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Navigators through the storm: A review of organization theories and the behavior of incumbent firms during transitions

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ABSTRACT

The literature on socio-technical transitions pays increasing attention to the role of incumbent firms during transitions. These firms have been found to variably further, delay, or to ignore transitions towards a more sustainable society. Yet, it remains unclear which factors cause incumbents to display different modes of behavior during transitions, and which factors affect the transition's impact on an incumbent's survival. We engage this issue by reviewing five prominent organization theories. We first discuss how the transitions literature conceptualizes incumbent behavior and relate the open questions to major debates in the organizational literature. We systematically summarize each organization theory's assumptions and expectations about incumbent behavior, and derive typical modes of behavior. Lastly, we discuss how an incumbent's characteristics influence its behavior and survival. Overall, our review provides stable footing for researchers seeking to conscientiously judge which theories are most appropriate to understand incumbent behavior in the transition process at hand.

1. Introduction

Large "socio-technical transitions" are drawing increasing attention from practitioners and scholars in a variety of domains and settings. A prominent example is the current transition towards sustainability, in which the circular economy, renewable energy sources, and sustainable products are promoted. In the scientific community, theoretical work on the mechanisms by which such transitions unfold typically departs from the "Multi-Level Perspective" (MLP) (Fuenfschilling and Truffer, 2014; Markard et al., 2012).

Spurred by repeated criticisms for the relative lack of agency in the MLP (Genus and Coles, 2008; Smith et al., 2005), recent studies draw explicit attention to the role of actors in transitions. This shows that the role of incumbent firms, which the MLP sees as important in transitions (Farla et al., 2012; Geels, 2014a; Geels and Schot, 2007), is under-conceptualized.

First, transition scholars typically conceptualized incumbents as locked-in and inert, but recent empirical studies show that this is not universally the case (Wesseling et al., 2015, 2014). Incumbents often respond to a transition. Some actively resist fundamental change (Geels, 2014b), while others contribute to the transition in various ways. For example, incumbents have been found to defensively respond to transitions by forming political coalitions (Hess, 2014) and formal networks (Musiolik et al., 2012), by strategically setting technical standards (Smink et al., 2013), managing expectations for novel technologies (Bakker et al., 2012; Konrad et al., 2012), resisting political work by institutional entrepreneurs (Jolly et al., 2016), but also by developing innovative transitional technologies (Berggren et al., 2015). The behavior of incumbent firms during transitions may depend on the timing and

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nature of the transition (Geels and Schot, 2007), but it also depends on shared expectations about the future regime (Budde et al., 2012) and on a general dissatisfaction with the current functioning of the system (Kishna et al., 2016).

These factors, however, are a partial explanation for the observed heterogeneity in incumbent behavior. Even within a particular transition, incumbents follow different modes of behavior (Bakker et al., 2014; Karltorp and Sandén, 2012; Penna and Geels, 2012), and change between modes of behavior over time (Bakker et al., 2014; Berggren et al., 2015; Smink et al., 2013; Wesseling et al., 2015, 2014). As such, the mechanisms that guide and coordinate incumbent firms' responses to transitions are under-conceptualized (Safarzynska et al., 2012; Vasileiadou and Safarzynska, 2010). This makes it hard to anticipate incumbent firm behavior and to understand how transitions that struggle to advance can be "unlocked" (Smith et al., 2010). Hence, our first research question is: "*which factors govern the modes of behavior of incumbents during transitions*?"

Second, transition studies typically conceptualized incumbents as the "old guard" and new entrants as the vanguards of new technologies, suggesting that entrants are the most likely survivors of a transition (Geels, 2002). But transitions are not always detrimental to incumbent firms. Boeing, for example was a lagging firm, but came out ahead after the transition from piston-propeller aircraft to jet engines (Geels, 2006). Yet despite the societal upheaval that a transition causes when new entrants replace incumbent firms, little is known about the factors that affect the fate of incumbent firms in transitions. This motivates our second research question: "*which factors govern the survival of incumbents during transitions*?"

The behavior and survival of large firms has seen extensive investigation in the domain of organization science. The MLP's conceptualization of actors in transitions (Geels, 2011) draws strongly on theories in the organization science domain, most notably Institutional Theory (IT) (DiMaggio and Powell, 1983; Meyer and Rowan, 1977) and, to a lesser degree, Evolutionary Economics (Nelson and Winter, 1982, 1977). Yet, other research traditions that form the foundation for contemporary organizational research, such as the Behavioral Theory of the Firm (BTOF) (Cyert and March, 1963), the Resource-Based View (RBV) (Barney, 1991; Wernerfelt, 1984), Resource Dependence Theory (RDT) (Pfeffer and Salancik, 2003), and Organizational Ecology (OE) (Hannan and Freeman, 1989), have their own—very different—assumptions about firm behavior. The theories highlight different dimensions of complex organizational processes (Willmott, 1993) that can help explain different modes of behavior by incumbent firms during transitions, as well as how these affect chances of survival.

In this paper, we add alternative explanations for different modes of behavior and the survival of incumbent firms during a transition. We thereby enrich the MLP, and contribute to a better understanding of the role of incumbent firms as key agents in sustainability or other socio-technical transition processes. To this end, we first discuss incumbent firm behavior as it is typically conceptualized in the MLP and relate our two questions to two major debates in the organizational literature that motivate our choice of theories. Next, we review the various theories in the context of transitions. We derive four modes of incumbent behavior during transitions, and discuss how an incumbent's characteristics influence its behavior and survival.

2. Incumbent firm behavior in the Multi-Level Perspective

The MLP sees a transition as unraveling in a socio-technical system (Geels, 2005a) that consists of networks of actors that interact with artifacts, technologies, and resources under the guidance of semi-coherent sets of regulative, normative, and cognitive rules that are called regimes[1] (Geels, 2011; Kemp, 1994). Every group of actors that shares a set of rules is associated with a unique regime that embodies those rules. Most transition scholars refer to the total patchwork of partially overlapping regimes that guide the behavior of the actors in a socio-technical system as the "socio-technical regime." We refer to the set of regimes that were dominant before a transition as the "incumbent socio-technical regime."

In this conceptualization, regimes guide and coordinate how incumbent firms interact with the artifacts, technologies, and resources in the system because incumbents draw upon regime rules to set their behavior. Large incumbent firms often share rules with multiple groups and thus draw from multiple regimes. The overlap between regimes can create conflicting demands (Fuenfschilling and Truffer, 2014; Raven, 2007a) that lead incumbent firms to deviate from the prevailing regimes. However, the repeated interaction between incumbents and the other actors in the socio-technical system typically leads to alignment between its regimes (Geels, 2006). This alignment makes the system's socio-technical regime internally consistent, which makes it difficult to change one of its regimes without requiring change in another. As a result, well-aligned regimes are continually reproduced by the groups of actors that draw upon them (Geels, 2004a). The socio-technical system then fluctuates around a stable configuration, although it may never be in equilibrium (see Geels and Schot, 2007).

The MLP also recognizes that incumbent behavior is affected by factors outside of the socio-technical system. Socio-technical systems are embedded in a "socio-technical landscape" that constitutes their wider external environment (Geels, 2004b). The landscape comprises relatively rigid societal structures and slowly progressing trends such as societal values, political ideologies, and demographic trends, but it can also represent environmental shocks such as destabilization of global currencies (Sirmon et al., 2007) or wars (Geels, 2011). The landscape is beyond the direct control of incumbent firms and forms an additional source of structuration of their behavior because it affects the viability of the various forms of behavior (Geels and Schot, 2007).

Because landscape change can relax some regime rules and tighten others, it is an important trigger for behavioral change in incumbent firms (Smith et al., 2010). When landscape change leads actors to inject deviant rules into the regime, the deviant rules loosen the alignment between the regimes that make up the wider socio-technical regime (Geels, 2002; Geels and Schot, 2007). When

[1] Some transition scholars also include physical components such as actors (Verbong and Geels, 2007) and technological artifacts (Smith et al., 2005) in the regime. We exclude tangible components and define a regime as a set of semi-coherent rules (Geels, 2011).

misalignment in a socio-technical regime becomes severe, it no longer leads actors to reproduce it uniformly. Fluctuations emerge, which opens a "window of opportunity" for invading innovations and the regimes associated with them to enter the system, which can result in a transition—a shift from one socio-technical regime to another (Geels, 2004a,b; Rip and Kemp, 1998).

