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Institutional work in diverse niche contexts: The case of low-carbon housing in the Netherlands

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ABSTRACT

Literature on sustainability transitions advocates the institutionalisation of niche innovations and assigns an important role for institutional work in this respect. Previous work has conceptually and empirically substantiated a range of strategies that institutional entrepreneurs perform. However, little is known about how institutional entrepreneurs engage differently in institutional strategies across different dynamic niche contexts. We distinguish between four different niche contexts: market-based niche development, market-based regime transformation, community-based niche development and community-based regime transformation. This typology is then conceptually combined with theory on institutional entrepreneurship and institutional work to examine the diverse agential processes of institutional change through which actors shape and transform their institutional environments. The usefulness of this framework is explored in an analysis of the low-carbon building stock in the Netherlands. The analysis demonstrates that the framework offers a comprehensive approach to examine variety in the arsenal of strategies of institutional work across different contexts.

1. Introduction

A growing body of research claims that fundamental changes in production and consumption systems are needed to address climate change and realise a low-carbon society (Elzen et al., 2004; Frantzeskaki and Avelino, 2017; Hoogma et al., 2002; Loorbach et al., 2017; Markard et al., 2012; Sengers et al., 2016). These fundamental shifts have been conceptualised as socio-technical transitions towards sustainability (Markard et al., 2012; Smith et al., 2010; Köhler et al., 2019). Within this body of literature, scholarly work highlights processes of institutional change in various ways, including regime shifts (Kemp et al., 2012), changes in dominant 'rules of the game' (Meadowcroft, 2009), dynamics in 'institutional pillars' (Geels, 2004) or the institutionalisation of new 'logics' (Fuenfschilling and Truffer, 2014). This paper aims to deepen contemporary understandings of strategic work involved in the institutionalisation of low-carbon innovations by examining differences in institutional work across different niche contexts.

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Previous studies in the field indicate that institutional theory can provide valuable insights into low-carbon transitions, particularly into how actors try to change their institutional environments (Fuenfschilling and Truffer, 2014, 2016; Jolly and Raven, 2015; Klein Woolthuis et al., 2013; Raven et al., 2017; Smink et al., 2015). Literature on institutional entrepreneurship and institutional work are particularly relevant as they examine agential processes of institutional change and study the strategies that actors adopt to transform their institutional environment (Dimaggio, 1988; Gasbarro et. al., 2017; Lawrence and Suddaby, 2006; Lawrence et al., 2011). Institutional entrepreneurs are conceptualised as individuals and as collectives of actors who purposefully aim to transform existing or create new institutions (Dimaggio, 1988; Eisenstadt, 1980; Fligstein, 1997; Garud et al., 2002).

Earlier work provided valuable perspectives on the kind of strategies that entrepreneurs enact for institutional change. However, so far little work has been conducted on how institutional strategies differ across a range of niche contexts. This is a notable gap as work within transition studies has shown that transition dynamics differ across different transition contexts (Smith et al., 2005), transition pathways (Geels et al., 2007; Kern et al., 2016; Walrave and Raven, 2016) and niche-contexts (Smith et al., 2014). The notion of niche contexts refers here to the idea that there is no single pathway through which niche innovations emerge and evolve. Rather, niche innovations come about through a range of pathways and sequences of events. Hence, it is likely that institutional strategies will be different, too. In this paper, we specifically hone in on differences in institutional strategies across four niche contexts that differ in terms of 1) emerging in markets versus communities; and 2) creating and maintaining niches versus transforming regimes. Linking this conceptualisation of niche context to insights from institutional theory, we explore how the institutional work differs across these contexts in terms of institutional strategies, actor characteristics and the role of field-level conditions.

We address the following research question: *How does institutional work differ across niche contexts for the low-carbon housing transition in the Netherlands?* Institutional work is defined as "the purposive action of individuals and organisations aimed at creating, maintaining and disrupting institutions" (Lawrence et al., 2009, p.1). The paper answers this question with an analysis of 13 institutional entrepreneurs in the context of an ongoing low-carbon housing transition in the Netherlands. Through desk research and interviews, we examine the strategies of institutional entrepreneurs who are purposefully engaging in institutional change. We show how their institutional strategies differ and reflect on possible explanations for differences. The decarbonisation of the building sector represents an interesting case because energy conservation and renewable energy generation in existing buildings are considered critical for low-carbon energy transition, but require fundamental changes in the provision of housing (Levine et al., 2007; UNEP, 2009).

The paper continues with a discussion of relevant literature and our analytical framework in Section 2. Subsequently, Section 3 will elaborate on the research design. Section 4 offers the results of the case study. We end the paper with conclusions in Section 5.

2. Institutionalising low-carbon innovations in sustainability transitions

2.1. Diverse niche contexts in sustainability transitions

Theory on sustainability transitions argues that sustainability transitions come about through processes at three levels: (1) the development of protective niches where radical innovations are shielded and nurtured, (2) incremental change and stability of socio-technical regimes; and (3) landscape trends and punctuating events that put pressure on socio-technical regimes and create windows of opportunities (Geels and Schot, 2007). The socio-technical regime (henceforth: regime) constitutes a central notion in theory on sustainability transitions and refers to highly institutionalised structures, related to different dimensions of socio-technical systems, that have evolved in alignment with dominant, high-carbon technologies (Fuenfschilling and Truffer, 2014; Geels, 2004). Landscape developments refer to wider societal trends and shocks that are largely beyond the direct control of individuals, such as wars or demographic trends.[1]

Niche development involves a process where low-carbon innovations are 'shielded' from mainstream regime pressures and 'nurtured' so that they can further develop (Kemp et al., 1998; Raven et al., 2016; Schot and Geels, 2008; Smith and Raven, 2012a, 2012b). Shielding refers to processes that hold at bay selection pressures from regime selection environments, for instance through temporary exemptions from planning rules. Nurturing concerns processes that support the development of path-breaking innovations, for instance through learning processes and the development of supportive actor networks (Smith and Raven, 2012a, 2012b).

Niche innovation processes can occur in a range of different settings. Niche literature has analytically distinguished between market- and community-based approaches (Seyfang and Smith, 2007; Smith and Seyfang, 2013). Market-based approaches, promoted by industry and other profit-driven actors, often focus on decarbonising the production-side of the economy by virtue of technological innovation and sectorial change, or develop low-carbon products and services that can be sold to consumers. Market-based niche actors regularly drive institutional change, for instance through innovating with business models and changes in value chains.

On the other hand, community-based approaches, such as community energy cooperatives, are governed by civil society. They focus on consumer and citizen practices and correspond to local needs, possibilities, and values (Seyfang and Smith, 2007; Seyfang,

[1] Note that this does not imply that there is no agency enacted at the landscape level. For instance, Antadze and McGowan (2017: 2 – 4) use the notion of moral entrepreneurs to refer to actors that "aim to delegitimise practices by disassociating them from their moral foundations" located at the landscape level and by doing so "connect niche level with landscape level". Earlier, Jørgenson (2012: 1000) made a similar observation, arguing that "landscape-initiated transition processes […] are the results of political interventions by actors". Hence, while from an analytical point of view certain processes and structures are outside of the scope of influence for the actor-in-focus (a methodological choice), these processes and structures are not outside of the scope of *all* actors and, therefore, not free of being subject to agency.

2010; Seyfang and Haxeltine, 2012; Walker et al., 2007; Walker, 2008). The concept of 'community' underlines the role of social innovations in transitions to low-carbon societies. A community-based approach generally encompasses the application of technologies, such as PV, but also offer new forms of social relations, such as novel forms of socio-economic organisation and behavioural innovations for sustainable behaviour.

Either way, niche development is regarded a dynamic process, coalescing with institutional changes, through which individual and collective actors develop new socio-technical innovations. As such, niche development involves institutional strategies aimed to create new institutional arrangements that enable shielding and nurturing of the innovation. Indeed, as Westley et al. (2014) note, the upscaling and mainstreaming of (social) innovations is a process that requires hard work from innovators that have to become institutional entrepreneurs to enable their niches to be maintained and grow. Here we add that although niche maintenance and growth are critical for the development of innovations, mainstreaming low-carbon innovation also requires institutional action targeted directly at regime transformation (Schaltegger and Wagner, 2011; Turnheim and Geels, 2013).

Regime transformation involves processes where incumbent institutional structures are challenged directly to align with the practices and principles promoted by the innovation, in order to empower niche practices and technologies (Smith and Raven, 2012a, 2012b). Actors do so through institutional strategies that aim to disrupt existing regime institutions. Attempts to change formal rules that prescribe that each new building needs to be connected to the natural gas grid is an example of institutional strategies for regime transformation. Institutional work for regime transformation is not just limited to the disruption of existing institutions, but may also involve the creation of new institutions that put pressure on the existing regimes, such as carbon pricing schemes. In general, strategies aiming at regime transformation have been underexplored in contrast with research on niche development strategies (Kivimaa and Kern, 2016; Turnheim and Geels, 2013).

As such, transition literature suggests that niche-contexts differ according to whether they are embedded in market-based versus community-based approaches, and whether they are aiming to maintain and grow niches versus directly changing regime institutions. We return to this distinction in Section 3. We first turn to discuss insights from institutional literature in the next section.

