Strategies of sustainable entrepreneurs to influence the innovation system

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Abstract
The transition towards sustainability in the energy sector, necessitates far-reaching changes in the structure and organization of the entire system context. Entrepreneurs that innovate are thought to be able to contribute to this transition by creating a new system with their sustainable innovations. Although much attention has been given as to how entrepreneurs innovate, it is much less known how innovating entrepreneurs create changes in the system context. This research aims to address this issue, by investigating the strategies of entrepreneurs to change the system context for the successful introduction and diffusion of sustainable innovations. Interviews have been held with 16 entrepreneurs introducing sustainable innovations, in the sector ‘energy in the built environment in The Netherlands’. The influences and strategies mentioned by the interviewed entrepreneurs are analyzed by using an innovation system framework that distinguishes between the type of system interaction and the actor from the system context with whom the interaction occurs. The results show that 2 types of entrepreneurs exist, with different approaches for interacting with the system context: system following entrepreneurs aim to connect with existing actors in the system and depend on other actors for creating changes in the institutional environment, while system building entrepreneurs create a new system through actively changing network interactions and institutions. Both types of entrepreneurs experience different influences from the system context and have different strategies to change the system context. These insights contribute to further understanding the interactions between entrepreneurs and the system context in order to more effectively stimulate and support innovating entrepreneurs to contribute to the transition towards sustainability.
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Preface

This working paper is based on the MSc thesis of Sybrand de Boer for the MSc program Science and Innovation Management. This research has an explorative function. The main aim is to find out whether this theme is an interesting enough research area to explore further by different staff members of the department of Innovation and Environmental Sciences at Utrecht University.
1 Introduction

1.1 Problem description

1.1.1 Transition towards sustainability

Society increasingly imposes a challenge for changing the nature of economic activities in almost every sector of the economy. The dependence of current energy production, distribution and consumption systems on the extensive use of fossil fuels, brings uncertainty with regard to the security of supply and contributes heavily to environmental degradation of ecosystems due to increased carbon emissions leading to global warming and climate change (IEA, 2008). Trends emerge in society as a reaction to these threats concerning the sustainability of how current economic activities are organized. It is becoming increasingly important that economic developments are sustainable, that is that they “meet the needs of the present without compromising the ability of future generations to meet their own needs” (WCED, 1987: 8). This concept of sustainability encompasses the ‘triple bottom line’, since it considers an integration of impacts in economic, environmental and social terms.

This societal trend for improving the sustainability of current economic systems, means that economic activities in the energy sector need to change in order to create sustainable, environmentally friendly and socially accepted forms of energy production, distribution and use. This structural, long-term reorientation and transformation of economic activities is termed a transition (Kemp, 1994; Geels, 2004). The transition towards sustainability acknowledges the increasingly important societal requirement that economic, social and environmental impacts of developments in the sector need to be jointly considered. This entails far-reaching changes in the energy sector that go beyond incremental processes caused by technical change only (Hekkert et al., 2007). Walking the path towards sustainability means that the current structure and organization of the energy sector will have to change.

1.1.2 Innovation

Innovation processes are thought to be fundamental driving forces for realizing the transition in society towards sustainability (Geels, 2004; Hekkert et al., 2007). Innovation contributes to the challenges of the sustainability transition, since innovation processes lead to the development of new technologies and practices that are necessary to effectively achieve a sustainable system (Geels, 2005; Hekkert et al., 2007). These promising innovations can lead to more efficient use of resources, less stress on the environment and even cleaning of the environment (Hekkert et al., 2007). Realizing these innovations, that move the sector towards sustainability, requires a change in the nature of innovation processes. In addition to a contribution to economic objectives of innovation such as sustainable profits, growth or revenues – which is still considered a requirement for successfully introducing new economic activity (Fagerberg & Godinho, 2005) –, firms need to incorporate in their innovation processes the social and environmental aspects of sustainability. This results in sustainable innovations: new combinations that integrate all three aspects of sustainability and that have the potential to contribute to the transition by changing the sector towards a more sustainable state (Ashford, 2001). Sustainable innovations create win-win situations in terms of the triple bottom line by integrating economic health, social equity and environmental resilience. This goes beyond the old perspective that innovations can only contribute to sustainability with an inherent trade-off to economic profitability (Cohen & Winn, 2007). Through the integration of the three aspects of sustainability, sustainable innovations will not only change the sector to become sustainable in environmental and social terms by reducing the deterioration of the human environment and of natural resources, but will also create sustainability in economic terms by creating added value and sustained economic competitiveness of the sector through improved ways of energy production, distribution and use (Gerlach, 2003).

1.1.3 Entrepreneurs

An important contribution to set in motion the transition is made by entrepreneurs that innovate (Geels, 2004; Hekkert et al., 2007). Entrepreneurs are venturesome people that are willing and able to experiment with innovations and that have the initiative and persistence to make change happen (Nooiteboom, 2008). According to Schumpeter, entrepreneurs are a driving force for realizing fundamental change in society through “the process of creative destruction” (Schumpeter, 1934) which
involves the discovery and exploitation by entrepreneurs of new combinations of technologies, products, markets, processes and organizational forms that create (revolutionary) changes in the economy. These ‘Schumpeterian entrepreneurs’ are able to overthrow and change the current structures around them and force the innovation process into new directions by shaping a new path towards renewal of the sector (Garud & Karnøe, 2001; Hekkert et al., 2007). Due to their ability to spawn variety and experiment with innovations in terms of new technologies and new organizational forms, entrepreneurs are thought to be in the right position to combine a contribution to the transition towards sustainability with an increase in economic competitiveness through the generation of value-adding sustainable innovations.

1.1.4 System change

Introducing and diffusing sustainable innovations necessitates far-reaching changes in the structure and organization of the entire system context. This system context consists of all important economic, social, political, organizational, institutional and other factors that influence the development, diffusion and use of sustainable innovations (Edquist, 2005). Entrepreneurs operate in this system context and are influenced by its policies, regulations, interactions, norms, societal pressures etc. (Jacobsson, 2002). Since the sustainable innovations that entrepreneurs aim to introduce create radically improved ways of organizing economic activities, a conflict arises with the current way of thinking and organizing in the sector (Hekkert et al., 2007). The current system of regulations, interactions, beliefs, behavior etc. is tuned to current products and services and not aligned with new practices, knowledge, values and interaction patterns of the sustainable innovation. Successful introduction and diffusion of a sustainable innovation thus requires profound changes in the way of thinking within organizations, in the way that organizations operate and interact and in the principles, standards, routines, norms and values of the system that influence the actions and interactions of organizations. Entrepreneurs that innovate can deploy various strategies to change the system context in which they operate, in order to foster the introduction of their sustainable innovations, such as active lobbying for changes in regulation, establishing new habits and practices, creating new partnerships, increasing societal acceptance of sustainability etc. Through these strategies, entrepreneurs are able to change the current standards, routines, norms and practices to build up a new and more sustainable system context that is aligned to the sustainable innovations and thus contribute to the transition towards sustainability in the sector. In order to successfully introduce and diffuse sustainable innovations in the system, entrepreneurs will have to take the lead and pave a new path in the system context to create space for sustainable innovations.