According to the MLP, invading innovations often arise in "niches" (Geels, 2006; Kemp et al., 1998; Schot, 1998), which are protected spaces in which actors are unencumbered by the structuring pressures of the incumbent socio-technical regime. Niches can emerge when technological or landscape change creates application domains where users have different preferences than mainstream users. Solar cells, for example, found willing applicants in space agencies (Smith and Raven, 2012). Alternatively, the emergence and sustenance of niches can result from processes that are internal to the socio-technical system, such as when the firms that occupy it raise barriers to entry (Bain, 1956), subject others to their market power (Tisdell and Seidl, 2004), or when they benefit from public subsidies and strategic investments (Brown et al., 2003; Hoogma et al., 2002). The sheltered nature of niches allows firms that enter them to experiment with novel behavior. When the firms that have entered a niche are not part of the incumbent socio-technical system, transition scholars typically expected incumbent firms to attempt to suppress the activities of the niche firms (Geels, 2005a; Raven, 2007b), but—as noted in the Introduction—this view is increasingly questioned.

3. Relating the organization and transition literatures

Theories in the literature on organizations relate to different dimensions of the behavior of incumbent firms during transitions, because they have different conceptualizations of "the firm" and the factors that govern its behavior. The theories share a lineage based on the rational view of the firm (Taylor, 1911; Weber, 1978), but grew into distinct and somewhat isolated theories as scholars drew inspiration from different disciplines, ranging from economics, management, sociology, and psychology to biology (Baum and Rowley, 2002). As a result, some theories conceptualize firms as a set of production plans (e.g. neo-classical theories), and others as bundles of assets (e.g. the RBV), coalitions of individuals and functional groups (e.g. BTOF), or as collective identities (e.g. IT). Transition studies typically leave the nature of the firm undefined and tends to view firms merely as economically motivated unitary actors. This fragmented disciplinary basis is still reflected by contemporary organization theories (Daft and Lewin, 1990; McKinley, 2010; McKinley et al., 1999), although the various theories can be seen as are complementary and interrelated rather than competing and orthogonal (Lewin and Volberda, 2003, 1999; Willmott, 1993).

There nevertheless remain several notable debates amongst organization theorists. Two debates have significant implications for how the dynamics of firm behavior unfold in the face of challenges in an external environment (Geels, 2014a), and tend to provide different explanations for observed outcomes. We therefore use the two debates to motivate the selection of theories included in our review.

3.1. Which factors govern the modes of behavior of incumbents during transitions: firm or environment

The first debate concerns the balance between the firm and its environment as the principal factor governing its behavior. Organization theories differ strongly in the degree of autonomy that they bestow on firms, which leads to very different expectations about the factors that govern the behavior of incumbents. Some theories, like the BTOF, assume that a firm's behavior flows primarily from intra-firm factors, while other theories, like IT, argue that firm behavior depends almost exclusively on environmental factors.

This debate relates to the first open question, "which factors govern the modes of behavior of incumbents during transitions?" Theories that suggest that firm-level factors govern behavior, leave room for incumbents to influence or change regimes pro-actively and introduce niche-defining innovations. The transition may therefore originate from inside of the socio-technical system.

3.2. Which factors govern the survival of incumbents during transitions: adaptation or selection

The second major organizational debate is the adaptation versus selection debate, which concerns the question of whether organizational failure and survival reflects adaptation or selection. This question has seen significant discussion for several decades, in part because it is somewhat misleading, seeing that adaptation and selection can refer to similar processes at different levels of analysis.

Yet what is selection at one level of analysis, is adaptation on another level. When strategic choices are selected by an organization, the organization adapts. When organizations are selected by their environment, the organizational population adapts.

In the context of the debate, selection usually refers to the selection of organizations by their environment, while the concept of adaptation refers to the selection of strategic choices by an organization. The pivotal question concerns the degree to which an organization's adaptive efforts influence its survival, which is important to the second open question: "which factors govern the survival of incumbents during transitions?"

The organization theories differ in the degree to which they claim that firms can intentionally and systematically change their behavior to survive environmental change (Lewin et al., 2004), which leads to different expectations about the factors that govern the survival of incumbents. Adaptation theories like RDT assume that firms can identify an appropriate response to a given environmental change, and that they can implement the intended response correctly and timely. Selection theories, such as OE, claim that these assumptions are unrealistic and that the dynamics of organizational populations must therefore reflect environmental selection. The likelihood of incumbent firm survival is determined by chance, rather than its adaptive efforts.

3.3. (In)compatibilities in the study of transitions as "environmental change"

Although the organizational literature can relate to the MLP on its open questions, there remain important differences. Transitions are central to the MLP, but not to the organizational literature, where transitions are considered an instance of environmental change. Since not all instances of environmental change can be considered a transition, it is necessary to detail precisely what kind of environmental change can be considered a transition, if the two literatures are to be made commensurable.

To complicate matters, the concept of "the environment" is used differently in the two literatures as well as within the organizational literature. Some organization theories conceptualize the environment as institutional (Scott, 2001), others as groups of actors (Pfeffer and Salancik, 2003) or as the set of conditions that determine the value of the firm's resources (Barney, 1991). The organizational literature also tends to distinguish between several "layers" or "dimensions" of the environment, with scholars variously distinguishing between dimensions of the environment (e.g. technological, economic, physical, social, and political (Andrews, 1971)), or a firm's relation with it (e.g. a firm's immediate "task environment," and the wider "general environment" (Bourgeois, 1980)). Because a transition's scope leads it to affect any kind of environment, we can consider a transition as a specific instance of "environmental change" that affects an organization's environment, regardless of a theory's conceptualization of the environment. Note however, that the MLP's conceptualization of the environment is different, because it focuses on a socio-technical system, rather than an individual firm. Taking the perspective of an individual firm, the MLP distinguishes between three types of environments. First, there is the landscape, which is beyond the immediate sphere of influence of the firm (Geels and Schot, 2007). Second, there is the socio-technical regime, which is enacted and reproduced by the actors in the system. Third, there are the other actors in the system.

As was the case with a firm's environment, "environmental change" is multidimensional. The organizational literature typically distinguishes between several dimensions of organizational change, such as its "frequency" (the number of environmental disturbances per unit of time), "amplitude" (the magnitude of change), "scope" (the number of environmental dimensions that are affected by the change), and "speed" (the rate of change) (Suarez and Oliva, 2005). In terms of these dimensions, transitions are rare, drastic, *"take place on all dimensions of the socio-technical regime"* (Geels, 2002), and usually take several decades to completely unfold (Geels, 2005b; Verbong and Geels, 2007). Transitions can thus be conceptualized as instances of environmental change with low frequency, high amplitude, exceptional scope, and low speed.[2]

Although environmental change of this kind is not the primary focus of the organizational literature, organization theories have nevertheless proven insightful in past studies. The BTOF, for example, was instrumental to Tan and Peng's (2003) study on how state-owned enterprises coped with China's turbulent economic transition, and IT to Chakrabarti's (2014) study on organizational adaptation in an economic shock. This shows that organization theories can be fruitfully applied to study the kinds of environmental changes associated with transitions.

4. Review design

The organizational literature comprises too many actively-used theories to consider in a single review. The present review therefore considers a subset of the available theories, namely the BTOF, the RBV, RDT, IT, and OE, which we selected as follows.

First, we choose theories that represent a good spread with respect to the different positions in the two debates discussed above. We further excluded neo-classical theories that assume fully rational behavior. These are altogether incompatible with the foundational assumptions of the MLP, which assumes that *"actors are self-interested, act strategically, and try to calculate which actions best achieve their goals. But cognitive capabilities and time are limited (bounded rationality). Hence, actors use cognitive rules and schemas, some of which are shared with others"* (Geels and Schot, 2007). We also excluded theories that have a primary focus on managerial inquiries on how firms can be efficiently and effectively managed, such as the broad area of leadership theories, or theories that focus on particular aspects of firm behavior, such as Transaction Costs Economics.

Second, we chose to cover only those theories and theory-elements that have seen extensive theoretical and empirical work, so that we avoid introducing nascent ideas into the transition studies domain. Given the aims of this review, we focus exclusively on those elements that belong to the core of the contemporary versions of the selected theories, as evidenced by their recurrent referencing in the theory's seminal papers and contemporary reviews.

Lastly, we chose to focus on older "foundational" theories that previously drew inspiration from distinct scientific disciplines. Contemporary theories often combine elements of these foundational theories. Our choice leads to the most distinctive combination of assumptions, mechanisms, and processes. This is important for the subject of transitions because different theoretical paradigms conceptualize agency and causal processes in different ways. Previous transitions studies have shown that *"transitions involve multiple types of agency and causal processes that may alternate. This implies that transition theory needs to accommodate various types of agency"* (Geels and Schot, 2007). This is in line with the interpretivistic nature of transition studies (Geels, 2010) that allows researchers to interpret their empirical findings in light of (combinations of) different the mechanisms highlighted in the different theories with which they are familiar.

For each of the selected theories, we summarize how it portrays firms and their assumptions about firm behavior. Next, we discuss how the theories conceptualize firm behavior in a stable environment. Then, we discuss how the theories expect firms to (attempt to)

[2] As Geels and Schot (2007) indicate, some transitions are triggered by very rapid and profound landscape changes such as wars. The behavior of incumbent firms in these kinds of transitions are likely to be inconsistent with the theories included in this review.