2.2. Institutional entrepreneurship and institutional work

Sustainability transitions literature is turning towards institutional theory for better understandings of how actors institutionalise niche innovations and attempt to transform regimes. Because societal transformation is rarely the result of individual agency, it must coincide with opportunities that arise within the broader social and institutional context (Westley and Antadze, 2010). The field of institutional theory has long been concerned with the question how institutions exert stabilising influence on social life (DiMaggio and Powell, 1982). Institutions are defined as the durable, more-or-less taken-for-granted repetitive and enduring patterns of social practice that shape political, economic and social interactions (Greenwood et al., 2008; Lawrence, 1999; North, 1991). Institutions determine the legitimacy of actions and - though socially constructed – have a reality-like status (Berger and Luckmann, 1966; Tolbert and Zucker, 1996). Organisations, and actors conform to institutions to safeguard their legitimacy – a generalised perception or assumption that the actions of an entity are desirable, proper, or appropriate with some socially constructed system of norms, values, beliefs, and definitions (Suchman, 1995) – and thus their chances of (organisational) survival (Meyer and Rowan, 1977; Suddaby and Greenwood, 2005). Institutions are constituted by regulative, normative, and cognitive pillars, which differ in their characteristics and bases of legitimacy (Scott, 2001). Regulations (regulative pillar), expectations (normative pillar) and shared understandings (cognitive pillar) are examples of the multifaceted nature of institutions.

Whereas institutional theory has traditionally considered exogenous shocks as main sources of institutional change, recent contributions on 'institutional entrepreneurship' and 'institutional work' have also explored agential processes of institutional change (Dimaggio, 1988; Lawrence and Suddaby, 2006; Lawrence et al., 2009). Institutional entrepreneurs are actors who purposefully aim to transform existing or create new institutions (Dimaggio, 1988; Eisenstadt, 1980; Fligstein, 1997; Garud et al., 2002). Like entrepreneurs, institutional entrepreneurs deviate from the social norm (Garud et al., 2007). Yet, institutional entrepreneurs differ from 'normal' entrepreneurs in the sense that they not (only) introduce new technologies or practices, but are purposively involved in the creation or transformation of institutions.

Theory on institutional work focuses on how day-to-day practices and processes of actors influence the creation and disruption of institutions, but adds that *maintenance* of institutions is equally important, and that other actors than only entrepreneurs can engage in institutional work (Lawrence and Suddaby, 2006). Rather than only focusing on the activities of single institutional entrepreneurs, this literature is also explicitly concerned with distributed agency and explores how (un)intended and (un)coordinated efforts of various actors shape and reproduce institutions. Literature on institutional entrepreneurship and institutional work, for instance on energy infrastructures (Giezen, 2018) or urban water governance (Ferguson et al., 2013), have different focal points, but they have in common that they highlight agential processes of institutional change and examine strategies employed by institutional entrepreneurs to transform their institutional environment.[2] We note here that we subscribe to the view of 'embedded agency', which implies that actors are not entirely free, but are situated in the context of existing institutions, which are both constraining and enabling actors to shape institutional change (see Farla et al., 2012 and Garud et al., 2002 and for further discussion on the notion of embedded agency). Embedded agents reproduce institutions in and through their (inter)actions. Knowledgeable, creative and

[2] For instance, institutional work literature has criticized institutional entrepreneurship literature for promoting an instrumental and disembedded view of agency that is arguably not compatible with sociological approaches in institutional theory (Battilana et al., 2009; Lawrence and Suddaby, 2006).

resourceful actors may attempt to break with institutionalised practices, taking into account the potential (legal, social or economic) sanctions that may follow from perceived misbehaviour.

Recent work has developed typologies of strategies of institutional entrepreneurs. For instance, drawing on an extensive literature review, Perkmann and Spicer (2008) made a distinction between political, technical, and cultural strategies of institutional work. Institutional work encompasses the purposive strategies of institutional entrepreneurs that can be directed at the creation, maintenance and transformation of new or existing institutions (Lawrence et al., 2009). Political strategies are directed at the regulative pillar of institutions, such as legal systems and regulatory structures. For instance, such strategies have the objective to develop a political constituency behind an innovation and to construct a policy environment that is favourable to its diffusion. Technical strategies, such as consultations about future costs and benefits, target the cognitive pillar of institutions, such as common frames, beliefs, and understandings through which actors make sense of the world. Cultural strategies encompass, for example, the development of narratives and discourse or ethical reasoning about what is appropriate or wrong, which primarily targets the normative pillar of institutions, such as values and duties. In a similar vein, Lawrence and Suddaby (2006) developed a typology that distinguishes between strategies for the creation, maintenance and disruption of institutions. Both typologies have previously been used to describe institutional strategies in the context of sustainability transitions (Fuenfschilling and Truffer, 2016; Jolly and Raven, 2015).

2.3. Understanding diverse institutional strategies across niche contexts

Scholars in the field of institutional theory have been interested in understanding diversity in institutional strategies. Battilana et al. (2009) examined conditions conducive to institutional entrepreneurship (namely agency) and proposes that both actor characteristics and field-level conditions can offer explanations for why certain actors engage in particular institutional strategies and not in others. Actor characteristics encompass actor's problem perception and their capacity. Regarding the first, Battilana et al. (2009) argue that actors' *problem perceptions* are likely influenced by one's social position as this mediates their relation with the environment and affects their perception of a field (Battilana et al., 2009). Regarding the second the *capacity of actors*, determined by resources and skills, also inform strategies. Previous studies point out that successful institutional change is influenced by actors' control over, and skills to mobilise, resources (Battilana et al., 2009; DiMaggio 1988; Kukk et al., 2016; Lawrence and Suddaby, 2006; Perkmann and Spicer, 2008). Perkmann and Spicer (2008) argue that actors need to possess political, analytical, and cultural skills for the deployment of political, technical, and cultural strategies respectively. Political skills include capabilities to inspire and mobilise others and to invoke common interests, analytical skills relate to abilities to develop abstract models and theories concerning the innovation, and cultural skills involve competences to influence wider societal norms and values through communication and persuasion (Fligstein, 1997; Perkmann and Spicer, 2008).

As agency must be understood as embedded agency, Battilana et al. (2009) propose that institutional entrepreneurs' capacity to engage with institutional change is also influenced by *field-level conditions*, which can be both enabling and constraining for institutional work (Farla et al., 2012; Garud et al., 2002; Geels, 2010). Actors act in and reproduce social contexts that shape the opportunities they have and agency is therefore both the medium and outcome of social behaviour (Giddens, 1979; Garud et al., 2007). Field-level conditions include incumbent institutional regime structures but also trends and developments that occur in the socio-technical landscape, such as demographic trends, wars or environmental challenges. Incumbent institutions pre-configure institutional entrepreneurs' possibilities and constraints in mobilising required resources, and, in consequence, shape their strategies. For instance, institutions, such as political opportunity structures, shape what and how resources may be used and whether actors have access to political decision-making processes (McAdam et al., 1996; Tarrow, 1998). Such dimensions can enable or prevent institutional entrepreneurship as they affect actors' access to resources and expectations for success in adopting strategies. Field conditions related to developments at the landscape level, such as environmental crises can lead to uncertainty in a field (Hardy and Maguire, 2008) and create 'windows of opportunity' that enable institutional entrepreneurs to strategically propose alternative institutional arrangements (Meyer, 1982).

These understandings from institutional theory – supporting the notion that both actor characteristics and field-level conditions inform strategies - can be complemented with findings within the field of transition theory. For instance, as for the significance of actors' problem perception, Geels and Schot (2007) argue that actors perceive different field conditions and accordingly may have different problem perceptions, leading them to explore different solutions. In the context of this research, problem perceptions can relate to the niche innovation itself (for instance poor performance), or involve concerns regarding the compatibility between the innovation and the regime. Regarding the latter, niche innovations can be compatible or incompatible with the regulative, cognitive, or normative pillars of the regime, in other words: with the institutions embedded in incumbent industries, markets, scientific paradigms, policy frameworks, or socio-cultural support (Geels, 2004). Furthermore, theory on sustainability transitions also supports the view that resources play a role in sustainability transitions. Avelino and Rotmans (2009) make a distinction between human, mental, monetary, natural, and artefactual resources.

In the next section we turn to our research design and elaborate the above conceptual discussions into a two-by-two typology matrix for mapping institutional strategies across different niche contexts. We will reflect on strategies directed to niche development and regime transformation. In general, strategies aiming at regime transformation have been underexplored in contrast with research on niche development strategies (Turnheim and Geels, 2013; Kivimaa and Kern, 2016). As a starting point for our analysis on examining factors informing strategies, we will build on the work by Battilana et al. (2009), proposing that both actor characteristics and field-level conditions can offer explanations for why certain actors engage in specific institutional strategies and not in others. This framework has thus far been conceptual and used for theoretical discussions on conditions conducive to agentic behaviour. We argue that it is a valuable starting point for exploring why actors engage differently in institutional strategies across different niche

contexts. We also expect to improve our understanding of the role of capacity in institutional work. While previous studies indicate that capacity matters (Avelino and Rotmans, 2009; Battilana et al., 2009; DiMaggio 1988; Kukk et al., 2016; Lawrence and Suddaby, 2006; Perkmann and Spicer, 200) robust theory linking resources and skills with the different strategies for institutional work across niche contexts is lacking.