Although much attention has been given as to how entrepreneurs innovate, it is much less known how innovating entrepreneurs create changes in the system context. The currently available literature on innovation and entrepreneurship fails to explain adequately how entrepreneurs can influence or even change the system context itself. Literature focused on the transition towards sustainability has so far disregarded the interactions between entrepreneurs and the system context and insufficiently explains how innovation can act as a driver for sustainability and economic growth of an industry simultaneously, with entrepreneurship as a method to reconcile both (Gerlach, 2003; Dijkema 2006; Cohen & Winn, 2007; Coenen & Díaz Lopez, 2008; Lepoutre, 2008). Innovation systems literature does recognize the great importance of the system context for introducing sustainable innovations, but insufficiently explains the strategies of entrepreneurs to change the system, which calls for more research to strengthen the link between the macro-level of innovation systems and the micro-level of entrepreneurial strategies in order to gain insight into the dynamic interactions between both levels (Hekkert et al., 2007; Markard & Truffer, 2008). The notion of path creation (Garud & Karnøe, 2001) makes a first step in this direction, by providing insight into how individual actors can shape and are shaped by the system context that emerges together with the introduction of innovations, but does not provide for a bottom-up overview of the range of strategies available to entrepreneurs to actively create and shape the new path. Literature that has started from the micro-perspective to identify strategies of entrepreneurs, offers some situations in which entrepreneurs are indeed able to change the system context: institutional entrepreneurship (DiMaggio, 1988; Oliver, 1991; Leca et al., 2008) emphasizes that actors need to be large and have power in order to change the system and literature on advocacy coalitions (Sabatier, 1988) and running in packs (Van de Ven, 2005) suggests that entrepreneurs can operate collectively in order to gain the necessary power. However, these theoretical insights do not satisfactorily explain whether and how small innovative entrepreneurs without power or without the right relationships are able to achieve system change. What
is missing in literature is a clear understanding of how entrepreneurs interact with the system context which, besides their reaction to pressures from the system context, also includes how entrepreneurs aim to influence the system in which they operate. With rising interest in research how the system context shapes entrepreneurs on the one hand and research into how entrepreneurs shape the system on the other, more research is needed on the interaction between these two streams (Leca et al., 2008).

1.2 Research question
As explained in the problem description, insight needs to be gained into the dynamic interaction between the influences of the system on entrepreneurs and the strategies of entrepreneurs that experiment with sustainable innovations to achieve changes in the system context. This research aims to find how entrepreneurs influence and shape the conditions of the system context to become favorable for the development and diffusion of sustainable innovations:

What are the strategies of entrepreneurs to change the system context for the successful introduction and diffusion of sustainable innovations?

Since the main research question is rather broad, it will be more structurally addressed by answering the following sub-questions:
1. Who are the entrepreneurs that introduce and diffuse sustainable innovations?
2. What are the influences of the system context on entrepreneurs?
3. What are the strategies of entrepreneurs to influence the system context?
4. Can different types of entrepreneurs be distinguished based on their interactions with the system context?

![Figure 1: Conceptual relations studied in this research](image)

In the introduction it was described that entrepreneurs can contribute to the transition towards sustainability; answering sub-question 1 will characterize who these entrepreneurs are. Since the relationship between entrepreneurs and the system context is interactive, the influences in both ways will be investigated separately by sub-questions 2 and 3 (see figure 1). Sub-question 4 combines insights from these previous sub-questions, by focusing on the development of a new typology of entrepreneurs based on their interactions with the system context. Combining the answers on the 4 sub-questions will subsequently lead to the identification of successful entrepreneurial strategies for the development and diffusion of sustainable innovations and thus provides an answer to the main research question.

1.2.1 Case: sustainable innovations in the built environment
Since the range of economic areas in which entrepreneurs could introduce sustainable innovations is very broad, this research is delineated by focusing on one specific sector. The empirical part of this research will be conducted in the sector ‘energy in the built environment’ in the Netherlands. The Dutch sector ‘energy in the built environment’ refers to the production, distribution and consumption of energy in all buildings in the Netherlands. These buildings include residential buildings, such as houses and apartment complexes, as well as utilities buildings, such as commercial, industrial or governmental buildings. The sector built environment is responsible for 40% of the total energy consumption of the Netherlands and offers an enormous potential for taking large steps in the transition towards energy sustainability of the Dutch economy (TNO, 2008). The sector experiences strong demands to move towards sustainability which results in a strongly voiced need for innovations that combine sustainability of energy with creating new businesses and practices in the building industry. Therefore, Dutch policy to facilitate the transition towards sustainability in the built environment provides strong support for a broad array of technological options and actively stimulates innovation in the energy sector (NOI, 2007). These policies are designed to exert pressure on the actors in the energy sector to move the direction of their innovation processes
towards sustainability. This pressure of guidance is intended to give an impulse to innovation processes in the direction of sustainability. Many entrepreneurs are now stepping up to develop sustainable innovations based on a plethora of technologies to contribute to this transition and exploit this opportunity to create a new business.

Achieving the transition towards sustainable energy in the built environment is considered a long-term process, since current economic actors and the way in which they are organized and operate will have to change profoundly to incorporate sustainability. These changes may involve many actors, such as (national, provincial, municipal) governmental bodies, housing corporations, project developers, investors, architects, building contractors, builders and installation services, building suppliers, consultancy companies, knowledge institutes, social communities and residents. Moreover, actors in the building sector are known to be particularly conservative, with strong vested interests, rigid interactions between them and opaque processes of competition and collaboration which make entry hard for outsiders such as innovating entrepreneurs. Given the strong need in this sector for innovation and entrepreneurship, contrasted with the rigid and conservative system context, this sector provides for an excellent case to investigate the strategies of entrepreneurs to influence the system context.

The outline of this research report is as follows. The next section will provide an more detailed overview of current literature and a discussion of their usefulness for the topic of this research. Section 3 will explain the methodology for data gathering and analysis from entrepreneurs in the sector. Section 4 presents the results of the mentioned influences and strategies and analyzes the dynamic entrepreneur-system interactions. Section 5 concludes this paper with an answer to the research question, implications for theory and recommendations for further research.

2 Theory
Several attempts have been made to explain the interaction between entrepreneurs and the system context. This section will provide a brief overview of literature relevant for this research and will explain the usefulness and limitations of current theories.

First, theories positioning innovation processes in the context of an innovation system are discussed. Next, the micro-level of entrepreneurs and their influence on the system is strengthened by using insights from sustainable entrepreneurship, institutional entrepreneurship and literature on collective entrepreneurial action. Third, the process of path creation is used to make a first step towards integrating the micro and macro-levels by explaining how entrepreneurs can build up and shape a new innovation system. Finally, the last paragraph of this section summarizes the usefulness and limitations of current theories, identifies where a gap in literature remains and explains the contributions of this research to address this gap.

2.1 System context of innovation
The emergence of innovations does not take place in a vacuum, but rather occurs through a dynamic interplay between various actors such as firms, universities and government bodies (Jacobsson, 2002; Hekkert et al., 2007). This is the central idea behind the Innovation System approach, which views innovation as the result of the interactions in an innovation system consisting of all actors and institutions that affect both the rate and direction of innovation in society (Edquist & Lundvall, 1993; Hekkert et al., 2007). The Innovation System approach emphasizes that innovation is both an individual and a collective act, resulting from interactions and coordination between several firms and organizations rather than from the independent actions of single dominant firms (Edquist, 2001; Nooteboom, 2008).

Individual firms and entrepreneurs are the micro-level of an innovation system, but they act within the larger context of the innovation system on macro-level (Markard & Truffer, 2008). Various factors within the innovation system could exert a pressure on entrepreneurs on the micro-level, such as interdependencies with multiple stakeholders, processes of competition and cooperation, governmental policies, regulations, societal norms, values etc. These influences from the system context can be both an enabler and a constraint for sustainable entrepreneurial action (Leca et al., 2008). Influences from the system context that enable and stimulate sustainable innovation, could be explanatory factors for why in
some settings entrepreneurs are able and willing to develop sustainable innovations while in other situations they are not.

![Diagram of Entrepreneur operating in the system context: embedded in network interactions and under the influence of institutions.](image)

This view on innovation as an interactive process of change embedded in a multi-actor network and influenced by institutional factors of the wider environment on the macro-level of the system (see figure 2), is shared by the multi-level perspective on innovation processes (Markard & Truffer, 2008). The multi-level perspective, like the innovation systems approach, stresses the importance of interactions between multiple actors for shaping innovation processes and stresses that innovation processes take place under the influence of institutions (Geels, 2005; Markard & Truffer, 2008; Coenen & Diaz Lopez, 2008).