Table 1
Core theory characteristics and expected firm behavior.

Theory	Goal of the firm	Firm–environment debate	Adaptation–selection debate	Behavior in a stable environment	Behavior in the wake of change
Behavioral Theory of the Firm	Achieve aspiration levels	Intra-firm—the interaction between routines, experience, and aspirations governs firm behavior.	Mixed—firms can adapt routines and capabilities that become inappropriate due to environmental change, but internal processes limit their ability to implement and identify the appropriate changes in time.	• Retain routines that are perceived to be valuable. • Imitate routines that are perceived to be valuable. • Develop absorptive capacity for knowledge related to existing knowledge domain. • Efficient firms accrue organizational slack. • When organizational slack is high, firms use slack search to explore ways to improve routines.	• Absorb minor changes with organizational slack. • When performance drops below aspirations, use problemistic search to identify solutions. • Attempt to implement the first satisfactory solution.
Resource-Based View	Acquire sustainable competitive advantage	Firm—resources and capabilities govern firm behavior.	Mixed—firms can adapt resource that lose value due to environmental change, but path dependencies make it hard to acquire valuable resources.	• Trade excess resources. • Diversify into areas where fungible excess resources can provide a competitive advantage. • Improve competitive position by developing new resources and capabilities. • Raise barriers to entry with isolating mechanisms.	• Develop dynamic capabilities that allow adaptation in unstable environments. • Use dynamic capabilities to adapt resources and capabilities to the novel environmental conditions.
Resource Dependence Theory	Minimize environmental uncertainties	Mixed—opportunities to control external contingencies govern firm behavior.	Adaptive—firms actively manage their external contingencies in response to anticipated and realized instances of environmental change.	• Grow organically to increase control over other firms. • Use mergers and acquisitions to reduce external contingencies. • Form ties with external dependencies that cannot be absorbed. • Engage in political action to create a favorable regulatory environment.	• Intensify regular strategies to minimize environmental uncertainties. • Use additional strategies specific to the source of environmental change.
Institutional Theory	Acquire legitimacy	Environment—institutional demands govern firm behavior.	Mixed—firms can successfully adapt to changes in their institutional environment, but internalized institutional rules can invoke lags or mismatches.	• Adopt features that the wider institutional environment considers legitimate. • Imitate firms that are perceived as successful or legitimate.	• Exhibit strategic behavior, ranging from adherence to institutions, through quiet non-conformity, to manipulation of institutional processes. • Select firms act as institutional entrepreneurs and introduce

(continued on next page)

Table 1 *(continued)*

Theory	Goal of the firm	Firm–environment debate	Adaptation–selection debate	Behavior in a stable environment	Behavior in the wake of change
					divergent changes to the field. • Remaining firms intensify coercive pressures to force institutional entrepreneurs to comply with the dominant institutions.
Organizational Ecology	Survive	Mixed—behavior is influenced by the environment, but not determined by it. Variation in behavior may occur.	Selective—although firms partially set their own behavior and will try to adapt to environmental change, they are unable to do so systematically.	• Legitimacy and competition processes that depend on the density of a population with a particular form of behavior shape its founding and failure rates. • Behavior that fits poorly with the environment is selected out. • Temporal variability in firm behavior decreases over time. • Market conditions and environmental dynamics determine the specialist/generalist ratio.	• Inert firms whose niche is not compatible with the new environment do not change their behavior and are selected out. • Inert firms whose niche is compatible with the new environment do not change their behavior, but are retained. • Generalist firms attempt to adapt, but have difficulty identifying and implementing appropriate changes.

adapt in the wake of environmental change. Lastly, we illustrate how the theory can be applied to study the behavior of incumbent firms during transitions. We summarize our findings in Table 1.

4.1. Behavioral theory of the firm

The BTOF sees intra-firm dynamics as the factor that principally determines firm behavior. The theory portrays firms as coalitions of individuals and functional groups that pursue individual goals (Stevenson et al., 1985). Since individual goals vary and often conflict, the goals of a firm result from the quasi-resolution of conflicts between its sub-coalitions (Stevenson et al., 1985). During the resolution process, each sub-coalition imposes independent aspiration-level constraints on the firm (Cyert and March, 1963), which are based on the performance of the firm's competitors (social aspirations) (Greve, 1998; Massini et al., 2005) and on its past performance (historical aspirations) (Lant, 1992; Lant et al., 1992). Situational complexity and computational limits make it impossible fully to consider the utility of every possible action. Firms thus rely on heuristics (Argote and Greve, 2007), and look "*for a course of action that is satisfactory or 'good enough'*" (Simon, 1997, p. 119) with respect to the demands of their sub-coalitions. The result is that firms do not behave according to the utility maximization postulate of neo-classical theories, but are "boundedly rational." The theory has an adaptive orientation, but argues that the firm's adaptive capacity is limited. As such it recognizes selection as well.

Contemporary studies associated with Evolutionary Economics and Organizational Learning commonly incorporate particular elements of the BTOF (Argote and Greve, 2007). For those elements, we draw on insights from all three traditions.

4.1.1. Firm behavior in stable environments

According to the BTOF, the behavior of a firm principally results from the interplay between its aspirations, its experience, and its routines. Routines are the "recurrent interaction patterns" (Becker, 2004) that firms use to attain their goals. Scholars using the BTOF often operationalize routines as *"the forms, rules, procedures, conventions, strategies, and technologies around which organizations are constructed"* (Levitt and March, 1988). Routines enable coordination of the behavior of intra-firm actors, provide stability, increase efficiency, and bind knowledge in the firm (Becker, 2004). As such, routines are building blocks of organizational capabilities (Dosi et al., 2000) and are therefore an important determinant of firm performance (Henderson and Cockburn, 1994).

Firms learn continuously by adapting their routines to their environment (Zollo and Winter, 2002). They do this by selecting routines on the basis of their perceived efficacy (Hodgson and Knudsen, 2004). Alternatively, firms may imitate the routines of other firms with which they or their members come into contact, such as through consultants (Levitt and March, 1988), personnel movements (Biggart, 1977), or educational institutions (Heimer, 1985). However, routines also change themselves (Becker, 2004)—the participants in a routine incrementally refine it on the basis of their experience of its outcomes (Feldman, 2000). As such, the development of routines is path dependent (Becker, 2004), leading to persistent inter-firm heterogeneity.

As firms learn, they develop "absorptive capacity" (Cohen and Levinthal, 1990, 1989). Firms' prior knowledge allows them to acquire, assimilate, transform, and exploit external knowledge (Lane et al., 2001; Lavie, 2006; Zahra and George, 2002). In the absence of internal (Kim, 1998) and external (e.g. environmental change) triggers, firms acquire absorptive capacity in a path dependent manner (Zahra and George, 2002), such that they focus on exploiting knowledge that is closely related to their current knowledge domain (Van den Bosch et al., 1999). Over time, firms become more and more adept at acquiring external knowledge related to their existing knowledge that can give them an edge over their competitors (Kim, 1998).

The efficient exploitation of routines leads to the buildup of organizational slack—a *"pool of resources in an organization that is in excess of the minimum necessary to produce a given level of organizational output"* (Nohria and Gulati, 1996, p. 1246). Firms accumulate slack in the form of excess administrative resources or financial reserves, or by lending less than they could (Greve, 2003a). Slack buffers a firm against environmental change and variations in performance (Cyert and March, 1963; Litschert and Bonham, 1978; Yasai-Ardekani, 1986) and can be consumed to fuel the search for innovations (Cyert and March, 1963). The accumulation of high levels of slack triggers "slack search," or exploration, whereby firms search for innovations that *"would not be approved in the face of scarcity but have strong subunit support"* (Cyert and March, 1963). Firms then increase their R & D intensity (Chen and Miller, 2007; Greve, 2003a) and the number of R & D projects they undertake (Salge, 2011), and are more likely to adopt innovations (Damanpour, 1987).

4.1.2. Firm behavior in the wake of environmental change

The BTOF argues that environmental change invokes behavioral change in two ways. First, environmental change can lower a firm's performance by invalidating its routines. Second, it can affect the performance of other firms, which may subsequently affect the focal firm's social aspirations.

In both cases, firms respond similarly. They initially absorb environmental fluctuations with organizational slack (Meyer, 1982) and refrain from changing their routines (Cyert and March, 1963; Litschert and Bonham, 1978; Yasai-Ardekani, 1986). Experienced firms, in particular, often retain routines that have previously been successful—even if they no longer match the firm's environment (Henderson and Clark, 1990; Starbuck, 1983). But when environmental change exceeds a firm's buffering capacity, its performance may drop below aspirations, which triggers "problemistic search" (Greve, 2003b).