3. Research design

We adopted an embedded case study design to explore and understand differences in institutional strategies to promote niche innovations. We deemed a qualitative approach appropriate given the exploratory nature of the research (Gerring, 2004). Case studies allow for a deeper insight into what strategies institutional entrepreneurs employ and how actor characteristics and field-level conditions shape diversity in institutional strategies. We employed a so-called embedded case study involving multiple sub-units of analysis (Yin, 2014). The case study is institutional entrepreneurship for promoting innovations contributing to the decarbonisation of the existing building stock in the Netherlands. The sub-units are institutional entrepreneurs within this field: organisations or networks that aim at decarbonising the building stock by advocating institutional change in favour of low-carbon innovations.

Using web search, we identified thirteen networks or organisations that - in accordance with the definition of institutional entrepreneurship described in Section 2 – (1) advocate innovations that reduce the carbon footprint of the building stock; and (2) leverage resources to create and/or transform institutions (Dimaggio, 1988; Eisenstadt, 1980; Fligstein, 1997; Garud et al., 2002).[3] First, an online keyword search was carried out. Keywords used for the web search (in English and Dutch) included: 'low-carbon housing', 'energy conservation housing', 'energy neutral housing', 'energy neutral transition', 'sustainability transitions in the building sector'. Second, a further selection was made by limiting results to collective actors such as platforms, intermediaries and networks, because these are critical in considered critical in niche institutionalization and regime transformation processes (Geels and Raven, 2006; Kivimaa et al. 2019). Results were also limited to Dutch initiatives. Based on the ways in which these initiatives presented themselves, we termed them either market-based or community-based initiatives. Table 1 provides overviews of the institutional entrepreneurs and their respondents whom we interviewed during the period June- November 2016. Generally, an interview was held with one respondent representing an institutional entrepreneur, but for some larger organisations two or more respondents were interviewed. Also, two respondents were interviewed that were involved in both Energiesprong and Stroomversnelling and who reflected on the activities of both organisations during the interviews. Respondents have been anonymised in order to maintain confidentiality.

The empirical research phase encompassed an iterative process of three steps and iterated between deductive and inductive data analyses. First, we gained a deep understanding of the empirical field through desk research. In line with the analytical framework, we first developed an overview of important field developments, such as sectoral trends, policy initiatives and major ups and downs in the wider landscape. Data sources used included reports on developments within the Dutch housing and energy sector (Schilder et al., 2016; RVO, 2015) and newspapers.

Second, we studied the activities of each institutional entrepreneur in Table 1. Internal validity and richness of the data was achieved through triangulation of data sources. Initially we conducted desk research to learn about the institutional entrepreneurs and map their strategies and actor characteristics. Data sources included organisational records and reports, newspaper articles about the innovation advocated by the institutional entrepreneur, and direct communications by the institutional entrepreneurs about the innovation via social media and internet (such as blogs, tweets and Youtube videos). Subsequently, we conducted fifteen semi-structured interviews (fourteen face-to-face, and one by email) with representatives of the institutional entrepreneurs that could offer a holistic perspective ('helicopter view') on their strategies (in most cases they were director or responsible program manager). The interviews followed a basic script that contained questions about the following themes: the innovations, institutional strategies, and explanations for why they engaged in particular strategies. The interviews allowed for flexibility and exploration of the strategies and underlying reasons by starting with open questions. Follow-up questions systematically asked about strategies and field-level conditions and actor characteristics identified in the literature. All interviews lasted between 1 h and 1.5 h and were transcribed and summarised. Table 2 offers working definitions of the key concepts guiding the interviews and examples of what to look for in the data. Appendix A provides an overview of the questionnaire and indicates how data from the interviews was coded.

Third, through an inductive analysis of the data on strategies and information on field-level conditions and actor characteristics, we developed a new analytical typology of institutional strategies in the context of sustainability transitions (Fig. 1). The typology is based on two dimensions: (1) market-based or community-based innovation and (2) niche development of regime transformation. We accordingly distinguish between four different niche contexts: market-based niche development, market-based regime transformation, community-based niche development and community-based regime transformation. The typology proposes that institutional work for sustainability transitions differs across different niche contexts. The analysis also confirmed distinctions in institutional strategies confirmed by previous works, thereby enhancing the scholarly rigor of these theoretical concepts (see Gioa et al., 2012).

[3] All institutional entrepreneurs actively advocate innovations that reduce the carbon footprint of the building stock and leverage resources to create and/or transform institutions in favour of those innovations. As they mobilize their resources to advance the creation and/or transformation of institutions, they fall within the definition of 'institutional entrepreneur' (Dimaggio, 1988; Eisenstadt, 1980; Fligstein, 1997; Garud et al., 2002), but differ from (conventional) 'entrepreneurs' that focus on the exploitation of economic opportunities (Shane and Venkataraman, 2000). Yet, some of the institutional entrepreneurs are– next to an institutional entrepreneur- also traditional entrepreneurs, working on the development of new business models.

Table 1
Description of the institutional entrepreneurs studied in this research.

Institutional entrepreneur	Description	Respondent
Energiesprong	Government-led innovation platform, in operation during the period 2010–2016, that was set up by the Ministry of the Interior and Kingdom Relations. The platform works on the strengthening of zero-energy building innovation concepts (ZEBs) (*market-based technical innovation*). ZEB concepts encapsulate the *trias Energetica* principle (maximum insulation, remaining energy demand is delivered from solar energy). The platform also works on the development of novel contractual arrangements (for instance, contracts where the energy performance fee is equal or less than energy bill) (*market-based social innovation*)	R1-4
Stroomversnelling	Market-led innovation platform, initiated in 2015, succeeding the Energiesprong program. The platform advocates the creation of market conditions required for the wide-scale application of zero-energy building concepts (ZEP) and novel contractual arrangements for financing ZEB renovations (*market-based technical and social innovation*). The platform consists of housing associations, building companies, suppliers, financers, grid operators, and municipalities.	R3-R4
Urgenda, thuisbaas	Independent association promoting climate change mitigation. Promotes the implementation of zero-energy building concepts using techniques that are available at this moment and that should not cost more than 35.000 euro per household (*market-based technical innovation*).	R5
Hier Klimaatbureau	Independent association promoting climate change mitigation. The association primarily advocates community cooperatives for organising energy retrofits and renewable energy generation (*community-based social innovation*).	R6
Klimaatverbond	Association of local governments promoting sustainable urban development. The association supports a variety of innovations for organising deep retrofits in communities (*market-based and community-based technical and social innovation*).	R7-R8
ODE Decentraal	Independent association representing decentralised energy initiatives. The association advocates the use of community energy initiatives to organise energy retrofits and renewable energy generation (*community-based social innovation*).	R9
Energie Akkoord Gelderland	Coalition of public and private actors operating in the province of Gelderland. The coalition works on the development of a social enterprise based energy service company to realise energy neutral neighbourhoods, together with businesses, communities and industry actors in the province (*community-based social innovation*).	R10
Transition Towns Netherlands	Transnational grassroots movement advocating the use of community energy initiatives to organise energy retrofits and renewable energy generation (*community-based social innovation*).	R11
Nature and Environmental Federations	Independent association supporting community energy initiatives to organise energy retrofits and renewable energy generation (*community-based social innovation*).	R12
Buurkracht	Non-profit initiative of energy utility Enexis aiming to promote energy conservation in the built environment. Buurkracht stimulates community energy initiatives to organise energy retrofits and renewable energy generation (*community-based social innovation*)	R13
Hoom	National energy cooperative (non-profit) stimulating energy cooperatives to organise energy retrofits (*community-based social innovation*).	R14
RVO	Netherlands enterprise agency encouraging entrepreneurs in sustainable and innovative businesses. Is actively supporting the use of zero-energy building concepts and energy performance contracts (*market-based social and technical innovation*).	R15
ESCO network	Network promoting the use of energy performance contracts for the retrofitting of buildings (*market-based social innovation*).	R15

The next section turns to the results of the analysis. We use the analytical scheme depicted in Fig. 1 to structure the analysis by discussing strategies, actor characteristics and field-level conditions for each quadrant. The results start with a description of relevant developments in low-carbon housing in the Netherlands and general descriptions of the institutional entrepreneurs involved.

4. Results

4.1. Background to the case

The decarbonisation of the building stock constitutes a highly cost-effective measure for climate mitigation and accelerating the low-carbon transition (Filippidou and Navarro, 2019; Levine et al., 2007; UNEP, 2009; UNEP and IEA, 2017). In the European Union, the building stock is the greatest contributor to carbon emissions: buildings are responsible for 40 % of energy consumption and 36 % of corresponding GHG emissions (EU, 2016). Hence, energy retrofitting of existing building is regarded a critical means for reducing Europe's energy consumption (BPIE, 2016; Bresaer, 2015). In addition to climate mitigation, the energy retrofitting of buildings can generate a variety of environmental, economic and social benefits, such as job creation, business opportunities, higher value of buildings, and enhanced comfort and health of residents (Immendoerfer et al., 2014; Levine et al., 2007; MacNaughton et al., 2018; UNEP, 2009). However, studies emphasise the need for an acceleration of energy retrofitting of buildings in order to achieve Europe's climate mitigation targets (D'agostino, Zangheri and Castellazzi, 2017; EEFIG 2014; UNEP, 2009).