When analyzing the influences from the system context of innovation processes, a clear distinction should be made between the ‘players’ and the ‘rules of the game’ (Klein Woolthuis et al., 2005). The players are the actors of an innovation system: various organizations (e.g. start-ups, large companies, government bodies, universities, research institutes etc.) that act and interact with each other. The ‘rules of the game’ are the institutions of an innovation system, which stipulate the norms, rules and (formal and informal) standards that regulate the interactions between actors (Jacobsson, 2002). The institutions shape, and are shaped by, the interactions between actors taking place within the innovation system. This distinction between actors and institutions is a crucial aspect to understand the structure of an innovation system and the activities that take place within it.

In innovation systems literature, entrepreneurs are regarded essential for a well functioning innovation system, since they can turn the potential of new knowledge, networks and markets into concrete actions to generate and exploit new business opportunities (Hekkert et al., 2007). However, the innovation systems literature lacks explanatory power about the contributions to innovation of individual actors on micro-level, such as entrepreneurs. Although the innovation system approach sheds light on how interactions between actors and the institutions on the system level could influence innovating entrepreneurs, the innovation system framework lacks insight on how the dynamics of innovation systems work out on the micro-level (Hekkert, 2008). The innovation system framework insufficiently explains how entrepreneurs are able to overthrow and change the current structures around them and force the innovation process into new directions (Hekkert et al., 2007). In order to adequately understand what the strategies are of entrepreneurs to interact with the system context, the macro-level of the innovation systems approach has to be linked with the micro-level of entrepreneurial strategies. Therefore, the next section will discuss insights from three streams of literature starting from a micro-perspective, to explain how individual actors might be able to change the system context around them: sustainable entrepreneurship, institutional entrepreneurship and collective entrepreneurial action.
2.2 Entrepreneurship literature

This section will describe three strands of literature on entrepreneurship, to strengthen the understanding of the micro-level of innovation systems and the interactions between entrepreneurs and the system context. First, insights from literature on sustainable entrepreneurship are used to explain how entrepreneurs can innovate to reconcile sustainability with economic growth. Second, insights from institutional entrepreneurship literature are used to explain in which cases and under which conditions actors are able to achieve institutional change. Third, strategies using an approach of collective entrepreneurial action are discussed to explain how cooperating entrepreneurs could influence the system context.

2.2.1 Sustainable entrepreneurship

Research which views entrepreneurship as a method to reconcile economic growth with a contribution to sustainability, is scarce. The concept of sustainable entrepreneurs as actors able to achieve exactly this, has recently become of interest to various researchers, however with a focus on environmental entrepreneurship (Gerlach, 2003; Dijkema 2006; Cohen & Winn, 2007; Lepoutre, 2008). This new strand trying to establish new theory on sustainable entrepreneurship, has mainly focused on entrepreneurial action through opportunity recognition in relation to market failures (Cohen & Winn, 2007; Dean & McMullen, 2007; Hall & Lobina, 2007). This disregards the societal pressures from the broader setting of innovation in societal systems and the potential of sustainable entrepreneurs for achieving changes in the system.

However, sustainable entrepreneurship literature has proposed some typologies of strategies of entrepreneurs for the advancement of sustainable innovations. Many authors speak of a distinction between reactive versus pro-active approaches towards sustainability (see for an overview: Lepoutre, 2008: page 39-41). A reactive strategy is deployed by entrepreneurs that adapt their current practices to comply with regulations or to enhance profitability, by using end-of-pipe control measures which results in incremental reduction of their environmental impact (Lepoutre, 2008). On the other end of the spectrum, a pro-active strategy is followed by entrepreneurs that are continuously improving the sustainability of their business, by anticipating to future regulations, social trends and building resources, interacting with social conditions and creating value, beyond what is legally required or accepted as standard practice (Aragon-Correa & Sharma, 2003; Sharma & Henriques, 2005; Lepoutre, 2008). Pro-active entrepreneurial strategies are more likely to occur when the institutional context pushes firms towards more voluntary attention to sustainability, but are less likely to occur when the business environment is complex and uncertain since this makes it harder for entrepreneurs to recognize social issues (Lepoutre, 2008).

Dijkema et al. (2006) distinguish four sequential phases in the development of companies towards sustainability, where in each phase companies have a longer planning horizon and think and act more proactively on sustainability. However, a conflict could arise from the fact that society’s demands for sustainability require a long-term view of developments, while the survival goals of entrepreneurs are more short-termed (Lepoutre, 2008). Companies should aim to make a contribution to sustainability not only by innovations in the product lifespan or by innovations in their network, but also through innovation of the social context of stakeholders and decision processes, by influencing public institutions, policy and regulatory frameworks (Dijkema et al., 2006). Larson (2000) makes a distinction between three streams of literature that have different ideas of how entrepreneurs deal with opportunities: the public policy view views regulation as the driver for innovation, in the voluntary standard perspective companies accept performance standards in order to avoid existing or anticipated ones and in the resource based perspective companies incorporate unsustainable considerations into strategic management. Gerlach (2003) discerns three strategies with regard to sustainability: sufficiency, efficiency and consistency. Sufficiency focuses on the rethinking of current consumption and production patterns; efficiency focuses on the improvement of current products and processes, thus by revising the means instead of the goals; and consistency concentrates on the quality of materials and consumption patterns, thus changing the quality of material flows instead of reducing the quantity of materials (Gerlach, 2003).
Although all authors mention that entrepreneurs are influenced by society to contribute to the sustainability challenges, there still seems to be a lack of knowledge about how entrepreneurs that help to resolve sustainability challenges are influenced and strategically react to pressures from the system context (Dean & McMullen, 2007). Moreover, the currently available literature on strategies of sustainable entrepreneurs fails to explain how entrepreneurs can influence or even change the system context itself. This research aims to address this issue by researching the interaction between the system context and the innovative actions by entrepreneurs and their strategies to influence the system context.

### 2.2.2 Institutional entrepreneurship

An important strand of literature that starts from the viewpoint of individual actors and aims to explain how changes in the system can be achieved by these actors, is institutional entrepreneurship. Literature on this topic has originated from earlier institutional theory, which has mainly paid attention to the constraints imposed by institutions on the system in which actors operate. From the perspective of institutional theory, fixed institutions create stability and reduce uncertainty for actors in a system. In order to create legitimacy, organizations tend to create fit with the institutional environment and adhere to current practices, norms, standards, values etc. Central to this is the notion of institutional isomorphism, whereby all organizations in a system that face the same set of pressures from institutions will eventually adopt the same kind of behavior. Institutional isomorphism could seriously hamper innovation since institutional variety and creating institutional change are a crucial part of successfully introducing and diffusing innovations.

Institutional entrepreneurship has provided insights on how organizations can take actions to shape, change or overthrow the institutions, despite pressure towards stasis (Leca et al., 2008). DiMaggio (1988) introduced the notion of ‘institutional entrepreneurs’ and explained them as actors that contribute to the genesis of new institutions. As opposed to exogenous shocks that challenge institutions, institutional entrepreneurship literature focuses on the agency of actors “who can serve as catalysts for system change by taking the lead and giving direction for structural change in society” (Leca et al., 2008). However, institutional change can only be achieved by institutional entrepreneurs in certain cases and under certain conditions (Oliver, 1991). Institutional entrepreneurs undergo pressures when they choose to resist institutions, such as a reduction of social legitimacy, lower degree of economic gains, conflicting demands by other actors on institutional arrangements, discrepancy with institutional requirements, legal coercion to comply with institutions and increased uncertainty in the organization’s environment (Oliver, 1991).

