinking markets and declining market shares (due to increasing Japanese competition) caused substantial losses (Fig. 9), which led to a bailout of Chrysler in 1979.

Politicians provided tax reliefs and financial aid to the industry and weakened safety regulations. The Reagan administration (1981–1989) favoured further regulatory rollbacks and proposed to abandon more than 34 safety, emissions and fuel economy regulations (Luger, 2000).

The controversy over standards (particularly 208) also continued, which slowed down industry innovation efforts. Successive Transportation Secretaries first (in 1976) proposed to withdraw Standard 208 if automakers would produce 40,000–400,000 airbag-equipped cars for demonstration programmes (Bollier and Claybrook, 1986), then (in 1977) reissued Standard 208, arguing that a demonstration programme was not necessary, and then (in 1981) repealed the standard as part of Reagan’s regulatory rollback, arguing that costs outweighed benefits (Miller, 1988).
Consumer groups and insurance companies challenged this decision (Waters et al., 1998), leading to prolonged legal struggles in the Court of Appeals and Supreme Court (1982–1984).

Consumers: In the luxury market segment consumers began to show some interest in safety, which benefitted European automakers such as Mercedes.

5.7.2. Car industry responses

American automakers continued to hinder safety standards (such as 208), arguing against airbags because of high costs, lack of consumer demand, risk of liability claims if airbags would not inflate properly, technical installation difficulties in small vehicles (Strother et al., 2003; Struble, 1998). Automakers also engaged in legal struggles, which created regulatory uncertainties that diminished their dedication to safety innovation strategies (Fig. 6). Industry resistance also had an ideological component, as a New York Times editorial (1981: p. A30) noted: “The real mystery (…) is why the auto industry fights safety so hard. The explanation for the mystery may be as simple as it is sad: American auto makers (…) oppose airbags because they would give regulation a good name”.

New entrants and regime outsiders: Insurance companies, engineers and airbag suppliers contested the industry’s arguments against airbags, arguing that technical difficulties were solved and that costs were half of what automakers claimed (Abeles, 2004). Many suppliers had to stop production, however, because airbag markets did not materialize (Albaum, 2005). Only Mercedes continued to work on airbags, collaborating with Bayern-Chemicals, Bosch (crash sensors), and Morton-Thiokol (inflators) (Nilsson et al., 2003). In 1981, Mercedes offered optional driver-side airbags for European luxury cars (Struble, 1998).


5.8.1. Problem-related pressures

Social movements and public attention: Public attention declined in the first half of the 1980s, but increased again from the late 1980s onwards (Fig. 4), because of industry-sponsored seatbelt campaigns (see below) and increasing cultural sensitivity to safety, stimulated by the broader health-and-safety movement. This translated into new behavioural practices such as increased seatbelt use (Fig. 10). In the 1990s, auto-safety became institutionalized as a cultural value and behavioural practice.

Consumers: Safety began to affect consumer preferences, creating market demand for safety features (Albaum, 2005). From the late-1980s, surveys indicated that consumers increasingly valued safety as a car purchase criterion (Fig. 11). Changing consumer attitudes were related to several factors: (1) ongoing public debates about auto-safety; (2) the institutionalization of the health-and-safety movement; (3) demographic changes, such as baby boomers reaching maturity and women becoming more involved in vehicle purchase decisions (Automotive News, August 22, 1988); (4) disclosure of auto-safety ratings (by consumer magazines and insurance companies), (5) industry advertisements of seatbelts and safety features, (6) spillover from the luxury market segment to mainstream markets.

In the early 1990s, changing consumer preferences stimulated rapid diffusion of airbags for drivers and passengers (Fig. 12), even before these were mandated.