As the built environment is a significant source of the country's GHG emissions, the Dutch government has set the objective to have an energy neutral built environment in 2050 (SER, 2013; Ministry of Economic Affairs, 2016). International and European legislation provide the basis for Dutch policy on climate mitigation and energy. At the time of conducting this research (2016), the

Table 2
Operationalisation of key concepts. Classification of political, technical, and cultural strategies in institutional work based on: Lawrence and Suddaby, 2006; Perkmann and Spicer, 2008.

Concept		Operational definition
Institutional entrepreneur		Actors fulfilling an intermediary position that (1) advocate innovations that offer a solution to reducing the carbon footprint of the building stock; (2) leverage resources to create new and/or transform existing institutions and (3) have been involved in various projects where the low-carbon innovations were applied
Strategies for niche development		Strategies that are oriented towards the creation of novel institutional arrangements contributing to the protection of low-carbon innovations from mainstream selection environments ('shielding') and their development and strengthening ('nurturing')
Strategies for regime transformation		Strategies that are applied to directly challenge and disrupt existing institutional structures so that they align with the practices and principles of the innovation and can empower niche practices
Community-based approach to innovation		Community-based approaches focus on consumer and citizen practices, underline the role of social innovations (for instance novel forms of socio-economic organisation and behavioural innovations) that correspond to local needs, possibilities, and values.
Market-based approach to innovation		Market-based approaches focus on decarbonising the production-side of the economy by virtue of technological innovation and sectorial change, or develop low-carbon products and services that can be sold to consumers.
Political strategies	Visioning	Creating a vision for change by defining problems, related to the dominant regime, and justifying how the innovation, can solve these problems
	Coalition building	The development of coalitions composed of actors, with different skills and knowledge, to mobilise collective action
	Advocacy	To gather political and regulatory support for a practice or innovation and disconnecting rewards and sanctions regarding dominant institutions through direct and deliberate techniques of political suasion.
	Vesting	The creation of new laws and policies that support the innovation
Technical strategies	Theorising	The development of abstract categories, models, frameworks, and cause-effect relations regarding innovations, institutions, and events
	Demonstrating	The demonstration of the workability of an innovation and corresponding institutional arrangements
	Standardising	The standardisation of products, business models, market mechanisms, or valuation techniques for the innovation
	Educating	The educating of actors in terms of skills and knowledge necessary to support the diffusion of the innovation
	Construction of learning communities	The construction of networks through which practices become normatively sanctioned and which form the relevant peer group with respect to compliance, monitoring, evaluating, and learning regarding an innovation
Cultural strategies	Changing normative associations, assumptions and beliefs	Awareness raising activities to shape the beliefs and perceptions of different stakeholders and to re-make the connections between sets of (new and existing) practices and the moral and cultural foundations of those practices
	Creation of new identities	Enhancing the attractiveness of innovations by connecting them to identities, roles, or values

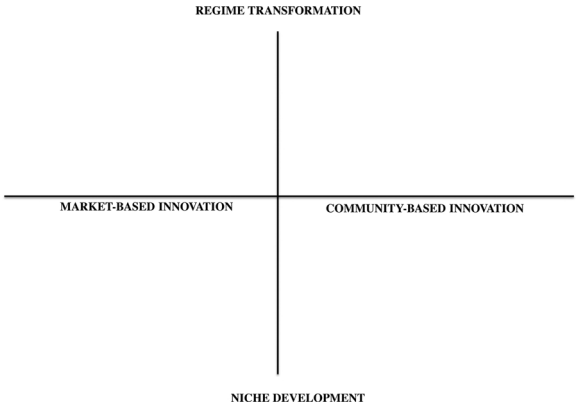

Fig. 1. Typology of institutional strategies. The typology proposes that institutional work for sustainability transitions differs across four different niche contexts: market-based niche development, market-based regime transformation, community-based niche development and community-based regime transformation.

Dutch government had set the goal - in line with the European Commission's target - to reduce GHG emissions with 30 % in 2020, with 40 % in 2030, and with 80 percent in 2050 compared to 1990 levels (EU, 2011). The Energy Agreement for Sustainable Growth (2013) (*SER-Energieakkoord*) forms an important starting point for energy and climate policies until 2030[4] . This national government, environmental organisations, and various branches collectively established this cooperative agreement, which sets various objectives including an annual reduction in energy consumption with 1,5 percent and an objective to obtain a 100 PJ energy consumption reduction by the year 2020.

Turning these political ambitions into practice is a challenge. Indeed, the transition to a low-carbon building stock demands deep energy retrofits and, for instance, involves fundamental changes in the way households heat and cook. In the Netherlands, natural gas provides 70 % of all energy demand in households. If all 7 million households must have an energy-neutral household in 2050, the use of natural gas for energy provision of buildings will need to decrease significantly (Ministry of Economic Affairs, 2016). Institutional entrepreneurs promote a range of niche innovations as solutions to these policy ambitions and transition challenges.

The institutional entrepreneurs studied in this research advocate different types of innovations as a solution for decarbonising the Dutch building stock (see Table 1). Six embrace market-based social and technical innovations around zero-energy building concepts and energy performance contracts. A zero-energy building is a building that has a net annual energy bill of zero. To achieve such a standard, a variety of technical measures can be used. Standard measures including thermal insulation of the housing shell, triple glazing, heat pumps, mechanical ventilation, and solar panels. Energy performance contracting is an innovative financial model stipulating that an energy service company or landlord finances the energy retrofit and that the owner use the monthly cost savings from the energy conservation to repay the energy retrofit. Other institutional entrepreneurs promote community-based, social innovations for decarbonising the building stock. Examples are energy cooperatives and community-based purchasing and retrofit schemes. Community-based initiatives highlight the development of local solutions for the global problem of climate change, while at the same time contributing to public education, the creation of social capital, community resilience, and public acceptability for climate policy.

While both market-based and community-based innovations advocated by institutional entrepreneurs have the potential to generate wider societal transformation, they experience internal barriers and are underpinned by a set of practices and institutional configurations that demonstrate little regime compatibility, which limits their institutionalisation and diffusion throughout society (a detailed overview of barriers can be found in Appendix B).

4.2. A typology of institutional strategies across niche contexts

The section below will present the typology of institutional strategies for sustainability transitions across four niche contexts. Empirical examples and quotes of the respondents are used to illustrate the typology and to discuss factors that inform strategy choices.

4.2.1. Institutional strategies for market-based niche development

The first niche context is where institutional entrepreneurs are working in market-based environments with an emphasis on nurturing and growing niche development. Institutional entrepreneurs engage in this category of institutional work because they

[4] In 2019 the Dutch Climate Law and the National Climate Agreement, which builds upon the Energy Agreement, were concluded. The Climate Law sets the target to reduce greenhouse gas emissions by 49% by 2030, compared to 1990 levels, and to reduce greenhouse gas emissions by 95% in 2050. The measures contained in the Climate agreement will enable the Netherlands to achieve the targets of the Paris Agreement.

perceive problems related to the capacity of current market-based solutions to solve societal challenges related to sustainability. "*We need to develop better products for lower prices, so that we can offer building owners an attractive alternative to their energy bill*" (R1). Energiesprong is a typical example of an institutional entrepreneur engaging in market-based niche development. This government-led platform, set up by the Dutch government in 2011, actively advocates the development of zero-energy building (ZEB) concepts. This concept is a response to the observation that the building sector needs to shift from building *projects* to developing *products* that can be produced at an industrial scale.

Institutional entrepreneurs engaging in market-based niche development use the political strategies ***coalition-building*** and ***visioning***. Energiesprong started with the development of a coalition of 'frontrunning' actors whose resources and skills are required to strengthen ZEB concepts. Respondents underline that coalition-building with different types of frontrunning actors was critical in order to bring together stakeholders related to supply (builders), demand (housing associations), regulation (Ministry), and financing (banks). "*All these actors feel as if they cannot exert any influence on other parties and the innovation process* (R5). "*The construction industry has limited margins and they can only invest a lot of money when there is a prospect of scale in an innovation*" (R1). Therefore, intermediating institutional entrepreneurs are needed who have knowledge with regards to the interests, business models and relevant decision-makers of all relevant stakeholders and who can create win-win solutions that are acceptable for all. Also, a focus on frontrunners is important to ensure that the coalition is sustainable. Over the years, Energiesprong developed various coalitions with frontrunning market parties in order to strengthen and broaden the coalition (for instance Deal Rental Sector). Instruments such as 'green deals', a type of covenant, are used to safeguard the continuity of niche coalitions and to guarantee scale. Moreover, "*coalition building is important for developing institutional configurations around the innovation"* (R10), such as business models and partnerships. To develop and continuously activate the coalition, institutional entrepreneurs engage in *visioning* to articulate goals and develop a common direction for all actors working on the innovation.