Actors have to be able to resist these outside pressures that are resulting from a strategy of non-compliance with current institutions. Finding a way to negate these pressures in order to achieve institutional change, requires a great extent of organizational power and legitimacy to be able to influence the system context and survive the negative influences. Institutional entrepreneurship literature implies that very large companies or powerful networks of organizations will have a better chance to resist these pressures, whereas a smaller firm acting on its own will probably not live to tell the tale (Taminiau et al., 2008).

This means that research on institutional entrepreneurship has so far mainly focused on large organizations with power, which are completely unlike the experimenting, small, innovative entrepreneurs this research focuses on. The innovative entrepreneurs of this research are thought to be able to set in motion a new path towards changing the system, however they lack the power and legitimacy of large organizations. Literature on institutional entrepreneurship does not satisfactorily explain whether and how small innovative entrepreneurs without power are able to achieve institutional change. Actors can seldom leverage sufficient power and resources alone, therefore entrepreneurs that aim to change institutions must mobilize allies and develop alliances in order to acquire the necessary resources, power and legitimacy for institutional change (Leca et al., 2008). Moreover, institutions are only one part of the system context influencing and pressurizing entrepreneurs. Interactive relationships with other actors in networks and processes of competition and collaboration are important additional sources of system influences for entrepreneurs. This research aims to complement literature on institutional entrepreneurship by empirically researching the strategies that small innovative entrepreneurs use to influence the system context.
2.2.3 Collective entrepreneurial action

From the micro-level theories on entrepreneurship above, it becomes clear that entrepreneurs acting alone can hardly change the system context. Two other authors have proposed certain strategies on how innovative small entrepreneurs could operate collectively in order to create the capacity to shape the system environment in a favorable form and secure their survival. Sabatier (1988) describes that advocacy coalitions consisting of a group of actors, including government agencies, societal organizations, academics, private businesses and individuals, act together to exert pressures on the policy cycle to influence policy making. Such a coalition of actors with shared beliefs and values that have forged relationships with each other, are important enough to influence the policy domain to steer policy changes in the direction of their preference. Van de Ven (2005) describes that entrepreneurs can coordinate their innovation activities through the strategy of ‘running in packs’, since individual entrepreneurs do not have the resources, power or legitimacy to produce institutional change alone. No single entrepreneur controls the innovation development process and small innovative players need to group together to combine their resources, competences and legitimacy to create critical mass for changing the institutions in order to make it collectively possible to commercialize a new business (Van de Ven, 2005). Both proposed strategies available to innovating entrepreneurs to change the system context are possible methods based on theoretical insights. However, there is no empirical evidence on the occurrence and effectiveness of these strategies in practice. Moreover, these methods are only two of the many potential strategies available to entrepreneurs to change the system context. More research is needed in order to find out which of the available strategies entrepreneurs actually use and whether strategies for collective entrepreneurial action are playing a vital role, which necessitates a detailed and comprehensive insight into the dynamic interaction between entrepreneurs and the system context.

2.3 Path creation

One way to link the system context with entrepreneurial strategies, is by describing the introduction and diffusion of technological innovations in terms of an unfolding process of ‘path creation’ (Garud & Karnoe, 2001; Garud & Karnoe, 2003). The notion of path creation describes innovation as a combination of strategies of entrepreneurs on micro-level and the mutual co-shaping of the system context on macro-level. Where incumbent actors suffer from path dependence within current systems, innovative entrepreneurs can break a technological regime through the process of ‘path creation’ (Garud & Karnoe, 2001), where they shape a new path towards renewal of the sector by setting processes in motion of developing innovations in the form of new social practices, products and services.

Path creation, like innovation systems literature, assumes that there is a multiplicity of actors acting and interacting to co-produce technological innovations. Interactions and learning processes between these actors can create new options for innovations. Agency is distributed over many actors such as users, producers, evaluators, regulators etc., and the inputs of all these actors together “co-shape and accumulate the artifacts, tools, practices, rules and knowledge” surrounding innovations (Garud & Karnoe, 2003). This embedding process of interactions creates virtuous learning cycles and momentum which leads to a gradual build-up of functionality of the innovation. Actors do not only create and shape paths, they are also influenced by the emerging path. Path creation thus assumes that actors become embedded in the accumulating path, since the inputs of many actors have created a path that in turn “starts shaping the actions and interactions of the involved actors” (Garud & Karnoe, 2003). The distributed and embedded nature of actor’s agency, can differ per emerging path. Some paths might be developing better than others.

Through a case of studying the emergence of Danish and US wind turbines, Garud & Karnoe (2003) identify two approaches for path creation: bricolage and breakthrough. The process of bricolage in shaping emerging paths, emphasizes the taking of small steps to allow for interactions with continuous feedbacks between actors. Within this emergent co-shaping, processes of collaboration are crucial for the steady scale-up of innovations. Bricolage occurs in an interactive learning network, benefiting from the distributed competencies of firms in networks. Actions and interactions between many actors and the coupling of learning processes with continual adjustments by all actors, is crucial for bricolage to occur. In contrast with bricolage, the breakthrough approach assumes that actors can leap-frog to an ideal situation for a new path. In breakthrough processes there is a hype of the future performance and actors
believe that through technology-push this can be achieved. The breakthrough approach leaves no time for interactive build-up of system context. Because actors aim to jump-start innovation by introducing the ideal-type innovation at once, there is not enough interaction and learning between players to allow for mutual co-shaping in the emerging path. Actors instead focus on finding the radical breakthrough, on competitivenes, on limiting costs and on how to scale up as quickly as possible. This leads to mostly short-term and one-off relationships where the advantages of learning and steady progress are completely lost. The authors argue that a breakthrough approach “stifles the micro-learning processes that allow for the mutual co-shaping of emerging technological paths” (Garud & Karnoe, 2003).

Concluding, in order to successfully introduce and diffuse innovations, technology entrepreneurs should pursue the bricolage approach and focus on interactions between many actors in order to co-shape the emergence of the innovation with the emergence of accompanying tools, practices, rules and knowledge. The notions of path creation and bricolage offer insights into the interactions and learning processes between a multiplicity of actors and stress the importance of co-shaping rules and practices together with the innovation. Yet the literature on path creation so far does not explain the specific strategies that entrepreneurs use for the process of bricolage. This research uses the notions of path creation and bricolage to illustrate the necessities for system build-up and aims to contribute to this literature by further clarifying the strategies available to path-creating entrepreneurs.

2.4 Literature gap

This section will first shortly summarize the theories discussed above to identify a gap in literature that this research will address. Next, a theoretical framework is introduced based on current theories, which is used in this research to address the literature gap.

2.4.1 Literature gap on entrepreneur-system interactions

As has become apparent from this discussion of relevant literature, current theories provide valuable insights on the systemic nature of innovation processes and offer possible strategies available to entrepreneurs to influence the system context, but there still remains a gap in literature. None of the theoretical insights provides a clear description, understanding or typology of the specific strategies that innovating entrepreneurs use to change the system context. Although innovation systems theory can be strengthened by using insights on micro-level from sustainable entrepreneurship, institutional entrepreneurship and collective entrepreneurial action, a clear understanding of the interactions between entrepreneurs and the system is lacking in literature. What is missing, is a clear picture of how entrepreneurs interact with the system context which includes both the reaction to pressures from the system context and their strategies to influence the system. Theories on how the system context shapes entrepreneurs and theories of how entrepreneurs shape the system, need to be integrated in order to explain the interactions between these two streams (Leca et al., 2008). A comprehensive overview is required of the range of strategies available to entrepreneurs to influence the system context, to be identified on micro-level. This empirical research aims to fill this gap in literature by providing a bottom-up overview of how entrepreneurs perceive the influence of their system context, what their strategies are for dealing with these influences and whether and how they aim to change the system context.