Policy makers: No federal safety regulations were introduced during the Reagan administration (Luger, 2000). But in 1984 the Supreme Court ended regulatory uncertainties by reissuing Standard 208, mandating passive restraint systems by 1989 (Bollier and Claybrook, 1986). A loophole promised annulment if sufficient parts of the population were covered by Mandatory Use Laws (MUL) for seatbelts (Miller, 1988). Automakers therefore lobbied states to pass MULs (O’Neill, 2009). By 1986, however, it became clear that the required threshold would not be reached (because of resistance from Californian legislators). The phase-in schedule of Standard 208 was then forwarded by 2 years. The 1991 Intermodal Surface Transportation Efficiency Act subsequently mandated that by 1997 new cars should have driver-side and passenger-side airbags. Because airbags were by then already a reality in the marketplace, the
20-year-long controversy on the passive restraint mandate came to a quiet end (Abeles, 2004).

5.8.2. Car industry responses

To repeal Standard 208, automakers promoted seatbelt use with ‘buckle-up’ advertising campaigns and a front organization (“Traffic Safety Now”) which lobbied states to enact MULS (Bollier and Claybrook, 1986). When the strategy failed, automakers planned to comply to Standard 208 with automatic seatbelts. But they became caught up in an unfolding airbag race, which was triggered by Mercedes’s introduction of optional airbags in 1984MY cars (Albaum, 2005). Mercedes changed the safety debate, because it offered airbags as complement to, not substitute of, seatbelts (O’Neill, 2009). Because Mercedes attracted positive attention from media and consumers, American companies also began offering optional airbags, Ford in 1986, Chrysler in 1987 and GM in 1989 (Nilsson et al., 2003; Albaum, 2005). The cracks in the industry front against airbags were further stimulated by insurance companies, which offered discounts for airbag-equipped vehicles (Abeles, 2004). Growing consumer demand in subsequent years triggered an airbag innovation race and accelerated airbag-related patenting activities (Fig. 6). Although American automakers experienced major financial problems in the early 1990s (Fig. 9), due to a recession and legacy problems (e.g. post-retirement and health benefits), they did not diminish attention to safety (as in the late 1970s), because it had become part of economic positioning strategies and industry mission. So, by the 1990s, automakers had changed core elements of the industry regime: (a) they abandoned the belief that ‘safety does not sell’, and included safety in their mission and strategic attitudes, (b) airbags (and associated micro-electronics and digital technologies) changed the industry’s technical capabilities. Airbag-patenting activities exploded in the 1990s (Fig. 6) as automakers exploited the innovation potential of digital sensors, software algorithms, side and curtain airbags (Struble, 1998).

6. Analysis

The case study showed the co-evolution between societal problems, industry strategies and technical solutions. To analyse the case we engage in pattern-matching between the empirical periods and the conceptual phases of the elaborated DILC-model.

The first period (1900–1924) fits well with phase 1 in the sense that: (a) activists, auto-club and newspapers demanded attention for safety problems, (b) the National Safety Council (NSC) became the dominant social movement organization around the car-safety issue, and c) automakers downplayed the role of car design. Minor deviations from the conceptual phase 1 are: (1) local authorities showed some interest earlier than predicted, (2) automakers did not deny the problem of accidents; they actually had some interest in it and accepted the 3E-framing (which excluded car design).

The second period (1924–1942) fits well with phase 2 in the sense of: (a) increasing public attention, (b) symbolic policy action, (c) incremental innovations, and (d) the creation of a closed industry front (via the Automobile Safety Foundation) that helped cement an advocacy coalition around the emerging 3E-framing. The period also displayed some minor deviations from phase 2: (1) public and political attention declined in the early 1930s (because of the economic Depression) and in the late 1930s (because of escalating military tensions), (2) an alternative interpretation of safety-problems was advanced by outside professionals, which focused on the (ignored) role of car design.

In the third period (1942–1946), the issue lifecycle was disrupted by the Second World War, which was a dramatic macro-event.