Once coalitions with frontrunners are established, technical strategies are applied. Experiments in real-life contexts play a key role in the development of theory, and to promote learning, regarding market-based innovations (***theorisation)***. Questions such as '*what institutional conditions need to be worked on in order to make the business model feasible?'* (R3) need to be answered in order to inform strategies for further niche institutionalisation. Institutional entrepreneurs also establish ***learning communities*** to generate and disseminate required knowledge and competences for application of ZEB concepts, which can ease the learning curve that all niche actors face. Furthermore, ***standardising***, through the development of guidelines, certification schemes, standardised contracts, supports the development of a common language among niche actors and helps monitoring and improving performance. Standardisation and the construction of learning networks optimise learning processes regarding innovations and "*are important to prevent actors from reinventing the wheel*" (R6).

While all institutional entrepreneurs in this category advocate market-based innovations, they have different perspectives on how radical deep retrofits should be. Actors such as Energiesprong underline the need for deep retrofits in order to prevent lock-in. They argue that conventional retrofits – where only some, but relatively costly energy conservation measures are applied - can lead to lock in as the households applying these measures will likely not invest in additional measures to reduce their carbon emissions in the near future. Moreover, Energiesprong strives to develop zero-energy buildings to provoke innovation as it requires industry actors to radically change their approach.

To engage in market-based niche development, institutional entrepreneurs must be *pragmatic* and solution-oriented. They have strong hands-on, organisational skills and possess sufficient human and monetary resources to create a coalition of frontrunners and initiate experiments. Human resources include both tangible aspects, such as the number of employees available, but interviewees particularly refer to intangible resources, such as leadership and perceived reliability and legitimacy. Respondents from Energiesprong underline the importance of being perceived as a legitimate partner by other actors in the building sector in order to mobilise stakeholders and develop a coalition. Coalition members must recognise that the institutional entrepreneur serves in their interests and that it must remain motivated to ensure continuous mobilisation of resources for the accomplishment of the niche's goals and vision. The deployment of technical strategies requires analytical skills, including the ability to monitor and analyse the impact of interventions, design templates and models, codify learning experiences, and study institutional conditions required for wide-scale diffusion.

There are specific field-level conditions that are conducive to this category of institutional work. Especially environmental challenges, such as the scarcity of raw resources and need for climate adaptation as well as changing consumer attitudes towards sustainability (see World Business Council for Sustainable Development (CBCSD, 2008) have led to increasing awareness within the sector concerning the need for circularity and sustainable innovation. While environmental challenges can be regarded threats to the building sector, frontrunning actors perceive them as *opportunities* for new organisational forms, the introduction of new business models and industrialisation. International and national policy developments are also conducive for market-based niche development, for instance by articulating a political ambition and providing policy support structures. To illustrate, Energiesprong's goals to develop zero-energy building concepts were driven by two important milestones set by European policy, namely to ensure that the building sector can build zero energy buildings by 2020 (see EPBD) and to have an energy-neutral built environment by 2050 (R3). A government approach supporting innovation may be crucial for institutional work directed at niche development more generally. For

instance, the government-led network 'Energy Leap' was developed as part of the Innovation Agenda Energy Neutral Built Environment by the platform for energy transition in the built environment (PEGO). Governmental support fostered the availability of sufficient financial resources (total of 50 million euro) for a period of 5 million, an important condition for the initiation of innovation programs.

4.2.2. Institutional strategies for market-based regime transformation

The second niche context is where institutional entrepreneurs are working in market-based environments with an emphasis on reforming incumbent regime institutions to align them with the practices and principles of market-based innovation directly. The strategies falling within this category are oriented to actors not yet involved in the niche. An institutional entrepreneur characterising this approach is the market-led innovation platform Stroomversnelling, a successor program of Energiesprong that aims to transform institutional structures in ways favourable to ZEB concepts.

To broaden the niche around the innovation and gain political support, they engage in ***visioning*** and develop discursive framings to explain how the innovation connects to different interests and offers a solution to numerous societal problems. To illustrate, Stroomversnelling initially described the ZEB concept as an 'energy product', but later on broadened this framing to link ZEB to a larger range of social challenges, such as climate adaptation, energy poverty, security, and conservation of biodiversity (R3). Institutional entrepreneurs also engage in ***coalition-building*** by establishing 'green deals' (see Section 4.2.1), which encourage a broadening of the coalition by involving previously uninvolved industry and market actors. Institutional entrepreneurs in market-based regime transformation also use the political strategies ***lobbying*** and ***vesting***, which they deem critical for creating a facilitative policy environment for new business models around low-carbon innovations. To illustrate, Stroomversnelling successfully mobilised resources to develop and transform regulations concerning the use of energy performance contracts. This regulatory reform makes it legally possible for landlords and housing associations to recoup the investments for retrofits in the form of an energy performance fee. Previously, housing associations were legally not able to charge an energy performance fee from their tenants, which made it impossible for housing associations to develop a business case for zero-energy buildings that does not rely on public support. The new law is believed to address the split-incentive problem and to generate benefits for both landlords and tenants. Other regulatory changes relate to the taxation of buildings and mortgage loans. Mortgage loans are generally calculated on the basis of one's salary and debts, but not on energy costs, even though this can be a significant part of homeowners' monthly expenditures. "*Thanks to lobbying we made it possible that ZEB is included as a standard in regulation concerning mortgage financing*", which makes it possible for building owners to receive substantial additional mortgage financing for zero-energy buildings (R4). Moreover, interviewees argued that for zero-energy buildings to be interesting for private building owners it is critical that saved energy costs are reflected in a higher value of the buildings.

Institutional entrepreneurs employ technical strategies, such as 'education' and 'demonstrating' to enhance the legitimacy of the innovation and to enable actors currently outside the niche to apply the innovation. Technical strategies become important when niche innovations have sufficiently strengthened and niche actors have reached consensus on required institutional conditions required for diffusion. ***Demonstrating*** is also a critical strategy for Stroomversnelling in order to reduce risk perception among other demand- and supply-side actors. Successful projects play an important role for conceptualising how 'the old ways of doing things are wrong' and how the innovation supported by the institutional entrepreneurs provides a solution thereto.

Institutional entrepreneurs engaging in this type of institutional work, such as Stroomversnelling, possess strong political skills. They create political attention, mobilise support, engage in political bargaining, and link the innovation to the interests of broader, external audiences. They are cognisant of the values and needs of regime actors and frame the innovation as a solution to their needs and interests. Moreover, lobbying activities requires them to have strong links to relevant political arenas and to enjoy the legitimacy to constructively engage in political decision-making processes. Links with relevant stakeholders within ministries are therefore important. Field level trends conducive to this category of institutional work include jolts and international policy developments. Earthquakes in the province of Groningen – caused by gas extraction - have been strategically framed by Stroomversnelling to promote political support for zero-energy buildings. Furthermore, the signing of the Paris Agreement on climate change were used as a window of opportunity for lobbying activities as it led to policy certainty that the high-carbon development will come to an end and investments in energy efficiency are needed.

4.2.3. Institutional strategies for community-based niche development

The third niche context is where institutional entrepreneurs are working in community-based environments with an emphasis on nurturing and growing niche development. Institutional entrepreneurs engaging in this category of institutional work perceive that the low-carbon transition must be realised from the bottom-up, at the local scale, often through civic engagement. The local level is seen as both the source and solution for global environmental challenges. Accordingly, this category of institutional work focuses on the strengthening of community-based innovations; such as community energy cooperatives and community-led energy retrofit schemes. Institutional entrepreneurs supporting community-based niche innovations recognise the importance of market-based solutions, but they subscribe to the view that such top-down approaches might not suffice if citizens experience a weak sense of

personal agency and have lack of faith in the (information offered by) the organisations offering the solution.

The work of Transition Towns Netherlands and the Dutch Nature and Environmental Federations are illustrative for community-based niche development. Transition Towns Netherlands founded in 2008, seeks to address the challenges of global climate change and reaching peak oil. The movement encourages local communities to unleash their creativity and knowledge for the creation of bottom-up solutions, regarding themes such as energy, food and transport, that correspond to local needs. The Dutch Nature and Environmental Federations also advocate the transition to a sustainable society and are actively supporting community-based initiatives in reducing the carbon footprint of their neighbourhoods.

This category of institutional work encompasses strategies that are similar market-based niche development, but with a different function. ***Coalition-building*** is critical for capacity-building and encouraging initiatives to work together. Coalition building also enhances the visibility of the movement and creates a 'collective voice', which is needed to counter resistance from incumbents who value the status quo and who, for instance, do not support the decentralisation and democratisation of the energy market. Institutional work in this category also encompasses the ***creation of learning communities, theorisation*** and ***standardisation*** to enhance the capacity of community-based innovations. Community initiatives are often established by engaged citizens who lack the required time, knowledge or skills to get initiatives off the ground. Generating knowledge and theories on the activities and impact of community-led initiatives is valuable for professionalisation and enhancing their perceived legitimacy by external actors. The Nature and Environmental Federations stimulate capacity building and learning among initiatives using a 'first aid line' and the creation of service points where communities can receive assistance. Coaching meetings are set up to discuss their goals and plans for decarbonising their neighbourhoods and to bring them in contact with relevant stakeholders and experts (R12). The activities of Transition Towns Netherlands illustrate that capacity-building does not only relate to skills and know-how on how to set-up an initiative, but may also relate to skills to deal with feelings of powerlessness of discomfort that actors can experience when they are engaging in, and promoting, sustainable behavioural change (R11).