2.4.2 Theory to analyze entrepreneur-system interactions

In order to structurally analyze the gap in literature on the interaction between entrepreneurs and the system context, this research aims to identify the influences from the system context on entrepreneurs and the strategies of entrepreneurs to influence the system context. The type and origin of the influences and the focus of the strategies that entrepreneurs experience in practice could vary widely, ranging from directly related to specific actions of actors to accepted practices established in the sector as a whole. A theoretical viewpoint with a clear perspective for looking at the data is needed to be able to assess the interactions between the system and entrepreneurs. In order to create structure in the chaos of influences and strategies, some conceptual distinctions for analyzing and mapping the influences and strategies need to be made. Based on insights from current literature, some concepts are introduced in this section in order to clearly structure and categorize the interactions between entrepreneurs and the system context.
First of all, with regard to the interactions with the system context, an important distinction can be made between the type of system interaction and the actor from the system context with whom the interaction occurs (Klein Woolthuis et al., 2005). The type refers to the systemic origin of the interaction, based on the different components of the system's structure, such as the networks, institutions or technology (Edquist & Johnson, 1997). The actor refers to the specific person or organization where the entrepreneur interacts with, i.e. where the influence is perceived to be coming from or where the strategy is directed at. This distinction between actors and types of interaction within the system context, is analogous to the 'system of innovation' framework developed by Klein Woolthuis et al. (2005), where a same kind of distinction is made. However, where she uses the term 'system failures' to refer to the different types of system interactions, this research will adopt the term 'category of system interaction'; since the word failure has a negative connotation whereas this research assumes that any type of interaction with the system can also be positive. Thus, each category of system interactions can hold barriers for entrepreneurs, but could also hold drivers and opportunities for sustainable entrepreneurship. Based upon the framework by Klein Woolthuis et al. (2005) and by using insights from the structural components of innovation systems by Edquist & Johnson (1997), 3 distinct categories of system interactions are distinguished:

1. **Network interactions**: interactions resulting from relations and connections with and between other actors and the whole organization of the network of actors around the entrepreneur (e.g. competition, partnerships, lack of cooperation, lobbying). This category of system interactions corresponds to the strong and weak network failures mentioned by Klein Woolthuis et al. (2005). When strong network failure occurs, actors in the system interact too much and become 'blind' for outside developments due to excessively close linkages, which results in inertia, internal dependences and lock-in into current technological trajectories. Weak network failure means that actors interact too little because of a lack of linkages and interactions, resulting in insufficient use of complementarities, lack of shared vision, no interactive learning processes and failure to create new ideas (Klein Woolthuis et al., 2005). Both strong and weak network failure have the same effect for the network interactions: it hampers innovation through the reluctance to let new entrants in and through the blocking of renewal from outside.

2. **Institutional interactions**: interactions resulting from the institutions that shape the interactions between actors and determine the way things are done (e.g. standards, behaviors, 'normal' practices, norms, rules, values etc.): 'the rules of the game'. Institutions are mentioned by many authors as a key component in the system context for guiding or hampering the introduction of innovations (DiMaggio & Powell, 1983; Scott, 2001; Lepoutre, 2008). A distinction is made between three types of institutions based on the three institutional pillars defined by Scott (2001): regulatory institutions (formal rules, legal requirements, governmental or industrial regulations, that can be enforced through legal means and sanctions), normative institutions (societal pressures, norms, values, social obligations within a community) and cognitive institutions (taken-for granted assumptions that are engrained in routines, habitual interactions, behaviors and cultural practices of people). Institutional interactions can occur with all three types of institutions. Failures in the institutional context could seriously hinder the exchange of knowledge, suppress interactions between players and even block the introduction and diffusion of innovations within industries (Klein Woolthuis et al., 2005).

3. **Technology interactions**: interactions resulting from the availability and progress of scientific and applied knowledge and skills (e.g. testing facilities, possibilities for knowledge transfer, technological breakthroughs etc.). This category corresponds to the science-technology part of infrastructural failure defined in the framework by Klein Woolthuis et al. (2005). For entrepreneurs to succeed, they need available and reliable technologies to enable their innovations and support long-term developments (Klein Woolthuis et al., 2005). Technological progress typically requires large-scale, indivisible and long-term planning and investments, which are hard to carry out as a single entrepreneur (Klein Woolthuis, 2005). Therefore, technology, technological progress and knowledge exchanges are an important category of influences from the system context that could drive or hamper the introduction of sustainable innovations by entrepreneurs.
These three categories describe the type of interaction that an entrepreneur has with the system context. An entrepreneur who is situated within the system context of the sector the built environment, interacts with the system in these three conceptual categories: interactions with networks, with institutions and with technology. Thus, entrepreneurs are influenced by and influence the system in three ways: with regard to the structure and relations between actors in networks, with the institutions shaping these interactions and with regard to technology and knowledge transfer. Besides these three categories of system interactions, each interaction of an entrepreneur also occurs with a specific actor or actor group in the system. Thus, each influence on an entrepreneur belongs to a specific category of system interactions, and comes from a specific actor. Also each strategy of an entrepreneur addresses a specific category of system interactions, and is directed at a certain actor or actor group. These two theoretical dimensions of interactions with the system context – actors and categories of system interactions – provide for a structured way of analyzing the gap in literature. With this theoretical conceptualization of the interactions between entrepreneurs and the system context in mind, the next step is to empirically investigate the interactions in practice.

3 Methodology

In order to determine the interactions between entrepreneurs and the system context, this research has empirically studied the interactions of entrepreneurs introducing innovations in the field of energy in the built environment in The Netherlands. In this section it will be explained how the empirical research was conducted. First the domain of this research is defined, next the methods for data gathering are explained and this section ends with a description of the methods used for data analysis.

3.1 Domain

This empirical research specifically focuses on the micro-level of entrepreneurs to determine how they interact with the system context from this bottom-up perspective. Since there is a lack of insight in the dynamics on micro-level, such a research calls for an explorative approach, rather than to test existing theories. The empirical part of this research is thus meant to find out how things work on micro-level to find out what the range of experiences and strategies is by directly asking the entrepreneurs themselves. For this purpose, the first step was to establish criteria to identify the entrepreneurs introducing sustainable innovations in this sector, which make up the population subject in this research. All interviewees had to satisfy four criteria: 1) they are entrepreneurs that create new economic activity leading to change in the marketplace, 2) they innovate, i.e. successful experimentation, development and introduction of new products, processes, combinations, services or organizational forms, 3) they contribute towards sustainability, i.e. they have the ability to be scaled up to change or replace current practices in the sector which results in reduced deterioration of the human environment and/or of natural resources while at the same time retained or improved economic competitiveness, and 4) they belong to the sector, i.e. they are suppliers of innovations (based on various technologies) to the sector energy in the built environment in The Netherlands. Thus, all entrepreneurs that have been interviewed by definition aim to contribute to the transition towards sustainability in the sector.