During problemistic search, firms either look for solutions to their unsatisfactory performance that are close to its perceived symptoms (Cyert and March, 1963), or draw upon the solutions of other firms (Baum and Dahlin, 2007; Park, 2007). Both strategies make firms seek and experiment with solutions outside the scope of their usual routines (Greve, 2003b; Van Rijnsoever et al., 2012). Environmental change is thus an important source of novelty, because it can trigger the creation of new routines (Lant and Mezias,

1992; Zhou, 1993). Once firms perceive that an identified solution is "good enough," they attempt to implement it, and abandon the search process (Gavetti et al., 2012). The identified solutions vary widely; firms may, for example, promptly join R & D consortia (Bolton, 1993), increase their R & D investments (Antonelli, 1989; Greve, 2003a), grow their production assets (Greve, 2003b), or initiate risky strategic changes (Greve, 1998; Greve and Taylor, 2000).

Firms encounter great difficulties when adapting to environmental changes that require changes in routines or capabilities (Henderson and Clark, 1990; Tushman and Anderson, 1986)—particularly when they need to change many routines at once (Tripsas and Gavetti, 2000). Even just unlearning routines that used to be effective often proves difficult (Betsch et al., 2004; Cohen and Bacdayan, 1994; Tripsas and Gavetti, 2000). In addition, although applied work on organizational learning commonly assumes that learning and routinized behavior improve performance (Schulz, 2002), other studies argue that firms' learning is sometimes myopic. Myopic learning harms long-term performance (Miner and Mezias, 1996), because firms overvalue the conclusions that they draw from recent experience and local situations, and may erroneously assume that particular actions caused an observed outcome (Levitt and March, 1988). At the same time, firms decrease their absorptive capacity with respect to new conditions when they adapt to current ones (David, 1985; Levinthal and March, 1993), which decreases their ability to acquire, assimilate, and transform new knowledge (Jansen et al., 2005). Identifying and implementing a solution to unsatisfactory performance therefore becomes harder as the distance between the current situation and the identified solution increases (Cohen and Levinthal, 1990), and even more so for firms with well-developed sets of routines.

4.1.3. Application to the behavior of incumbent firms during transitions

Seen through the lens of the BTOF, the initial stage of a transition has a limited impact on the performance of incumbent firms. This allows firms to buffer themselves from variations in performance by consuming organizational slack. But as the transition proceeds, incumbents run out of slack. This results in an active search for successful novel technological niches (Kotha et al., 2011), that incumbents enter by imitating the firms that occupy them. In turn, this is likely to trigger other incumbents to do the same due to the social nature of firms' aspirations. Yet, when there are no suitable niches to imitate, incumbents seek innovative solutions and may be the first to discover new niches to exploit (Jiang et al., 2010). This is particularly likely when a transition leads to performance issues that are inherent to the incumbents' core technologies, because this leads firms to search for alternative technologies. Alternatively, incumbent firms may discover new niches when their historical performance was good, because the organizational slack that they have built is likely to trigger slack search that can uncover new niches.

Regardless of whether incumbent firms discover a new niche or enter one by imitating others, adapting to a transition is likely to prove troublesome in the view of the Behavior Theory of the Firm. Especially incumbents that were part of a historically stable socio-technical system will have adapted their routines to a stable environment, at the cost of flexibility. These incumbents have limited absorptive capacity with respect to the novel environment, and their routines are unlikely to fit with it. Only when these incumbents have a significant amount of slack will they be able to afford themselves the time they need to adapt to the novel conditions.

4.2. Resource-based view

The RBV sees firms as bundles of tangible and intangible assets that scholars call *resources* (Barney, 2001; Penrose, 1959; Wernerfelt, 1984). Some resources are valuable, and give the firms that possess them a competitive advantage because they allow it to "*conceive of or implement strategies that improve efficiency and effectiveness*" (Barney, 1991). A firm's advantage, however, is only *sustainable* if its resources are rare and imperfectly imitable, and cannot be substituted with strategically equivalent resources that are not themselves rare or imperfectly imitable (Barney, 1991). It is up to the firm's management to deploy resources strategically and, thereby, to realize their value (Amit and Schoemaker, 1993; Fahy, 2000; Lippman and Rumelt, 2003). As such, firms have *capabilities* that allow them to utilize their resources (Amit and Schoemaker, 1993).

The RBV initially focused almost exclusively on how firms exploit their existing resources and capabilities—it discounted the ability of firms to change these (Eisenhardt and Martin, 2000; Helfat and Peteraf, 2009). To remedy this perceived deficiency, Teece and Pisano (Teece and Pisano, 1994) introduced the notion of dynamic capabilities to capture a firm's ability to "*integrate, build, and reconfigure internal and external competences to address rapidly changing environments*" (Teece et al., 1997). Spurred on by fast-growing scholarly research (Vogel and Güttel, 2012), the concept has shed its connection to environmental change and has been extended to capture the *general* proficiency of firms deliberately to change their key internal components (Barreto, 2010). Firms change their internal components to maintain or extend their competitive advantage. The theory sees firms as continuously adapting to their environment, but limits their ability to do so. It thus has elements of both adaptation and selection.

4.2.1. Firm behavior in stable environments

The RBV assumes that firms' resources are heterogeneous (Peteraf, 1993; Wernerfelt, 1995, p. 172). Resource heterogeneity stems from variations in methods of information gathering, luck, managerial ability, technological know-how (Lewin et al., 2004), and uncertain imitability (Rumelt, 1984). Even in stable environments, firms with valuable resources cannot afford to remain passive and merely exploit their resources. To maintain their competitive advantage, they need to prevent imitation by other firms by raising barriers to entry (Mahoney and Pandian, 1992; Rumelt, 1984). Firms do this with *isolating mechanisms* (Rumelt, 1984) such as property rights, reputation, information asymmetries, and causal ambiguity (Lippman and Rumelt, 1982).

Firms rarely use their heterogeneous resources to their full extent (Pettus, 2001). To take advantage of excess resources, firms seek to trade them on open markets. Some excess resources, however, are fungible and costly or difficult to trade. Firms may decide to use resources that are subject to market failure internally (Montgomery and Hariharan, 1991), by diversifying into industries that have

resource requirements similar to their own (Montgomery and Wernerfelt, 1988; Penrose, 1959; Peteraf, 1993).

In stable environments, firms continuously improve their competitive position by using their dynamic capabilities to develop the capabilities to use their resources more effectively and efficiently (Teece et al., 1997), and to develop or acquire new resources (Amit and Schoemaker, 1993; Fiol, 1991). Developing new resources is time-consuming, expensive (Wernerfelt, 1995), and subject to strong path dependencies because the resources and capabilities that firms can develop in the future depend on the complementarities between their current resources (Harrison et al., 1991; Pettus, 2001). As a result, firms tend to develop their resources along unique trajectories that are contingent upon the current environmental conditions.

When firms use their dynamic capabilities to develop resources, they form new dynamic capabilities (Argote, 1999; Eisenhardt and Martin, 2000) through the accumulation of experience and the articulation and codification of knowledge (Zollo and Winter, 2002). However, dynamic capabilities depreciate when they fall in disuse, which means that firms have to maintain them to retain them (Helfat et al., 2007). Because maintaining dynamic capabilities is expensive (Ambrosini and Bowman, 2009; Lavie, 2006; Winter, 2003; Zollo and Winter, 2002), firms only retain dynamic capabilities that provide a clear benefit. In stable environments, dynamic capabilities are beneficial when they allow firms to cope with predictable market change, which requires dynamic capabilities that are detailed, structured, predictable, and rely heavily on existing knowledge (Eisenhardt and Martin, 2000; Helfat, 1997; Wang and Ahmed, 2007).

4.2.2. Firm behavior in the wake of environmental change

Within the parameters of the RBV, the value of strategic resources is closely tied to the conditions under which those resources are used (Barney, 1991). This means that environmental change can render strategic resources obsolete (Abell, 1978; Miller and Shamsie, 1996; Porter, 1991; Robinson et al., 1992), which opens opportunities for founding and new entry because incumbents and entrants are on a more level playing field. When environmental change is severe, incumbents may even be in a disadvantaged position compared to new entrants, because the high resource heterogeneity of entrants (Walker et al., 2002) is likely to cause some of them to possess resources that are valuable in the new environment (Miller and Shamsie, 1996; Rumelt, 1984; Thornhill and Amit, 2003). The incumbents, on the other hand, will not have retained these resources if they did not provide value in the old environment.

To survive environment change, firms have to change their resources or the way they deploy them (Sirmon et al., 2007). However, the inimitable nature of strategic resources makes it hard to identify the appropriate changes (Rumelt, 1984). Even when firms are able to identify appropriate changes, developing resources and capabilities internally is time-consuming (Dierickx and Cool, 1989), while acquiring them externally is unlikely to succeed. Firms that control critical resources are unlikely to share them with competitors without significant compensation, because sharing could compromise their own competitive position (Barney, 1986a). Other critical resources such as tacit knowledge (Dierickx and Cool, 1989), reputation (Teece, 1980), and organizational culture (Barney, 1986b) cannot be traded directly at all; they can only be shared or partially transferred with intense involvement of both buyer and seller (Chi, 1994).