Institutional entrepreneurs also work towards the ***creation of new identities*** – a cultural strategy - to establish a distinct and common identity among community actors. As illustrated by a respondent: "*Some initiatives feel as if they have to fight the rest of the world. It is important that they feel that they are part of a greater movement. Back in our village we might be alone, but we belong to a greater movement. Creating that sense of identity is a key aspect of the work we do*" (R12).

Institutional entrepreneurs engaging in community-based niche development are grounded in local communities and are perceived as legitimate and trusted actors. Furthermore, they possess many 'soft' and practical skills. A key societal trend conducive to community-based niche development concerns the increase in energy cooperatives and other forms of citizen-led initiatives that have the goal to promote sustainability. "*Citizens and local communities no longer want to be dependent on big businesses or governments and wish to work collectively towards a sustainable future*" (R12). Of course, this trend of associational activity and civic engagement is also influenced by macro societal trends, such as the arrival of internet, globalisation and liberalisation of the energy market, which empowers individuals to act (Hajer, 2011; van der Steen et al., 2016). Governments are also increasingly turning towards local communities for achieving their sustainability goals ('government by community' or 'big society'), which can stimulate this type of institutional work. In the context of the broader political shift from 'government to governance' (Rhodes, 1996; Driessen et al., 2012), states are increasingly aware that the successful realisation of transitions is very much dependent on negotiations outside formal state institutions (Jhagroe and Loorbach, 2014).

4.2.4. Institutional strategies for community-based regime transformation

The fourth and final niche context is where institutional entrepreneurs are working in community-based environments with an emphasis on reforming incumbent regime institutions, thereby creating institutional structures that enable community-based innovations to play a more sophisticated role in sustainability transitions. Illustrative of this category of institutional work is the work by ODE Decentraal.

Political strategies include visioning, coalition-building, vesting and lobbying. When engaging in visioning and lobbying, institutional entrepreneurs draw on local cultures, interests, and opportunities in their narratives. Innovations are framed as appropriate solutions for climate mitigation, but also as a vehicle for, amongst others, local regeneration, social cohesion, affordable energy, the democratisation of the energy market, and the avoidance of the impacts of peak oil and related geopolitical risks. ODE-Decentraal has been lobbying actively for changing Dutch fiscal policies, which make it difficult for small, community-based producers to develop a business case and the creation of an investment fund. Such a fund is critical during the start-up phase of community-led initiatives because community-led initiatives are often not seen as creditworthy. After a long lobbying process, communities investing in renewable energy projects are now eligible for a reduced energy tax, which makes it attractive for communities to generate their own energy. Furthermore, technical strategies ***educating*** and ***demonstrating*** are applied to convince and enable other communities to conserve and generate energy.

Institutional entrepreneurs engaging community-based regime transformation also mobilise resources to ***change normative associations***, a cultural strategy. Awareness raising programs and engagement programs are developed to address barriers related to the socio-cultural dimension of the regime, such as lack in sense of urgency and sustainability values. Respondents state that information

Table 3
Institutional strategies, actor characteristics and field-level conditions across transition categories.

	Market-based niche-development	Market-based regime transformation	Community-based niche-development	Community-based regime transformation
Institutional strategies (political, technical, cultural	*Political:* visioning, coalition-building *Technical*: standardising, theorising, constructing learning communities	*Political*: visioning, coalition-building, vesting, lobbying *Technical*: demonstrating, educating	*Political*: visioning, coalition-building *Technical*:standardising, theorising, constructing learning communities *Cultural:* creation of new identities	*Political*: lobbying, vesting *Technical*: demonstrating, educating *Cultural*: awareness raising activities
Actor characteristics (Problem perception, capacity)	*Problem perception:* market and industry actors need to take on a different role and work together in developing integrated low-carbon innovations with an improved price-performance ratio Capacity: institutional entrepreneurs possess *political* and *technical* skills to develop coalitions and implement experiments. They are pragmatic, solution-oriented and possess strong hands-on, organisational skills.	*Problem perception:* business models for low-carbon innovations are only feasible when policy and market institutional structures are transformed, and a facilitative investment environment is created Capacity: institutional entrepreneurs possess *political* skills to create political attention, mobilise support, engage in political bargaining, and can link the innovation to the interests of regime actors.	*Problem perception:* the transition to a low-carbon building stock can only be achieved from the bottom-up, through community-based initiatives, but community energy initiatives lack the professional capacity (time, expertise, money) to do this Capacity: institutional entrepreneurs possess *technical* and *cultural* skills to connect and support community initiatives. They are grounded in local communities, perceived as legitimate and trusted actors and possess soft and practical skills.	*Problem perception:* the transition to a low-carbon building stock demands a transformation in socio-cultural and policy institutional structures to improve public environmental awareness and urgency to mitigate climate change and to empower community-led energy initiatives Capacity: institutional entrepreneurs possess *political* and *cultural* skills to engage in political bargaining and awareness raising activities. They have a broad network in policy circles and are perceived as legitimate actors to access such processes
Field-level conditions	Trends in environmental challenges and (inter)national policy developments concerning low-carbon development are mobilized to create discursive pressure on the building sector and to highlight the need for sustainable market-based innovation.	Jolts (such as earthquakes in Groningen) and international policy goals (for instance the Paris Agreement) are mobilised to highlight the need for a low-carbon housing stock and changing institutional structures (such as price incentives) within a competitive market paradigm.	The trend from government to governance, through which non-state actors are increasingly involved in creation of public values (such as climate mitigation and environmental protection) is mobilised to legitimise community energy.	Jolts such as weather extremes and new international policy goals (for instance the Paris Agreement) are mobilised to highlight the need for sustainable behavioural change and associated changes in cultural and political institutions.

provision alone is not sufficient for changing peoples' attitudes and behaviour; people should also be given specific instruments and instructions. Furthermore, they maintain that changing people's conduct does not necessarily have to result from a change in attitudes, but can also occur the other way around. By enabling people to reduce their energy consumption through behavioural or single energy conservation measures, they can incrementally change their sustainability attitudes and values and be more susceptible to deep energy retrofits. Cultural strategies are also applied to create a sense of urgency for political action among the public, so that barriers related to the policy dimension of the regime can be addressed.

Institutional entrepreneurs engaging in these strategies often have much experience, a broad network in policy circles and are perceived as legitimate actors to access such political resources. They have formal and informal access to political decision-making processes (*political opportunity structure*) to successfully lobby for policy change. Lobbying also requires institutional entrepreneurs to be recalcitrant, but also flexible and patient because political processes can take a long time and can involve instances where other, bigger parties will claim success. Jolts and (international) policy developments, such as the signing of the Paris Agreement, generate public and political attention, which serve in particular as policy windows for lobbying and awareness raising activities.

5. Discussion: comparing institutional strategies across niche-contexts

The previous section has illustrated how institutional strategies for sustainability transitions differ across niche contexts, namely in terms of market-based versus community-based and focussed on niche development versus regime transformation. We note here that this typology serves primarily analytical purposes. Empirical reality is messier and more dynamic; institutional entrepreneurs empirically fit more than one category or change their strategies over time. Nevertheless, the analytical scheme allows to identify and explain differences and similarities of institutional work in different niche contexts. Table 3 compares and synthesises strategies, actor characteristics and field-level conditions across the four different niche contexts categories from Fig. 1.

Regarding institutional strategies, we find that institutional entrepreneurs across all niche contexts engage with political, technical and/or cultural work, but they so in different ways and not all institutional entrepreneurs engage in all strategies. Typical for institutional entrepreneurs working in market-based niche development contexts is that they strengthen the efficiency and effectiveness of (primarily technical) innovations and support institutional arrangements through the creation of coalitions of frontrunning market-actors and learning communities (see Section 4.2.1). In contrast, institutional entrepreneurs working in community-based niche development contexts aim to strengthen the capacity of local communities to develop and implement energy solutions, corresponding to local values and needs, and try to create community identities so as to develop a sense of belonging among local actors. Strategies in both market-based and community-based niche development contexts are of hands-on nature in which experimentation with low-carbon innovations constitutes a central element (see Sengers et al., 2016). We also note that strategies in market- and community-based niche development contexts, - 'construction of learning communities', 'visioning', and 'coalition-building' - align with activities that have been identified within theory on strategic niche management, namely 'assisting learning processes', 'articulating expectations', and 'networking' (Schot and Geels, 2008), but their dynamics and orientation are different (see also Seyfang and Smith, 2007).

We also observe similarities and differences across niche contexts in strategies directed at regime transformation. Typical for institutional entrepreneurs working on market-based regime transformation is that they engage in political and technical strategies to attract regime players to the niche and to lobby for changes in regulatory structures needed to develop a business case around low-carbon innovations. Institutional entrepreneurs working on community-based regime transformation apply political and cultural strategies that home in on awareness raising activities and lobbying to activate public values on sustainability and create a greater role of communities in energy and climate policy.