In total 16 entrepreneurs were selected for the empirical research. These entrepreneurs all satisfy the 4 population criteria mentioned above. However, some variety exists within this achieved domain in terms of the phase in the life-cycle of the companies and the technologies that are used for the sustainable innovations. The range of specific characteristics of the interviewed entrepreneurs is presented in table 1 and the distribution of the size of the companies in figure 3, see the references for further details.
Table 1: Characteristics of interviewed entrepreneurs

<table>
<thead>
<tr>
<th>Reference number</th>
<th>Phase in life-cycle</th>
<th>Technology used for sustainable innovation:</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Start-up</td>
<td>Photo-voltaics with solar thermal</td>
</tr>
<tr>
<td>2</td>
<td>Growth</td>
<td>Photo-voltaics, solar thermal, urban wind, biomass</td>
</tr>
<tr>
<td>3</td>
<td>Start-up</td>
<td>Photo-voltaics</td>
</tr>
<tr>
<td>4</td>
<td>Maturity</td>
<td>Heat collection &amp; storage</td>
</tr>
<tr>
<td>5</td>
<td>Start-up</td>
<td>Solar thermal, water power</td>
</tr>
<tr>
<td>6</td>
<td>Growth</td>
<td>Solar thermal, wind, heat pump &amp; storage</td>
</tr>
<tr>
<td>7</td>
<td>Start-up</td>
<td>Urban biowaste</td>
</tr>
<tr>
<td>8</td>
<td>Growth</td>
<td>Photo-voltaics</td>
</tr>
<tr>
<td>9</td>
<td>Start-up</td>
<td>Electricity, electronics</td>
</tr>
<tr>
<td>10</td>
<td>Start-up</td>
<td>Urban wind power</td>
</tr>
<tr>
<td>11</td>
<td>Growth</td>
<td>Climate systems, electronics</td>
</tr>
<tr>
<td>12</td>
<td>Growth</td>
<td>Electricity, wireless electronics</td>
</tr>
<tr>
<td>13</td>
<td>Growth</td>
<td>Wind, solar thermal, photo-voltaics, heat storage</td>
</tr>
<tr>
<td>14</td>
<td>Growth</td>
<td>Heat exchange</td>
</tr>
<tr>
<td>15</td>
<td>Start-up</td>
<td>Solar thermal</td>
</tr>
<tr>
<td>16</td>
<td>Start-up</td>
<td>Mechanics and photo-voltaics</td>
</tr>
</tbody>
</table>

Figure 3: Size distribution of interviewed entrepreneurial companies

3.2 Data gathering: interviews with entrepreneurs
To gather data, a series of in-depth, face-to-face interviews have been held with the 16 entrepreneurs introducing sustainable innovations in the sector energy in the built environment. This qualitative format has been chosen because this research aims to investigate a ‘how’ question which demands qualitative way of research offering the necessary flexibility to appropriately investigate the strategies of entrepreneurs and the causal relations underlying them (Yin, 1994). All interviews have been held with the entrepreneurs themselves: the people within the entrepreneurial companies who are able to explain the rationales behind the strategy of the entrepreneurial undertaking – in most cases this was the founder and CEO of the company. These are the experts on the questions in this research and are best able to report how they experienced influences from the system and how they react and contribute to it.

The interviews have been held in a semi-structured way, with a prepared scheme of questions that need answering but that have been asked in an open way to allow the interviewees to explain their underlying reasons. This approach was tested by conducting a try-out interview to validate the interview approach and has proved to offer the required coherence and structure to compare different interviews but also the necessary flexibility and openness to avoid socially wishful answers to get a complete and undisturbed picture of the various entrepreneurial strategies and their underlying reasoning.
In the interviews, the entrepreneurs were asked to voice their opinions and experiences on three issues: 1) how the entrepreneur aims to contribute to the sustainability of the sector and their approach for developing sustainable innovations (sub-question 1); 2) the system factors influencing the strategy of the entrepreneur, to what extent, their importance and how this has had an impact (sub-question 2); and 3) the system factors that the entrepreneur aims to influence and the strategy of how this is done (sub-question 3).

3.3 Data analysis: theoretical framework

In order to analyze the data gathered from the 16 interviews, the conceptual distinctions regarding the interactions between entrepreneurs and the system context as introduced in the theoretical section have been used. First of all, each interaction with the system context that an entrepreneur mentioned, was assigned to a specific category of system interactions, as defined in paragraph 2.4.2. Besides assigning an influence or strategy to one of the categories of system interactions, the influence or strategy also was tracked back to an actor or actor group where it is specifically located. Concerning the actor with whom the entrepreneur interacts, a distinction is made between 5 groups of actors where interactions are mentioned to be present: governments, industry, consumers, capital providers and knowledge providers. Sometimes influences or strategies are perceived to be specifically located with a single actor, whereas sometimes they seem to be coming from all actors.

By carefully assessing and analyzing all the influences and strategies mentioned by the interviewed entrepreneurs, they can be traced back to be coming from a distinct category of system interactions and to a distinct actor or actor group. For instance, the entrepreneurial barrier of needing permits for their innovations was assigned to the category of regulative institutions and to the actor government, while a strategy of partnering with a powerful consortium of companies in the building sector was assigned to network interactions with industry actors. By putting the categories of system interactions on the vertical axis and the groups of actors on the horizontal axis, a two-dimensional framework is created where the influences from the system context and the strategies from entrepreneurs can be clearly mapped (see table 2).

<table>
<thead>
<tr>
<th>Categories of system interactions</th>
<th>Actors:</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Government</td>
</tr>
<tr>
<td>Network interactions</td>
<td></td>
</tr>
<tr>
<td>Institutional interactions</td>
<td>Regulative</td>
</tr>
<tr>
<td></td>
<td>Normative</td>
</tr>
<tr>
<td></td>
<td>Cognitive</td>
</tr>
<tr>
<td>Technology interactions</td>
<td></td>
</tr>
</tbody>
</table>

This theoretical framework, distinguishing between actors and categories of system interactions, proved to be an appropriate perspective to analyze the interview data. Starting from the empirical findings from the interview answers, each mentioned influence or strategy could be assigned to one or more of the defined categories of system interactions and to one or more of the specified actors. The same theoretical framework also showed to be applicable for structuring the interview results of a similar research in the healthcare sector (Janssen, 2009). This shows that this theoretical framework is a fitting way to structurally analyze and map the interactions between entrepreneurs and the system context.
4 Results

In this section, the results are presented of the interviews held with entrepreneurs introducing innovations in the field of sustainable energy in the built environment. The description of the results is structured on the basis of the research sub-questions defined in the introduction. The first paragraph gives a description of how the entrepreneurs aim to contribute to the transition towards sustainability, which leads to the introduction of two types of entrepreneurs that have different approaches for interacting with the system context. In the second paragraph, the results are presented of the influences that both types of entrepreneurs experience from the system context in the sector the built environment. In the third paragraph, the results are presented on the strategies that these entrepreneurs have to influence the system context in order to introduce and diffuse their sustainable innovations. Finally, the last section will integrate and analyze these results on the influences and strategies in order to arrive at a clear characterization of the typology of entrepreneurs and their interactions with the system context.

4.1 Who are the entrepreneurs introducing sustainable innovations

This paragraph discusses the characteristics of the entrepreneurs introducing sustainable innovations in the sector energy in the built environment. First, similarities in the focus on sustainability of entrepreneurs are discussed. Next, two types of entrepreneurs are introduced that differ in their approach towards interacting with the system context.

4.1.1 Focus on sustainability

The interviewed entrepreneurs can be characterized as entrepreneurs in the Schumpeterian sense, with the initiative, drive and persistence to make change happen, particularly with regard to sustainability in the sector. The motivation to start a business with a sustainable innovation is for most entrepreneurs partly based on idealistic motives, “to contribute to the sustainability of this world” 1. However, for all entrepreneurs the main motive is and has been commercial: they perceive a business opportunity in sustainability. Idealistic motives are helpful at the start, but in order to be successful and to make an impact the entrepreneurs emphasize that “business sense is crucial” 10. In fact, companies where the entrepreneur emphasizes business skills 2,3,11,14, tend to experience more rapid growth than where entrepreneurs emphasize their idealistic motives.