As such, firms can only maintain the match between their resources, their capabilities, and the environment by using their dynamic capabilities (Teece et al., 1997; Zahra et al., 2006). This requires dynamic capabilities that are different from those needed in stable environments (Eisenhardt and Martin, 2000; Helfat and Peteraf, 2009). Instead of being heavily reliant on existing knowledge, detailed, structured, and predictable, they need to be simple (to avoid locking managers into generalizing from past experience) and flexible, and should specify only the boundary conditions and priorities (Eisenhardt and Martin, 2000). This type of dynamic capabilities is even more expensive (Lavie, 2006; Winter, 2003; Zollo and Winter, 2002) and harder to maintain (Eisenhardt and Martin, 2000). As a result, firms that operate in industries where environmental change is uncommon are likely to fail when change does occur, because they will not have retained the right type of dynamic capabilities.

4.2.3. Application to the behavior of incumbent firms during transitions

Seen through the lens of the RBV, persistent inter-firm resource heterogeneity causes a transition's impact to vary between incumbents. Some resources retain their value during a transition, while other resources lose their ability to provide a competitive advantage. As a result, incumbents with specialized resource bases are likely to find their competitive advantage significantly diminished, while incumbents with diverse resource bases may retain some of their advantage.

In both cases, incumbents will seek to exploit their—now excess—resources. When emergent niches are present during the transition, incumbents are therefore likely to diversify into them. This strategy becomes progressively more difficult as niches have more time to independently develop. If this happens, incumbents have no choice but to develop new resources that are critical to the technologies around which the niches have coalesced. The other firms, incumbents or new entrants, that are already active in the niches are then likely to deter entry with isolating mechanisms. When, on the other hand, isolating mechanisms are weak or have yet to develop, any advantages that niche firms have over incumbents are only temporary.

In the absence of emergent niches, incumbents have more time to revise their resources and capabilities with their dynamic capabilities. Incumbents can then be the first to discover new niches. Whether this is successful depends on the characteristics of the socio-technical system in which incumbents previously operated. Incumbents that operated in stable systems will not have retained the dynamic capabilities they need to adapt to environmental change, which, over time, has made them progressively less resilient to transitions.

4.3. Resource dependence theory

RDT shares many elements with the RBV, but differs in two major respects. First, the theory assumes that firms aim for continued

support, operational stability, and survival, rather than for competitive advantage (Lin et al., 2009; Pfeffer and Salancik, 2003). Second, it focuses on the relationship between firms and their environment, rather than on the firms themselves (Lewin et al., 2004). The theory builds on two previously disconnected research traditions: one that focuses on the role that environments play in the structure of firms, and the other a sociological tradition that focuses on inter-firm power relations (Wry et al., 2013). RDT integrates the two traditions by positing that a firm's environment is comprised of other firms that each have their own goals and that these firms hold power over the focal firm in proportion to the indispensability of their resources in the attainment of its goals (Pfeffer and Salancik, 2003). Firms strive to minimize other's power over them by reducing environmental uncertainties and external contingencies (Hillman et al., 2009; Pfeffer and Salancik, 2003).

In this sense, the RDT expects firms to select and implement strategies that allow them to adapt to their environment, which gives it a strong adaptive orientation. A distinctive feature of the theory is that it goes beyond adaptation (Lewin et al., 2004), by arguing that firms proactively enact their environment to reduce future uncertainty (Pfeffer and Salancik, 2003).

4.3.1. Firm behavior in stable environments

In stable environments, firms try to reduce uncertainties and contingencies in several ways (Hillman et al., 2009). First, firms try to absorb their external constraints by altering their boundaries. They do so by growing organically, which increases their power over the resources of other firms, or by merging with the firms on which their transactions are most dependent (Campling and Michelson, 1998; Finkelstein, 1997; Pennings et al., 1984; Pfeffer, 1972). Mergers are especially likely in highly concentrated industries, because firms in such industries have more power to negotiate better prices and, hence, have more to lose when their transactions are constrained (Finkelstein, 1997). Although mergers between two mutually dependent firms are likely to succeed, success is unlikely when there are substantial power imbalances between them (Casciaro and Piskorski, 2005; Gulati and Sytch, 2007). Second, firms may try to form close ties with the firms on which they are dependent for resources to minimize the uncertainties that arise from their dependence (Burgers et al., 1993; Pfeffer and Leong, 1977). When firms find that another party is unwilling to form ties with them, they attempt to control it indirectly by building ties with a third party that has control over the second party (Gargiulo, 1993). Firm are most likely to form ties at intermediate levels of industry concentration, because the uncertainty resulting from interdependence is most problematic at this level (Pfeffer and Salancik, 2003; Phillips, 1960). Lastly, firms can resort to political action to create a new regulatory environment that minimizes their own dependencies and uncertainties (Mizruchi, 1989). Large and powerful firms, in particular, engage in political action, such as lobbying and advocacy advertising (Meznar and Nigh, 1995).

Over time, firms' attempts to minimize other's power over them turns their industries into carefully coordinated and relatively stable networks in which heterogeneous firms are tightly coupled to the firms on which they rely for resources.

4.3.2. Firm behavior in the wake of environmental change

Environmental change can upset the power relationships in an industry, because it alters the importance of a firm's resources in the attainment of other firms' goals. Even the anticipation of environmental change can trigger behavioral change, because it increases the uncertainties resulting from a firm's external contingencies.

According to RDT, firms intensify their use of the strategies outlined above when they face anticipated and realized instances of environmental change (Pfeffer and Salancik, 2003). In addition, firms try to identify the source of the most significant uncertainties, and implement measures to minimize them. These measures depend on the nature of the uncertainty to which the firm is exposed. When the uncertainty is firm-specific, firms tend to form alliances with partners from outside their network, while they strengthen existing network ties when they are part of a larger group that is collectively facing uncertainty (Beckman et al., 2004). When the source of uncertainty is a novel technology, firms make strategic use of trade secrets, licensing, and various forms of patent application, acquisition, and sharing, to control access to the technology (Dunford, 1987). When these strategies fail, large and powerful firms may resort to takeovers to suppress the technology (Cooper and Schendel, 1976; Dunford, 1987).

4.3.3. Application to the behavior of incumbent firms during transitions

Seen through the lens of RDT, socio-technical transitions can result from the behavior of the incumbent firms. Stable socio-technical systems allow powerful incumbents to continuously enact their environment, which leads to carefully coordinated and relatively stable networks of interdependent firms. Such powerful incumbents perceive a transition as a source of uncertainty and will therefore respond by attempting to prevent or delay it. The theory specifies several ways in which they are likely to do so. First, because transitions expose the incumbents in a socio-technical system to the same source of uncertainty, incumbents are likely to strengthen their mutual ties to raise widespread resistance to the system. Second, incumbents upon whom many other firms are dependent for resources use their power to raise resistance to the transition among firms that are not directly affected by it. Third, large and powerful firms engage in political action to raise resistance against the transition in the wider society. Fourth, incumbents attempt to use their patents to control access to the technology that defines the transition. Lastly, the firms that drive the development of the technology that defines the transition are likely targets of mergers and acquisitions by powerful incumbents.

Some select incumbents may perceive the transition as a way to reduce their external contingencies because the technology that defines the transition relies on resources that they control. Incumbents that take such a favorable view on a transition try to accelerate it and are likely to seek out emerging niches. Powerful incumbents that do so are likely to pressure the firms that depend on them for resources to follow them into niches. However, both scenarios are unlikely if there are significant uncertainties surrounding the transition. Powerful incumbents can thus influence the pace of the transition to increase their chances of survival, while less powerful incumbents do not have these privileges and are at the mercy of their contingencies. However, transitions often lead to a redistribution of power and are therefore likely to decrease the power that incumbents hold over others. As a result, incumbents become

less likely to stall a transition as it continues to unfold. In addition, the uncertainties surrounding a transition tend to decrease over time—which may even lead incumbents to eventually follow into niches

4.4. Institutional theory

IT posits that firms reflect the dominant institutions, the "rules of the game" in a society (DiMaggio and Powell, 1991; Meyer and Rowan, 1977; North, 1990; Zucker, 1983). Rather than striving for profit maximization, firms strive for legitimacy; the "*generalized perception or assumption that [their] actions […] are desirable, proper, or appropriate within some socially constructed system of norms, values, beliefs, and definitions*" (Suchman, 1995). Firms continually incorporate behavioral and organizational features that the wider institutional environment considers legitimate (Donaldson, 2006; Meyer and Rowan, 1977; Tolbert and Zucker, 1983), thus increasing their legitimacy and thereby their chances of survival (Baum and Oliver, 1991; Drazin et al., 2004).