Furthermore, we observe that differences regarding institutional strategies can be understood as resting in different actor characteristics, namely problem perception and capacity, which vary across niche-contexts. Regarding problem perception, overall our cases suggest that institutional entrepreneurs engaging in niche development typically do so with a problem perception informed by the need to reduce barriers internal to the niche, with the aim of enhancing capacity to solve societal challenges. Institutional entrepreneurs engaging in market-based niche development, however, perceive that the greatest challenge lies in strengthening the price-performance ratio of technical innovations. Hence, much efforts go into technical work to develop better performing innovations as well as political work to shift the direction of innovation through new market incentives and regulatory changes. Actors promoting community-based solutions also subscribe to the importance of technological innovation, but they perceive that the transition to a low-carbon building stock can only be achieved from the bottom-up, through behavioural change. Hence, communities are seen as medium for innovating with sustainable behavioural change and developing local solutions, initiated by trusted actors that are in sync with local needs and capabilities (see Seyfang and Smith, 2007; Seyfang, 2010; Seyfang and Haxeltine, 2012; Walker et al., 2007; Walker, 2008).

Likewise, differences in actors' problem perceptions also inform strategies for regime transformation differently. Whereas institutional entrepreneurs in a market-based regime transformation context only engage in political and technical strategies to set the right conditions for sustainable innovations, institutional entrepreneurs in a community-based transformation context also engage in

cultural strategies to move beyond narrow market-based innovation and legitimise community initiatives and behavioural change more widely.

Differences in institutional strategies are also explained by variations in the capacity of institutional entrepreneurs. The institutional entrepreneurs who are studied differ to a large extent in terms of capacity. Those working in a market-based context, such as government- and industry-initiated innovation networks including Energiesprong and Stroomversnelling, have the capacity to involve networks with extensive human, monetary, and mental resources. On the other hand, actors working in community-based contexts, such as Transitions Towns, are dependent on volunteers and members' time, efforts and donations. Moreover, our analysis finds that in market-based niche development contexts, institutional entrepreneurs must be pragmatic, solution-oriented and possess strong hands-on, organisational skills. To engage in community-based niche development contexts, however, institutional entrepreneurs must be grounded in local communities, perceived as legitimate and trusted actors and possess many soft and practical skills.

Differences in institutional strategies across niche contexts also need to be understood as resting in different ways in which field-level conditions exert influence. Environmental challenges, such as climate change and resource scarcity, and international policy developments are conducive across all niche contexts when they are mobilised to create pressure on the regime and underline the need for sustainable innovation. The findings suggest that institutional entrepreneurs across all contexts also strategically make use of trends and discourses within the organisational fields in which they operate. There are differences, however. Institutional entrepreneurs working in community-based contexts tend to mobilise field-level conditions to promote wide social and cultural change and political reforms. Institutional entrepreneurs in community-based niche development contexts underline that their conduct is influenced by a changing political landscape in which non-state actors are increasingly involved in the creation of environmental policy, reflecting a move from 'government to governance' (Driessen et al., 2012; Rhodes, 1996). Indeed, these institutional entrepreneurs acknowledge that they are both the product of – but also make use of - this 'energised society', reflecting the rise of an ethic of self-reliance among citizens (see Hajer, 2011). Institutional entrepreneurs engaging in market-based contexts, on the other hand, tend to mobilise field-level conditions in a narrower way and emphasise that niche innovation and regime transformation can occur within a conventional 'competitive markets' paradigm. This corroborates the findings by Gasbarro et al. (2018), in which they state that market-oriented sustainable entrepreneurs leverage the sustainability aspect of their innovation as opposed to the systemic transformations that could occur.

Finally, we also find that jolts and crises lead to uncertainty and criticism concerning dominant ways of organising societal functions and thus offer opportunities to promote alternative practices and technologies (see Battilana et al., 2009; Geels, 2005; Hardy and Maguire, 2008). Because such 'policy windows' generate wide political and public attention, strategies related to regime transformation are considered especially effective when such a window occurs (see Meyer, 1982). Again, however, there are differences in how such policy windows play out for community- versus regime-based transformation, because of underlying difference in political opportunity structures. Because institutional entrepreneurs promoting community-based innovations often have limited formal and informal connections to political decision-making procedures, it is more challenging for these groups to actually shape political decision-making during a policy window.

6. Conclusion

The paper seeks to address the following research question: *How does institutional work differ across niche contexts for the low-carbon housing transition in the Netherlands?* To address this question, this paper has presented a typology of niche contexts that differ namely in terms of market-based versus community-based and focussed on niche development versus regime transformation. A case study analysis of thirteen institutional entrepreneurs in the context of an ongoing low-carbon housing transition in the Netherlands has illustrated the relevance of this typology. The main conclusion is that the typology proves to be not only valuable in theoretical terms but also a useful heuristics for empirical analysis, because it allows to unpack the heterogeneous work that institutional entrepreneurs do across different contexts (see Table 3 for a summary).

In reflection, the results suggest that not only are institutional entrepreneurs multi-skilled and possess a plurality of resources, but they also do within an understanding of the diverse contexts in which they operate: institutional entrepreneurs adapt their strategies to the context in which they play. In fact, as strategies 'compete' for resources and skills, our work suggests that institutional entrepreneurs carefully consider how their capacity is best served to accomplish their goals. This is an important insight that complements the theoretical framework we developed in Section 2.

For further theory development on institutional entrepreneurship we suggest to explore whether success is most likely when orchestrating institutional work across niche contexts. On the basis of our current work, we expect this to be particular true when strategies for niche development and regime transformation co-evolve, for instance when successful institutionalisation of niche innovations become part of broader storylines aimed at regime transformation, and, similarly, when community-based initiatives and market-based initiatives are recognised to be developing in tandem. Yet, such institutional work is likely to require substantial 'meta-coordination', resources and skills, which are particularly challenging for institutional entrepreneurs with limited capacity (see

Dorado, 2005). Future research may therefore explore in more depth the role of intermediary institutional work across different niche-contexts (Kivimaa et al., 2019)

A second suggested line of future research addresses agentic efforts to affect landscape dynamics. Our finding that community-based institutional entrepreneurship includes strategies that aim to change the larger cultural context is interesting and raises the question to what extent and how agency from within niches is capable to influence landscape dimensions. In literature on sustainability transitions, this relationship is under-studied, in contract to niche-regime interactions (Geels, 2010). We expect that social movement theory and the study of collective mobilisation can offer useful insights for further developing this direction of research as these bodies of literature examine the influence of social groups on cultural norms and values.

As a third line of future research, we suggest that the typology is applied to more cases in order to enhance its applicability and to determine whether our observations are also found in other sectors and contexts. Examining how and why institutional work directed at decarbonising other sectors in different countries can further improve our understanding about the relationships between institutional work, actor-characteristics and field-level conditions. In addition, longitudinal studies may be conducted to assess the impact of institutional entrepreneurs' endeavours in transforming their institutional environment. Examining the (lack of) impact of strategies on (the different pillars of) institutions was beyond the scope of this paper, but knowledge on this issue is important for learning more about the process of institutionalisation and the influence of institutional work on institutions, which may inform wider debates on structure-agency.

Finally, we suggest that future research could also focus on the maintenance of institutions, a type of institutional work that was not included in our framework and empirical analysis. We believe that theory and empirical findings regarding these lines of research are critical for academics and practitioners to understand and advance sustainability transitions.

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Appendix A

QUESTIONNAIRE
Approach for the institutionalization *of low-carbon innovations*

- What are the vision and objectives of the organization with respect to the decarbonisation of the built environment?
  - Open coding
- What are the key characteristics of the innovation that is supported as a solution for reducing the carbon footprint of the built environment?
  - Coding: market-based or community-based innovation; social or technical innovation
- What are key barriers that need to be addressed in order to promote the institutionalization of the innovation?
  - Coding: internal barriers and/or barriers related to the regime compatibility. Barriers related to regime dimensions are coded in accordance with the different regime dimensions.