An important observation is that all entrepreneurs confirm the possibility of win-win situations in terms of the triple bottom line: all interviewees successfully combine the creation of new, profitable economic activity with a focus on sustainability: “we make profit by fully focusing on sustainability” 6. Although almost all sustainable innovations require initial investments, all sustainable innovations eventually payback economically within 1 to sometimes 15 years. This is because some innovations directly and immediately lead to cost-savings, whereas others require large upfront investments and have long payback times. All the entrepreneurial companies in this research were actively focused on contributing to sustainability and have experienced growth in recent years in terms of turnover and employees. This confirms the proposition of the literature on sustainable entrepreneurship: entrepreneurs are indeed able to reconcile economic growth with a contribution to sustainability.

Their vision on the future is clear and for the long term. All entrepreneurs believe in the future of decentralized sustainable energy, and the success of their companies relies on the successful functioning of a two-way the electricity grid 1,3,5,16. Most entrepreneurs have a long-term horizon, are passionate about the role of their innovation and envision an important role for their company to be “part of the sustainable future” 8 and aim to fundamentally contribute to the sustainability of energy in the built environment 1,3,5,6,8,16. However, they are aware there still is a long way to go in achieving the transition: “we have to fundamentally change the structure in the sector and transform the lifestyles of people” 9. All entrepreneurs acknowledge that the current system is not able to support their innovation and voice the need for change in the system environment, to break open the potential for sustainable innovations.

Besides an identical focus on sustainability of all interviewed entrepreneurs, some clear differences were apparent with regard to their approach for successfully introducing and diffusing sustainable innovations, which are discussed below.
4.1.2  Two entrepreneural approaches to interact with the system context

During the interviews it was found that entrepreneurs have two different approaches towards interacting with the system context. One type of entrepreneur, which is labeled as a ‘system following entrepreneur’, connects with current actors and with current institutions in order to introduce and diffuse sustainable innovations and aims to move the current system towards sustainability. The other type of entrepreneur, labeled ‘system building entrepreneur’ has an entirely different approach: they aim to forge new network relationships and create new institutions for the introduction and diffusion of their sustainable innovations, in order to create a new system around their innovation that is more sustainable and that competes with the old system.

Both types of entrepreneurs are innovative and both contribute to the transition towards sustainability, albeit in different ways. System following entrepreneurs are entrepreneurs for which the introduction and diffusion of sustainable innovations does not coincide with large changes in the system context. Although all entrepreneurs very much depend on changes in the system for the successful introduction and diffusion of their innovations, this type of entrepreneur is not the one initiating systemic changes, because they believe they “simply can’t change the system themselves”. Although they can unmistakably make a contribution to the transition in the sector by pushing other actors towards sustainability, system following entrepreneurs are not the instigator of systemic changes. On the contrary, for system building entrepreneurs, introducing and diffusing sustainable innovations coincides with actively creating changes in the system context. System building entrepreneurs create a new system, with new network interactions and new institutions, that fights and aims to compete with the old system. They aim to create a “young, growing forest with many small innovative trees” to develop a range of sustainable innovations that compete with the “unsustainable old forest”. System building entrepreneurs therefore have to look on the longer term and further into the future. It is this type of entrepreneurs that truly contributes to setting in motion processes where the introduction and diffusion of sustainable innovations coincides with actively creating changes in the system context.

The 8 system following entrepreneurs and the 8 system building entrepreneurs that have been interviewed in this research, have shown to clearly differ in the mix of influences they perceive and in the mix of strategies they use to influence the system context. Some influences and strategies that have been found are the same for both types, but some influences and strategies strongly belong to one particular type of entrepreneur. These differences make that the two types of entrepreneurs have a different approach for interacting with the system context. Therefore, the next paragraphs discuss the results on the influences and the strategies that have been mentioned in detail for each of the two types of entrepreneurs.

4.2  Influences from the system context

The interviews have led to a list of 22 influences (see appendix I) that have been mentioned by entrepreneurs, with underlying explanations for these influences. When these influences from the system context mentioned by the entrepreneurs are put into the two-dimensional framework as outlined in the methodology, 6 distinct groups of influences emerge which are shown in table 3. Each of these influences affects both types of entrepreneurs, although in different ways. So both types of entrepreneurs are influenced by these 6 groups of influences, but some differences exist between the two types in how the influences work out. Some influences have the same effect on both types of entrepreneurs, while some influences are perceived differently. The underlying reasoning of the exact effects of the 6 influences from the system context on each of the two types of entrepreneurs is described below.
Table 3: Influences from the system context on entrepreneurs

<table>
<thead>
<tr>
<th>Category of system interactions:</th>
<th>Actor:</th>
<th>Government (national, local)</th>
<th>Industry (large firms, SMEs, competitors, suppliers)</th>
<th>Consumers (households, companies)</th>
<th>Capital providers (banks, private investors)</th>
<th>Knowledge providers (universities, research institutes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Network interactions</td>
<td></td>
<td>No guidance</td>
<td>Lock-in</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Institutional interactions</td>
<td>Regulative</td>
<td>Regulation &amp; subsidies</td>
<td>Awareness</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Normative</td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>Cognitive</td>
<td></td>
<td>Thinking differently</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Technology interactions</td>
<td></td>
<td>Knowledge exchange</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

4.2.1 Influences

4.2.1.1 No guidance

One influence that has very often been mentioned by entrepreneurs as a particularly strong barrier for successfully introducing their sustainable innovations, is the lack of guidance from the government. This influence affects both the system following and the system building entrepreneurs, but is perceived as a stronger barrier by the latter. Eleven entrepreneurs stress that the national government does not adequately create the right normative institutions by setting the right environmental conditions that are necessary to be able to change the system context: the government “insufficiently facilitates sustainable entrepreneurship” \(^{10}\) and “does not clearly indicate a direction for progress of society” \(^{12}\). The government does not stick to the choices they make. This short-term behavior coupled with major political changes every 4 years is “hurting the national reliability and stability” \(^{8}\) that the government should provide since it is crucial for entrepreneurs that aim to build up a new system. Instead, entrepreneurs want the government to create a long-term horizon for society and industry, with “associated policies that create certainty for entrepreneurs” \(^{3}\) and put strength with the choices they make by “putting money where their mouth is” \(^{11}\). This would give more certainty for entrepreneurs on the direction of technological and market developments, which could form a stable basis to build a business on. As one entrepreneur said it, “the government should worry about vision and the long-term, then I can start worrying about my short-term survival” \(^{3}\).

Moreover, the government suffers from weak interaction failure, which also primarily hurts system building entrepreneurs. The national government tends to listen mainly to the large industrial players and does not support innovative SME’s. Innovative entrepreneurs that do not have relationships with these large players, are overlooked by the government \(^{8,10,15,16}\). The governments is open to sustainability initiatives from established players, but “does not listen to ideas from newcomers” \(^{10}\). The national government follows the hype of the technology of the day which is led by large industrial companies, while sustainable innovations by entrepreneurs “need long-term encouragements” \(^{8}\) that are independent of individual powerful actors. Governments are in the unique position to ignore the powerful position of individual stakeholders to stimulate an entire industry and therefore they should initiate overarching cooperative projects for sustainability.
There were also some positive influences mentioned from the government by both system following and system building entrepreneurs. The ‘headrunners desk’, specifically initiated by the national government to stimulate innovative entrepreneurs, has an important positive influence through facilitating activities (removing specific barriers and regulations), because “they listen to the problems of SME’s” 11,12. Also networking activities to give access to policy makers, politicians and new customers etc. 6,11,12 and providing credit funding 5,7,10,14 are positive experiences from the headrunners desk mentioned by entrepreneurs. Moreover, campaigns and media statements by representatives of the national government emphasizing the importance of sustainability and entrepreneurship, tend to positively influence entrepreneurs 4,5,7,9,10,12,15; this changes the normative institutions in society to help people “realize the importance of sustainable innovations”. 12.