Firms also conform to institutions for other reasons. Firms may, consciously or unconsciously, imitate other firms that adhere to particular institutions (DiMaggio and Powell, 1983; Galaskiewicz and Wasserman, 1989; Oliver, 1991). Institutional beliefs and practices can also become so widely accepted that they make the institutions themselves invisible to the firms they influence, such that firms are unable to recognize alternatives (DiMaggio, 1988). Yet, even when firms recognize alternatives, they may not implement them because of their aversion to risk (Kondra and Hinings, 1998) or because they want to avoid the legitimacy penalty associated with non-compliance (Scott, 2001). When firms do choose to deviate from institutions, they are likely to minimize the above factors by decoupling some aspects of their formal structure from their technical core. This allows them to uphold the perception of institutional conformity, while retaining some degree of discretion (Meyer and Rowan, 1977; Seo and Creed, 2002; Westphal and Zajac, 1994).

IT's focus on institutions led early theorists to emphasize structure (Barley and Tolbert, 1997), which made the role of agency ambiguous (Battilana et al., 2009; DiMaggio and Powell, 1991; Oliver, 1991; Scott, 2001). This ambiguity has seen extensive theoretical and empirical investigation in recent years (Dacin et al., 2002; Peng, 2003), leading to a notable change in the dominant discourse in the literature. Under the new discourse, scholars perceive the rules, norms, and beliefs of actors as guided by institutional demands, rather than determined by them (Koelbe, 1995; Scott, 2005). This leaves room for "institutional entrepreneurs" to deviate from institutional norms by introducing divergent changes such as new business models and organizational practices (Battilana et al., 2009; DiMaggio and Powell, 1983).

Institutional Theory expects firms to adapt to institutional environments, rather than technological environments. However, because firms internalize institutional rules, their adaptations can lag or fail to match a changing environment. The theory therefore has elements of both adaptation and selection.

4.4.1. Firm behavior in stable environments

According to IT, firms operate in organizational fields, which are "*richly contextualized spaces where disparate organizations involve themselves with one another in an effort to develop collective understandings regarding matters that are consequential for organizational and field-level activities*" (Wooten and Hoffman, 2008, p. 138). Organizational fields feature three types of environmental pressures (DiMaggio and Powell, 1983) and associated processes (Scott, 2001) that are responsible for a large share of the behavior of firms in stable environments. First, coercive pressures and regulative processes stem from the socio-political expectations and pressures exerted on firms by the organizations upon which they are dependent (Meyer and Rowan, 1977; Salancik, 1979; Townley, 1997). Second, mimetic pressures and cognitive processes arise because firms imitate other firms that they perceive as successful or legitimate (Budros, 1997; Fligstein, 1985; Haunschild, 1994). Lastly, normative pressures and processes emerge because firms in the same field draw personnel from similar cognitive bases and filter them by similar methods, and because normative rules about organizational and professional behavior spread across firms through professional networks (DiMaggio and Powell, 1983; Galaskiewicz and Wasserman, 1989). These pressures and processes lead to isomorphic change, whereby firms become increasingly similar over time (DiMaggio and Powell, 1983).

The conceptualization of firm behavior as conforming to institutions implies a static and homogenous outcome in stable environments (Holm, 1995; Seo and Creed, 2002). As long as isomorphic pressures are maintained, institutional scholars expect little variation in performance (Kondra and Hinings, 1998). Nevertheless, some firms may unknowingly deviate from institutional norms (Kondra and Hinings, 1998). Slight variations in behavior and performance therefore persist—even in stable environments.

4.4.2. Firm behavior in the wake of environmental change

Environmental change is an important source of firms' deviations from institutions because it creates the conditions (Battilana et al., 2009; Oliver, 1991) under which firms exhibit "strategic behavior." Strategic behavior ranges from complete adherence to institutions, through quiet non-conformity, to active attempts to manipulate institutional processes. Institutionally embedded firms can thus act as institutional entrepreneurs and contribute to institutional change.

The institutional literature recognizes several factors associated with environmental change that promote strategic behavior. First, environmental shocks can disturb institutions by invoking the failure of dominant actors in the field (Child et al., 2007; Fligstein and Mara-Drita, 1996; Greenwood et al., 2002; Hoffman, 1999), which invites deviant behavior to resolve (Battilana et al., 2009). Such shocks can originate from outside of the field, such as technological disruptions, sudden changes in factor conditions, or changes in product demand (Ruttan and Hayami, 1984), but they can also be internal to it, such as the depletion of a critical resource (Kingston and Caballero, 2009; Leblebici et al., 1991). Second, when environmental change exposes a field to multiple conflicting institutions, firms may suddenly see the institutions as problematic (Clemens and Cook, 1999; Seo and Creed, 2002; Sewell, 1992). This triggers

their reflective capacity, which makes then question the institutions (Battilana et al., 2009). Third, when the degree of institutionalization is low, environmental change leads to uncertainty about the institutional order, which opens the door for strategic behavior (Battilana et al., 2009; DiMaggio, 1988). Lastly, cumulative environmental or institutional change progressively increases the gap between institutional norms and firms' technically efficient practices, which makes it hard for firms to decouple their technical core from their formal structure (Greenwood and Hinings, 1996; Oliver, 1992, 1991; Seo and Creed, 2002). This increases the incentives for firms to deviate from institutional norms and to act as institutional entrepreneurs.

Although environmental change affects all firms in a field, their tendency to exhibit strategic behavior varies, because firms differ in their perception of the environment, in their access to the resources required to act as institutional entrepreneurs (Battilana et al., 2009), and in their dependence on institutional constituents (Oliver, 1991; Salancik, 1979). Environmental change will therefore only make some firms act as institutional entrepreneurs.

Deviant behavior is likely to affect institutional entrepreneurs' performance according to the institutionalized performance standards (Kondra and Hinings, 1998). When institutional entrepreneurs perform worse than, or similar to, firms that conform to the dominant institutions, then incumbent firms are likely to ignore the entrepreneurs. It is therefore easier to achieve consensus about slight deviations from institutional expectations than about major deviations (Kingston and Caballero, 2009; North, 1990). But when institutional entrepreneurs perform better than firms that conform to the institutions, or when they threaten established organizational privileges and social positions within the field (Battilana et al., 2009), "institutional defenders" are likely to arise (DiMaggio, 1988; Levy and Scully, 2007). Institutional defenders intensify the existing coercive pressures to force the deviants to comply with the dominant institutions. If this proves unsuccessful, defenders may imitate the behavior of the deviants (Battilana et al., 2009). As a result, even though successful radical behavioral change is rare, it is revolutionary when it does occur and is likely to involve all of the affected actors (Greenwood and Hinings, 1996; Seo and Creed, 2002). When imitation of institutional entrepreneurs becomes common, institutionalization sets in and the novel behavior slowly becomes legitimated.

4.4.3. Application to the behavior of incumbent firms during transitions

Seen through the lens of IT, incumbent firms initially increase their conformance to the institutions of the incumbent socio-technical regime when faced with a transition because they face uncertainty about institutional demands. Prolonged uncertainty about institutional demands decreases the environmental pressures that emanate from the regime, which gradually reduces the alignment of the socio-technical regime. This decreases the degree of institutionalization and leads to conflicting institutions and technical inefficiencies in incumbent behavior, which opens the door for institutional entrepreneurs to develop emergent niches.

Institutional entrepreneurs can originate both from inside as well as outside of the socio-technical system, since misalignment simultaneously attracts new entrants and invites strategic behavior by incumbent firms. In general, the longer a firm's institutional environment remains stable, the more the gap between environmental demands and the firm's technically efficient practices tends to increase. This can lead incumbents that are relatively independent from the institutional constituents and those that perceive severe conflicts in their institutional environment to act as institutional entrepreneurs. For as long as the institutional entrepreneurs perform worse than incumbents that act in accordance with the incumbent socio-technical regime, they are likely to be ignored. This allows institutional entrepreneurs to develop their activities in emergent niches, relatively isolated from the incumbent socio-technical regime. However, as soon as the perceived performance of institutional entrepreneurs according to the institutionalized performance standards (Kondra and Hinings, 1998) exceeds that of the firms that adhere to the incumbent socio-technical regime, the latter respond by intensifying the existing coercive pressures to stifle the institutional entrepreneurs. When this proves unsuccessful, other incumbent firms imitate the institutional entrepreneurs, which further reduces the alignment of the socio-technical regime and invites more imitation. The result is that the behavior of the institutional entrepreneurs becomes institutionalized. Institutional entrepreneurs and imitating incumbents then adhere to the same institutions. The most likely survivors of the transition are the firms that have gained the most legitimacy during the transition and the firms that helped to shape the new institutions, as they can align the institutions with their existing practices and technologies (Smink et al., 2013).