Strategies

- What strategies are applied to promote the institutionalization of the innovation? [open question]
- Coding: visioning; coalition-building; lobbying; vesting; theorizing; demonstrating; standardizing; educating; constructing learning communities; changing normative associations and constructing new identities.
- Please reflect on the strategies stated in Table 1 (see Section 2.2.2, non-exhaustive list) and provide examples.
- Coding: visioning; coalition-building; lobbying; vesting; theorizing; demonstrating; standardizing; educating; constructing learning communities; changing normative associations and constructing new identities.
- Why have the respective strategies been deployed?
  - Coding: niche development and/or regime transformation
- Why have the other strategies not been applied?
  - Open coding

Factors informing strategy choice

- Problem perception
  - What barriers are addressed with the different strategies?
    - Coding: internal barriers and/or barriers related to the regime compatibility. Barriers related to regime dimensions are coded in accordance with the different regime dimensions.
- Capacity
  - What capacity does the organization have?
    - Coding: resources: human, mental, monetary, artefactual, natural (non-exhaustive). Skills: political, analytical, cultural (non-exhaustive).
  - What capacity is required for the deployment of the different strategies? Please list per strategy the type of resources and skills that are required for the successful deployment thereof. Resources may include human, mental, monetary, artefactual, and natural resources and skills may encompass political, analytical, and cultural skills (non-exhaustive).
  - How are the chosen strategies influenced by the capacity of the organization?
- Field-level conditions
  - Do exogenous events or conditions influence the organization's strategy choice?
    - Coding: political opportunity structure; jolts or crises; actions of other actors (non-exhaustive)
  - If yes, how and why?
    - Open coding

INTERNAL BARRIERS		
		Insufficient resource availability to develop and improve the innovation
		Insufficient collaboration and learning between niche actors
		High price of zero energy building concepts; need to develop financially feasible zero-energy building concepts that can be developed at industrial scale (MB)
		Guarantee of performance of zero-energy building concepts (MB)
		Level of professionalization of community energy initiatives to organize retrofits (CB)
BARRIERS RELATED TO REGIME INCOMPATABILITY		
Regime Dimension	*Actors*	
Industry	Contractors; suppliers; R&D; maintenance actors	*Cognitive pillar*
		Sector fragmentation and lack in collaboration in organizing energy retrofits; Information asymmetry and great diversity in offers and products for energy retrofits; No actors that offer integrated, all-in-one zero-energy retrofit concepts and guarantee the energy performance of products (MB)
Market	Intermediaries; consultants; financers; architects; developers	*Cognitive pillar*
		Lack in financing arrangements for energy retrofits
		Property valorisation practices and routines by banks and appraisers; Insufficient economic valorisation of energy efficient buildings and no instruments for the economic valorisation of energy efficient buildings
		Risk aversion/ High risk perception to zero energy buildings and retrofits / Uncertainty concerning the performance of zero energy building concepts, performance contracts (MB)
		Financing practices by banks/ high risk perception for financing small-scale community-based initiatives (CB)
Science	Academic and private research institutes	*Cognitive pillar*
		No scientific consensus on how to achieve zero energy buildings and a low-carbon building stock
Policy	Policy-makers; planners	*Cognitive pillar*
		Lack in political leadership and long-term political goals; lack in political urgency; political short-termism
		Community energy initiatives not sufficiently involved in policy implementation; risk aversion of policy-makers (CB)
		Regulatory pillar
		Legislation concerning mortgages for energy retrofits
		Legislation concerning property valorisation; insufficient valorisation of energy efficient buildings (until 2016)
		Legal obligation to be connected to the gas grid
		Legislation concerning the use of energy performance contract; landlords legally not allowed to change an energy performance fee leading to the split-incentive problem (until 2016) (MB)
		Tax schemes for community energy (until 2016) (CB)
Socio-cultural	End-users, building owners	*Cognitive pillar*
		Lack in awareness about the possibilities and benefits of energy conservation among building owners/ risk aversion
		Normative pillar
		Lack in sense of urgency for energy conservation (short-termism) ; lack in sustainability values

Appendix B

Summary of barriers to the institutionalization of low-carbon innovations contributing to the decarbonisation of the Dutch building stock, as mentioned by the majority of respondents. MB means that the barrier only applies to market-based innovations; CB means that the barrier only applies to community-based innovations. Regime dimensions based on Geels (2004)[5]

	STRATEGY	# OF INSTANCES IN DATA		FUNCTION	FACTORS INFORMING STRATEGY CHOICE				
					ACTOR CHARACTERISTICS			FIELD-LEVEL CONDITIONS	
					Problem perception (regime dimension and institutional pillar)	*Capacity*		*Political structure*	*Jolts, crises, political developments, sector trends*
						Resources	*Skills*		
NICHE DEVELOPMENT	***POLITICAL***								
	Visioning	13	-	Articulate goals and develop a common direction for all actors working on the innovation	*Internal* - Resource availability to develop and improve the performance of innovations - Insufficient collaboration and learning between niche actors	Human - Leadership - Reliability and legitimacy - Coalition of front running actors Mental - Interdisciplinary project team with general and specialized knowledge and expertise Monetary - Budget to mobilize coalitions	Organizational - Being able to set up experiments and expectations; mobilize and coordinate niche actors	n/a	Societal dynamics and sector development and trends. Examples include the challenges experienced by the building sector and the rise of 'the energetic society'
	Coalition-building	13	-	Enhance problem solving capacity of the coalition and make niche actors feel big of a bigger movement					
			-	Reflect on institutional configurations around the innovation					
			-	Enhance the visibility of the movement and create a constituency on whose behalf can be lobbied for institutional reform					
	TECHNICAL								
	Theorizing	8	-	Legitimize how an innovation offers a solution to problems in the regime	*Internal* - Insufficient collaboration and learning between niche actors - High price of zero-energy building concepts (MB) - Level of professionalization of community energy initiatives to organize retrofits (CB)	Human - Coalition of front running actors Mental - Interdisciplinary project team with general and specialized knowledge and expertise Monetary - Budget to finance experiments and research Natural - Space, land Artefactual - Buildings; technologies	Analytical - The ability to develop abstract models and representation of an institution (mental models, cause-and-effect schemata, projections Organizational - Being able to set up experiments and expectations; mobilize and coordinate niche actors		
			-	Learn about institutional conditions of the regime that need to be transformed					
	Standardizing	10	-	Develop a common language among actors applying the innovation					
			-	Enhance the efficiency and effectiveness of innovations					
	Construction of a learning community	6	-	Generate and disseminate experiences, knowledge and skills concerning the innovation					
	CULTURAL								
	Creation of new identities	6	-	Linking the innovation to (new) roles, identities and values	- Insufficient collaboration and learning between niche actors	Human - Coalition of front running actors Mental - Interdisciplinary project team with general and specialized knowledge and expertise Monetary - Budget to finance strategy	Organizational - Being able to set up experiments and expectations; mobilize and coordinate niche actors		
REGIME TRANSFORMATION	***POLITICAL***								
	Visioning	13	-	Gain political support and broaden the coalition around the innovation	*Policy, cognitive pillar* - Lack in political leadership *Market, cognitive pillar* - Risk aversion/ High risk perception *Socio-cultural, cognitive pillar* - Lack in sense of urgency for energy conservation	Human - Legitimacy - Connections in policy networks Mental - Expertise on policy and regulatory conditions and developments Monetary - Budget to finance strategies	Political - The ability to communicate a clear vision for change and connect the innovation to different interests and needs Cultural: - Ability to represent the innovation so that it appeals to a broader audience	Access to political decision-making procedures	Events and crises, such as climate change, earthquakes caused by gas extractions and international policy developments
	Coalition-building	13	-	Broaden the niche and political constituency behind an innovation	*Industry, cognitive pillar* - Sector fragmentation and lack in collaboration in organizing energy retrofits				
	Lobbying	6	-	Creating policy conditions facilitative for diffusion; address barriers related to policy dimension of the regime	*Policy, regulative pillar* - Legislation concerning mortgages for energy retrofits				
	Vesting	4	-	Creating policy conditions facilitative for diffusion; address barriers related to policy dimension of the regime	- Legislation concerning property valorisation; insufficient valorisation of energy efficient buildings - Legislation concerning use of energy performance contract; landlords legally not allowed to change an energy performance fee - Insufficient economic valorisation of energy efficient buildings and no instruments for the economic valorisation of energy efficient buildings - Lack in political leadership - Regulatory obligation to be connected to the gas grid - Tax schemes for community energy				
	TECHNICAL								
	Educating	9	-	Encouraging and enabling actors outside the niche to apply the innovation by providing them with skills and know-how	*Market, cognitive pillar* - Risk aversion/ High risk perception to zero energy buildings and retrofits; uncertainty concerning the performance of zero energy building concepts *Science, cognitive pillar* - No scientific consensus on how to achieve zero energy buildings and a low-carbon building stock *Socio-cultural, cognitive pillar* - Lack in awareness about the benefits and possibilities of energy conservation among building owners/ risk aversion	Human - Team who are effective in communication and instructing Mental - Interdisciplinary project team with general and specialized knowledge and expertise Monetary - Budget to finance strategies	Analytical - The ability to develop abstract models and representation of an institution Cultural - The ability to represent an innovation so that is appeals to a broader audience; ability to instruct other actors about the benefits and impacts of an innovation	N/a	
	Demonstrating	13	-	Reducing risk perception concerning the innovation among supply- and demand-side actors					
			-	Enhancing the legitimacy of an innovation as a solution to a problem					
	CULTURAL								
	Awareness raising activities directed at changing normative associations	8	-	Change people's perceptions concerning an innovation or dominant ways of organizing societal functions	*Socio-cultural, cognitive pillar* - Lack in awareness concerning the possibilities and benefits of energy conservation among building owners. *Socio-cultural, normative pillar* - Lack in sense of urgency; energy conservation	Human - Local operating team who have access to, and are trusted by, households - Legitimacy and credibility Mental - Interdisciplinary project team with knowledge on values and needs of different target audiences. Monetary - Budget to finance strategies	Cultural - The ability to represent an innovation so that is appeals to a broader audience; ability to instruct other actors about the benefits and impacts of an innovation	N/a	
			-	Create a sense of political urgency among the public					

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[5] Appendix B contains only barriers with an institutional source (for instance no material or infrastructure barriers)/barriers related to the material selection environment.

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