The fourth period (1946–1955) is more difficult to qualify in terms of our phase-model. Because of high-level political concern and Presidential attention, the period fits with phase 4 (issue moving into the macro-political arena). Macro-politicians did not, however, introduce substantial policy action. This fits with the elaborated DILC-model (Section 2.2), because policymakers did not change their understanding of the problem, but adopted the existing policy-framing advocated by mainstream actors. Because of the lack of major policy change, automakers did not diversify towards radically new technologies. But they did start developing some new capabilities in corporate safety departments (a phase-3 element). The period also deviated from phase 4 in the sense that public attention remained relatively low in the post-war decade (because people were more interested in fun, style, and design extravaganzan than in safety). This period displayed additional complexity because of the alternative issue-framing, which gained credibility and legitimacy because of accumulating support from professional communities (thus displaying elements of phase 2). So, this period has elements of different phases because there are two different issue-frames (and associated advocacy coalitions). Because of a pronounced macro-political dynamic, we nevertheless propose to characterize it as phase 4.

The fifth period (1955–1965) fits well with phase 3 because of the prominence of debates in specialist sub-committees, where the 3E-framing began to lose appeal and the alternative design-oriented framing gained momentum (because of ongoing activities from professional communities). The period also fits phase 3 because of early industry tensions related to Ford’s differentiation attempt with safety-innovations (which GM apprehended).

The sixth period (1965–1976) fits well with phase 4: (a) public attention escalated (because of the Ribicoff hearings and Ralph Nader scandal), pushing the issue back into macro-political arenas, (b) politicians introduced radical legislation (the 1966 NITMVS), which incorporated a change in issue-framing (emphasizing technical design and injury-prevention), (c) automakers (reluctantly) complied by implementing safety-innovations, but also resisted standards (with litigation, lobbying, inconvenient technical designs), (d) automakers explored more radical alternatives (airbags), causing cracks in the front against airbags (because of GM’s strategic differentiation attempt in 1974), which closed again in 1976, (e) automakers did not incorporate safety in their mission because they believed that it was externally imposed by regulators, not demanded by customers.

The seventh period (1976–1984) fits well with phase 3 because of: (a) political and technical controversies over standards in the policy sub-system, (b) deliberate weakening of safety implementation in the policy sub-system (especially under the Reagan administration), and (c) diminished innovation efforts by automakers.

In the eighth period (1984–1995), the issue quickly moved through phase 4 and into phase 5. The 1984 Supreme Court decision was a macro-political event that reinstated implemen-tation pressure (phase 4). Meanwhile, however, the safety-issuestill affected mainstream consumer preferences, creating markets for safety-innovation (phase 5). So, legislation (in 1984 and 1991) formalized what was already happening in the market. The emerging economic opportunities enabled Mercedes (a relatively small firm in American markets) to jockey for position with safety-innovations such as combined airbags and seatbelt packages (phase 4). Mercedes’s success helped to break up the closed industry front and triggered an innovation race (phase 5), which resulted in comprehensive reorientation in the 1990s, with firms including safety in core beliefs, missions, strategies and technical capabilities (phase 5). This dynamic highlights the potential importance of relative outsiders in industry reorientation.
The above analysis suggests that most periods had a relatively good match with a particular phase in the elaborated DILC-model. Some periods had minor deviations in the sense of also displaying characteristics of another phase or having other actors perform predicted activities (e.g., professional communities criticizing the 3E-framing rather than social movements). Such deviations are to be expected because real-world cases are usually more complex than stylized conceptual frameworks. So, the DILC-model should be used flexibly as a heuristic sense-making framework and not as an analytical straightjacket.

The case had three larger deviations from the DILC-model, which provide scope for reflections about further conceptual elaborations. First, while the DILC-model tends to emphasize increasing problem-related pressures on industries, the eighth period additionally highlights the importance of (technical and economic) opportunities for industry reorientation (and the role of relative outsiders in breaking closed industry fronts). This deviation suggests that the DILC-model should pay more attention to the role of opportunities in phase 4 and 5. This does not invalidate the emphasis on problem-related pressures, which are likely to be important in the construction of opportunities (e.g., through spillovers to consumer preferences), but it does suggest that the DILC-model should better accommodate a relative shift in emphasis from pressures in earlier phases to opportunities in later phases.