4.5. Organizational ecology

OE focuses on how environmental conditions affect the abundance and diversity of firms. Like other contemporary theories, OE claims that a firm's performance depends on its match with its environment (Hannan and Freeman, 1977). Unlike other theories, OE claims that the match between environmental change and a firm's response to it is essentially random in changeable and unpredictable environments, because it is hard to identify and implement appropriate responses in time (Hannan and Freeman, 1977). This means that selection processes—rather than adaptation processes—principally govern firm survival (Baum and Shipilov, 2006; Hannan and Freeman, 1989).

When firm survival primarily reflects environmental selection, it becomes meaningful to study higher levels of aggregation than individual firms (Hannan and Freeman, 1977). Ecologists primarily study "organizational populations," which are sets of organizations that engage in similar activities and have similar environmental dependencies (Hannan and Freeman, 1989, 1977).

4.5.1. Firm behavior in stable environments

Consistent with its focus on populations, OE is primarily concerned with changes in the prevalence of particular kinds of behavior, rather than with the behavior itself. According to ecologists, changes in the prevalence of particular kinds of behavior therefore reflect variations in the growth rates of populations that exhibit those kinds of behavior. The growth rate of a population depends on legitimacy and competition processes (Carroll and Hannan, 1989; Carroll and Swaminathan, 1991; Hannan and Carroll, 1992). A

population becomes more legitimate when its firms become more numerous and increase in mass which, in turn, further increases the growth rate of the population (Baum and Oliver, 1992). However, as the population grows, competition for resources intensifies, which progressively slows down its growth rate (Barnett and Amburgey, 1990), until it stabilizes around its "carrying capacity" (Hannan and Freeman, 1989). As a result, novel forms of behavior acquire prevalence along an S-shaped curve.

Once a form of behavior has established itself along with a population, the surviving firms increasingly are "structurally inert"—they rarely change their core features such as their goals, core technologies, and market strategies (Hannan and Freeman, 1984). This structural inertia results from internal factors, such as sunk costs and routinized behavior, but also from external factors, such as legal barriers, exchange relations, and the potential loss of legitimacy that may accompany change. The temporal variability in firm behavior also tends to decrease as populations age and their firms grow. Large, accountable, and reliable firms are less likely to fail than small firms (Baum and Shipilov, 2006; Geroski et al., 2010), because stable environments favor accountable and reliable firms (Hannan and Freeman, 1984). Small firms, on the other hand, suffer from *liabilities of smallness* related to problems with meeting government requirements, raising capital, and acquiring employees (Aldrich and Auster, 1986).

According to OE, each firm has a "niche," which is defined as the combinations of resource types and levels under which it can survive (Hannan et al., 2003). Empirically, niches are commonly conceptualized as a firm's market breadth (Baum and Singh, 1994), product range (Sorenson et al., 2006), and a combination of its strategy and size (Swaminathan, 1995). Firms that operate in narrow niches are "specialists" and perform well in a stable environment because they invest their resources to efficiently and reliably do one thing (Hannan and Freeman, 1989). "Generalists," on the other hand, can survive under a range of resource combinations, but must spread their resources and maintain persistent excess capacity to do so. As a result, the firms that survive in stable environments tend to be specialized and focused on a limited number of strategies, products, and markets.

Under particular conditions, the organizational populations in stable environments become more heterogeneous than the above view implies. When there are economies of scale, when market resources are finite, and when resources are heterogeneous but concentrated in the center of the market (Boone et al., 2009; Carroll, 1985; Carroll et al., 2002), generalist firms emerge that exploit the economies of scale. These generalists increasingly compete for the densest "center" of the market, which increases their failure rates and forces them to diminish their presence in the periphery of the market. This opens up more of the periphery of the market to specialists (Carroll and Swaminathan, 2000; Mezias and Mezias, 2000; Swaminathan, 1995), and leads to a dual market structure that features generalists as well as specialists (Van Witteloostuijn and Boone, 2006).

4.5.2. Firm behavior in the wake of environmental change

In the view of OE, environmental change affects firms by changing the resources that are available in their environment. When a firm's niche is not compatible with the resources of the new environment, its performance suffers greatly. Large firms, in particular, are negatively affected by environmental change, because they suffer from higher structural inertia and are therefore less likely to change their behavior. Low-performing firms, on the other hand, can receive a short-term benefit from environmental change, because it levels the competitive landscape vis-à-vis their competitors (Greve, 1999).

The most important factor, however, is whether a firm is a specialist or a generalist. Specialist firms are likely to fail when they encounter environmental change, because they can only survive under a limited combination of resource types and levels. Generalist firms, on the other hand, hold two advantages over specialists. First, their wider niche increases the chance that the novel environment provides a combination of resource types and levels under which they can survive. Second, the number of changes that firms have previously undertaken increases the probability that they will undertake a similar change in the future, because the process of change becomes routinized (Baum and Shipilov, 2006). Generalists with a history of innovative change may therefore continue the practice of pushing their boundaries to expand their niches (Sorenson et al., 2006) in the wake of environmental change. Since environmental change often requires change on the part of firms, this form of inertia gives generalists an additional edge over specialists.

As a result, the degree to which firm behavior changes because of environmental change reflects historical environmental dynamics, because historical dynamics determine the pervasiveness of generalists and specialists at the time of change. According to OE, specialists become prevalent in environments that are stable or that experience frequent, but short, fluctuations around their mean configuration regardless of the strength of the fluctuations (Popielarz and Neal, 2007). Environments that experience infrequent, but long, fluctuations also favor specialists, but only when the strength of the fluctuations is low. When the strength is high, generalists become prevalent because these are more likely to retain a satisfactory match with their environment (Freeman and Hannan, 1983; Hannan and Freeman, 1989). This means that environmental change leads to smaller changes in organizational populations that operate in environments that have previously experienced infrequent, but strong, changes than in populations that operate in historically stable environments.

4.5.3. Application to the behavior of incumbent firms during transitions

Seen through the lens of OE, incumbent firms are likely to remain inert when faced with a transition. When the core assumptions of the theory are met, there are only two ways in which incumbents can survive a transition. Neither of these ways relies strongly on the kind of behavior the incumbents exhibit. First, select incumbents may survive by mere chance, because their niches happen to be compatible with the resources that are available in the post-transition environment. Second, incumbents may attempt to change their core features in response to a transition. Although these changes will not be successful on a systematic basis, some changes may—again, by chance—turn out to be appropriate.

Both ways of surviving are more likely to occur for generalist incumbents than for specialists, because generalists have wider niches and are likely to make changes to their core features to further expand their niche. Transitions are therefore likely to cause

widespread failure or exit in socio-technical systems that are dominated by specialist firms. This makes the conditions under which generalist incumbents emerge an important explanation for transition outcomes.

5. Synthesis

We now discuss the implied transition regularities of the theories to answer our two main research questions.

5.1. Which factors govern the modes of behavior of incumbents during transitions: firm or environment

The behavior of incumbents during transitions suggested by the reviewed theories can be summarized by four typical modes of behavior in relation to the niches (Table 2).

Niches can be exploited by incumbent firms or by new entrants. The first mode of behavior is thus to be the *first to enter niches*. By being the first to enter a niche, incumbent firms initially further the transition. This mode of behavior can bring large benefits to a firm (Lieberman and Montgomery, 1988) as long as the socio-technical changes are not too abrupt (Suarez and Lanzolla, 2007). In the context of transitions, this means that an incumbent firm is among the first to exploit the opportunities of a niche after it emerges. However, as the outcome of the transition is not certain, first-movers also expose themselves to great risks. All theories recognize this mode of behavior, but attribute different characteristics to the most likely first-movers (see Table 2). The precise associated characteristics vary, but overall they can be summarized in that incumbents first move into niches out of necessity (BTOF, IT, OE), or to exploit an opportunity (BTOF, RBV, RDT). This mode of behavior has been empirically noted by transition scholars in the heavy vehicle industry (Berggren et al., 2015).

The second mode of behavior is to *follow into niches*. Incumbents that exhibit this behavior wait for other actors to pioneer them. These incumbents advance the transition, but face lower risks and rewards than the first-movers (Hoppe, 2000). All theories recognize this mode of behavior, but the characteristics that they attribute to the most likely followers differ. Notable is that the BTOF and the RBV see following into niches as a firm-level decision, while for the other theories moving into niches is the natural outcome of processes that are largely beyond the control of the firm. RDT takes the strongest stance in this respect and argues that powerful incumbents can even force other incumbents into a specific niche. This mode of behavior has not been empirically noted as a distinct strategy in transition studies. Instead, it is typically regarded as similar to the first to enter niches strategy. Table 2 shows that most theories attribute different characteristics and motivations to the most likely first-movers and followers.