The second larger deviation is that the case did not follow a linear sequence of five phases, but instead moved backwards and forwards between phases. We therefore conclude that auto-safety followed a ‘cyclical’ pattern, in which the issue experienced several ups and downs: phase 1 (1900–1924), phase 2 (1924–1942), interruption (1942–1946), phase 4 (1946–1955), phase 3 (1955–1965), phase 4 (1965–1976), phase 3 (1976–1984), phases 4 and 5 (1984–1995). The case study confirms the propositions in Section 2.3 that deviations from the ‘normal’ path are related to: (a) ups and downs in problem-related pressure such as public attention to auto-safety and the weakening of the 3E-framing and advocacy coalition (which moved the issue back to phase 3 in the 1955–1965 period), (b) successful industry fight-back, which resulted in implementation struggles and controversies (which moved the issue back to phase 3 in the 1976–1984 period), (c) changing macro-contexts such as World War 2 and the political ideology of the Reagan administration (which moved the issue back to phase 3 in the 1976–1984 period).

The third deviation is that the case entailed a major change in the interpretation of the safety-issue, from the 3E-framing to the design-oriented injury-prevention framing. The case therefore contained two dynamics related to different issue-framings, which is why certain periods (e.g., 1946–1955) had characteristics of two phases. Despite competition from the emerging injury-prevention framing, the established 3E-framing was still dominant in the 1946–1955 period, which helps explain why no major policy change occurred when the issue reached the macro-political arena in that period. Major change in the directionality of the issue-lifecycle (and major policy change) did occur in the 1965–1976 period, when the design-oriented framing reached the macro-political agenda. So, the case suggests that more complex patterns can also arise from changes in the meaning and definition of societal problems, which is something that could be explored further in future research.

7. Conclusions

We conclude that the elaborated DILC-model is a useful heuristic framework to analyse the co-evolution of societal problems and industry reorientation. The further specifications of core dynamics and mechanisms within phases allow for more differentiated interpretations of real-world cases. Minor deviations between complex cases and the DILC-model should be expected. Larger deviations require further explanation and reflection, as we attempted above. We suggest that the elaborated DILC-model goes some way in addressing the research gap identified by Morlacchi and Martin (2009). In particular, we highlight the importance of analysing the co-evolving dynamics of both problems and solutions, which differentiates our conceptual model from the innovation system approach mentioned in the introduction. Based on the elaborated model and two case studies (air pollution and auto-safety), we highlight the following salient aspects regarding industry reorientation towards addressing societal problems. After initial denial and downplaying, industry actors may start exploring alternatives when policymakers begin discussing the problem and possible solutions (phase 3). Policy change in policy subsystems may, however, remain incremental for long periods, as does industry reorientation. More substantial policy change, which requires a high public sense of urgency and problem redefinition in macro-political arenas, may trigger further (reluctant) reorientation (phase 4). Powerful firms, especially when operating as closed industry fronts, may be very effective in hindering and delaying the implementation of substantive policies. Comprehensive reorientation (phase 5) therefore requires spillovers to consumer preferences, the emergence of market opportunities, and successful initiatives (often by relative outsiders) that can open up closed industry fronts and trigger innovation races.

With regard to the second contribution, we conclude that the case study validates the ‘cyclical’ lifecycle path, in which issues move forwards and backwards through phases, depending on the three factors identified above. We tentatively suggest that this cyclical pattern may have relevance for contemporary ‘grand societal challenges’, such as climate change, where strong vested interests and multiple potential solutions supported by various stakeholders in shifting coalitions are unlikely to follow a linear lifecycle pattern. We further suggest that complex patterns may also arise from changes in problem-definitions and interpretations of social problems. The case study indicates that issue lifecycles need not be singular and can contain multiple competing issue-framings and coalitions. We recommend further investigation of this aspect in future research.

Acknowledgements

We thank Andrew McMeekin, Andy Stirling, Ed Steinmueller and two reviewers for their thoughtful and stimulating comments on previous versions of the paper. This work has been supported by an ERC grant (No. 204246) and the Centre on Innovation and Energy Demand, funded by the EPSRC/ESRC(grant number EP/K011790/1). We also wish to thank Bruno Turner for helping develop Table 1.

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