The third mode of behavior is to *remain inert,* which means that the incumbent firm does not significantly change its behavior during a transition. All theories subscribe to the importance of inertia and argue that inertia can result from an incumbent's inability to move into a niche. The other conditions for inertia differ between the various theories. BTOF and the RBV attribute inertia to internal factors such as conflicts and the lack of dynamic capabilities. RDT and IT primarily attribute inertia to external sources, namely an incumbent's dependence on other firms and the initially high uncertainties surrounding niches. OE recognizes both internal and external sources of inertia and has traditionally placed more emphasis on inertia than the other theories. Although OE was not an important source of inspiration for the MLP, this mode of behavior is closest to the way in which the perspective initially conceptualized incumbent firms.

A fourth mode of behavior is to *delay the transition*, in which case incumbents employ strategies to slow down the pace of the transition or to prevent it. The RBV, RDT and IT are most explicit about this strategy, but provide different motivations and mechanisms for it. According to RBV, the incumbent firms are likely to use isolating mechanisms to deter new entry. One of the most well-known examples is the use of patents to give a single firm the opportunity to exploit a niche all by itself. Interestingly, the RBV expects this behavior from both firms that adhere to the incumbent socio-technical regime as well as those that have entered a niche. The net effect of an incumbent's entry into a niche on the pace of the transition remains an empirical question. RDT and IT reason from the perspective of incumbent firms and argue that these firms aim to protect their position by delaying the development of niches until the most opportune time. In transition studies, incumbents have been found to do delay transitions (Geels, 2014b; Hess, 2014), for example with political action strategies (Wesseling et al., 2014) and by strategically setting technical standards to maintain the stability of the incumbent socio-technical regime (Smink et al., 2013).

As noted by Berggren et al. (2015), these modes of behavior are not mutually exclusive. Indeed, the reviewed theories jointly recognize that an incumbent firm can diversify into a new niche, while also exploiting its current business activities. This is in line with findings in the transitions domain, which suggest that incumbents may shift their strategic focus over time (Penna and Geels, 2015; Smink et al., 2013). Our review suggests that shifts between modes of behavior are most likely when a transition process gradually changes the status of incumbents' behavior-governing characteristics over time.

5.2. When do incumbents survive a transition: adaptation or selection

All theories imply that if an incumbent firm moves into niches, its chances of survival are larger than that of firms that remain inert. Socio-technical transitions are so radical that they deprive the latter group from all means to sustain themselves. Firms that actively delay the transition may have a better chance of survival, because they can buy themselves time to adapt to the transition or to be prevent it altogether. Nevertheless, when incumbent firms enter a new niche during a transition, their chance of surviving the transition becomes critically entangled with the fate of this niche.

Yet even after an incumbent firm enters a niche that becomes successful, not all incumbent firms are equally likely to survive the transition. The incumbents still need to adapt to the demands of their new environment. Organization Ecology assumes that selection

Table 2
Relationship between incumbent characteristics and behavior during transitions.

Theory	First to enter niches	Follow into niches	Delay the transition	Remain inert
Behavioral Theory of the Firm	• Incumbents who do not meet their aspirations, in the absence of a niche that is perceived to be successful. • Incumbents with a high amount of slack.	• Incumbents who do not meet their aspirations, in the presence of a niche that is perceived to be successful.		• Incumbents that meet their aspirations. • Incumbents with internal conflicts. • Incumbents with sufficient slack. • Incumbents with well-developed routines.*
Resource-Based View	• Incumbents with dynamic capabilities.* • Incumbents with excess resources that can be exploited in a niche.	• Incumbents with dynamic capabilities and resources that fit better with a niche than the regime.*	• Incumbents that can raise isolating mechanisms.	• Incumbents without dynamic capabilities or excess resources.*
Resource Dependence Theory	• Incumbents that control resources that allow them to increase the control over their environment in a niche.	• Incumbents that are dependent on powerful firms that support a niche.	• Powerful incumbents that support the incumbent socio-technical regime.	• Incumbents that are dependent on powerful firms that support the incumbent socio-technical regime.
Institutional Theory	• Incumbents that are exposed to multiple conflicting institutions.* • Incumbents whose technically efficient practices deviate strongly from institutional demands.	• Incumbents whose legitimacy is higher in a niche than in the regime.	• Incumbents whose organizational privileges and social position are threatened.	• Incumbents that are only exposed to the institutions from the incumbent socio-technical regime.* • Incumbents whose legitimacy is higher in the incumbent socio-technical regime than in a niche.
Organizational Ecology	• Incumbents with a history of innovative organizational change.*	• Incumbent generalists.* • Small incumbents.		• Incumbent specialists.* • Large incumbents.

* Characteristic is associated with the level of historical stability of the socio-technical system.

Table 3
Implied characteristics for successful adaptation.

Theory	Implied characteristics
Behavioral Theory of the Firm	• Incumbents with high organizational slack are more likely to survive than those without.*
Resource-Based View	• Incumbents whose resources have retained their value after a transition are more likely to survive than those whose resources have not. • Incumbents with strong dynamic capabilities are more likely to survive than those without.* • Incumbents with diverse resource bases are more likely to survive than those with specific resource bases.*
Resource Dependence Theory	• Incumbents that are powerful enough to control the pace of the transition are more likely to survive.* • Incumbents that are forced to follow into a niche by other powerful incumbents are less likely to survive.
Institutional Theory	• Incumbents that shape the institutions of a niche are more likely to survive.*
Organizational Ecology	• Incumbent survival is mostly based on chance.

* Characteristic is associated with the level of historical stability of the socio-technical system.

is more important than adaptation because inertia makes incumbents unable to adapt to new environmental demands in time. In this case, survival is mostly a matter of luck. The other theories assume that, despite their inertia, some incumbents have enough time to adapt to a transition. We summarize the characteristics that these theories attribute to the incumbents that are most likely to do so in Table 3.

Except for OE, the reviewed theories suggest that powerful incumbents with a combination of a large and diverse resource base and a history of innovative change are the most likely to successfully adapt to a new niche. Incumbents that have these characteristics are therefore the most likely to survive a transition, although these characteristics are neither necessary nor sufficient to survive. Small incumbent firms with well-developed dynamic capabilities may also be well-positioned to survive, as are incumbents with high organizational slack. There thus may be multiple pathways to survival.

Overall, the various theories imply markedly different incumbent firm-level characteristics as governing the four modes of behavior and the adaptive capacity of incumbent firms. However, the theories jointly imply that the historical stability of a socio-technical system is a critical factor affecting some of the characteristics of the incumbents that have survived until the start of the transition. Indeed, the prevalence of many of the characteristics, marked with an asterisk (*) in Tables 2 and 3, depends on the level of historical stability. For example, historically unstable environments lead to the survival of incumbents with a diverse resource base and strong dynamic capabilities. Firms that survived in historically stable socio-technical systems do not have these advantages.

5.3. Implications for sustainability transitions

Our results aid scholars and practitioners that wish to promote sustainability transitions, in which incumbent firms play a key role. By carefully considering the nature of the firms, and of the socio-technical system, scholars and policy makers can identify which theoretical mechanisms are at work. This allows them to understand the modes of behavior of different incumbent firms, and what the potential consequences of the transitions are for these firms. For example, Volvo's choice to make all of its new models run—at least partially—on electricity (Marshall, 2017), can be explained by its exposure to multiple conflicting institutions, its relative lack of dependence on incumbent players, it's quest for legitimacy, or the build-up of resources and dynamic capabilities. The theories also make different predictions. IT argues that this move creates legitimacy for electric vehicles, which can induce other incumbents to follow into this niche, RDT argues that Volvo can now force its dependent firms to also enter the niche, and the RBV argues that Volvo can raise entry barriers to the niche.

5.4. Conclusions

We identified four typical modes of behavior during a transition: first to enter niches, follow in niches, delay the transition, and remain inert. We further derived the firm characteristics that are most likely to be associated with each mode of behavior and survival.

Overall, our review adds balance to the predominantly institutional view on the behavior and survival of incumbent firms. The five theories acknowledge similar modes of behavior, but highlight separate, but complementary and interrelated, mechanisms of complex organizational realities (Lewin and Volberda, 2003, 1999). Thereby we have added alternate explanatory mechanisms for the behavior of incumbent firms during transitions. Hence, it is important to maintain an open view when studying the behavior of incumbents during a transition. This is in line with the interpretivistic nature of transition studies (Geels, 2010). We recommend researchers to interpret their empirical findings in light of (combinations of) the mechanisms highlighted in the different theories, and to conscientiously judge which theories are most appropriate to understand the transition process at hand. We further recommend studying the effects of historical stability of the socio-technical system, which has received little attention so far in transitions studies.

Although the reviewed theories were carefully selected and cover much of the intellectual foundations of contemporary organizational studies, our review is not a comprehensive review of the organizational literature. The consideration of other theories might lead to a greater variety in expected behavior. We therefore encourage future research to explore other strands of theory in the context of transitions.

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