4.2.1.2 Regulation & subsidies
Specifically in the field of regulative institutions, the interviewed entrepreneurs mention strong influences coming from the government. The influences are in the form of regulations and subsidies. Regulations are experienced by system following entrepreneurs as a driver for sustainable innovations, and by system building entrepreneurs as a barrier. Subsidy schemes contain barriers for both types, but system building entrepreneurs do not depend on them. The underlying reasons for this are explained below.

Concerning regulation, this provides an impulse for three system following entrepreneurs 1,4,5. These entrepreneurs mention that regulation is a “pushing mechanism” 1 in cases where large, incumbent players are forced through governmental rules, laws and directives to move towards sustainability (such as energy labels and energy performance standards). This creates a demand for the system following entrepreneurs that are supplying innovative sustainable solutions to these large players. However, for five system building entrepreneurs 2,8,10,15, regulation is seen as a strong barrier. System building entrepreneurs look further into the future when they aim to create a new sustainable system, which means that current regulative institutions are sometimes restricting or opposing. These entrepreneurs go ahead of the government and have difficulties with introducing their innovations that “go past current standards and requirements” 2 which makes that sometimes they “even introduce illegal innovations, because the government is too slow with adapting the regulations”. 9. Important barriers in regulative institutions in this respect are getting the local permissions and licenses for innovations that visually affect the built environment 1,3,5,10,15 (e.g. solar heat boilers, urban windmills), the lack of standardization of policies and regulations in the innovative field 1,2,9,10,15,16 and too little coordination on national, local and regional governmental levels 2,10.

Concerning subsidies, both types of entrepreneurs mention predominantly negative influences from the various available subsidy schemes. Subsidies for consumers for buying sustainable innovations could form an important part of an enabling regulative institutional environment, by providing a “boost to the market” 3,7,14 for sustainable innovations. However, this boost is perceived by entrepreneurs to be temporary since the “whimsical and unreliable nature of the subsidy policies makes long-term positive influences impossible” 5. This even results in a negative influence: uncertainty due to abrupt shocks in the market. More than 90% of the entrepreneurs complain about subsidies, concerning “the unreliability due to abrupt and frequent changes” 13 made in the subsidy schemes 1,3,5,10,13,16, about the “vast amounts of complex paperwork” 16 involved 1,6,9,13,14,16 and about the “exorbitantly long waiting times” 3 for subsidy approval 3,7,9,10,14,15. This unreliability of the subsidies is “killing for investors” 9, therefore the most innovative entrepreneurs that are looking on the long term do not perceive a positive influence from subsidy schemes 1,2,6,8,10,15. System building entrepreneurs “do no want to rely on subsidies” 15 and rather set up their company without depending on subsidy schemes. This means that mostly the system following entrepreneurs tend to profit from subsidies. Therefore, in practice subsidies do not provide a structural boost to the market and neither provide a boost in stimulating system building entrepreneurs. However, subsidies for demonstration projects seem to have been useful in each case 6,7,11,14 and also more longer-term tax deduction schemes are experienced as being more reliable 11,12. Subsidy opportunities with local governments are growing, these do provide a boost locally, but increase complexity on national level due to varying schemes 7,10.
4.2.1.3 Lock-in

Another strong barrier mentioned by entrepreneurs is coming from companies in the energy and building industry and belongs to the category of network interactions, specifically strong network failure: the locked-in interactions between vested interests. System following as well as system building entrepreneurs both experience this barrier as explained below.

Projects in the built environment require inputs and effort from many stakeholders, from governments, businesses, owners, developers, suppliers etc., which makes cooperation and coordination crucial. All the interviewed entrepreneurs have mentioned that a great number of large players are currently occupying a strong and powerful position within cooperation networks in the building sector. The groups of actors with their currently powerful positions are referred to here as vested interests. These vested interests consist of groups of large companies that “seek to maintain power and control in the sector” from which they derive their profits. The whole supply chain, up to the contacts with the customers, is dominated by these large players who cooperate only with each other to stay in power. The interactions between them are based on historic relations, are rigid and fixed. Entrepreneurs mention that they cannot interact with them, because “these stakeholders have been operating and cooperating in the same manner for decades” and “the whole system with all activities is based on rusted routines” which are hard to change. This creates strong network failures based on a lock-in of interactions between the vested interests in the building industry. As a result, interactions and processes of competition and cooperation between industry players are very traditional and opaque for entrepreneurs, since the industry players stay in existing cooperation structures. These large players have limited incentives to change their interaction patterns, since they seek to maintain power and control in the sector. This way of organizing the sector limits the possibilities for entrance of innovative entrepreneurs, since they feel that there is “little room for outsiders to enter the competition of the industry”. 1,4 entrepreneurs have mentioned strong negative influences from these vested interests and said they have to fight them in order to gain a position and power and to successfully introduce their sustainable innovations. The fact that projects concerning energy in the built environment typically involve many stakeholders from both the energy and the building industries, increases the complexity of changing this process towards sustainability. It is much harder to get all these stakeholders facing in the same direction to try something new – there can easily be “just one stakeholder that veto’s the implementation” of sustainable innovations. And if the entrepreneurs do find a way in to establish a position in the industry, often they remain dominated by a large partner or a more powerful supplier who can effectively control the small entrepreneur due to it’s power over resources or market access. Entrepreneurs perceive no negative influences from competing entrepreneurs, since all of them are fighting the same enemy. In fact, actions by competitors even result in a positive influence for entrepreneurs, since it leads to “increased attention for the emerging entrepreneurial industry”.

From the energy sector there is a less negative influence coming from vested interests than from the building sector, since most of the large players are forced to become more sustainable. However, these large energy companies have power and a strong energy lobby: “they can afford to hire their own lobbyists”. Although the government aims to force these big companies to move towards sustainability through regulation and negotiation, the energy lobby can influence, stall or even prevent this. The entrepreneurs lack this power, and argue that “they are too small to have an influence”. System following entrepreneurs connect with the vested interests and as a result mainly experience positive effects from the initiatives of energy companies – including increased media attention for sustainability, the ability to participate with large players in large projects, gaining access to existing markets and gaining access to higher governments. System building entrepreneurs cooperate outside of the vested interests and experience more opposing effects from them, such as the delaying of sustainable investments and lobbying to halt new sustainability regulations. Therefore, system building entrepreneurs argue that energy companies have no real incentive for reducing energy consumption or for promoting sustainable energy, they have “no clean motives”, but rather a “conflict of interests” since their primary aim is to make as much profit as possible from selling energy. According to the system building entrepreneurs, energy companies are sometimes an initiator for sustainability, but mostly they follow other actors and “do not run forward in the field of sustainability” as they do themselves.
4.2.1.4 Awareness

An important driver for sustainable innovations that has been mentioned by entrepreneurs, is the increasing awareness of the importance of the transition towards sustainability that occurs with governments, industry and consumers. This societal rise of awareness with the accompanying norms, values and expectations concerning sustainability, has a strong positive influence on both types of interviewed entrepreneurs in the category of normative institutions.

The public awareness that sustainable energy will form an integral part of our future, partly induced by Al Gore, has increased steadily over time and has a very important positive influence on all 16 entrepreneurs introducing sustainable innovations, through 3 actor groups: 1) increased awareness with customers (e.g. consumers, companies) has led to a higher propensity to invest in sustainable innovations which creates “legitimacy for their business” and results in increased demand; 2) increased awareness with companies in the building industry provides an “impulse in the application” of their innovative products; and 3) increased awareness at local and municipal governments has a strong positive effect due to their power to “initiate building projects” and to regulate, coordinate and support actors realizing them.

Half of the entrepreneurs argue however, that this sustainability awareness has not yet fully penetrated the building sector. There still is a strong opposing normative institutional force in the building and energy industry: “the market still remains very cost-focused”. Entrepreneurs feel that competition is still based primarily on price and not so much on other aspects such as quality, innovativeness or sustainability. Entrepreneurs note that “the building market still believes sustainable investments are costing money”, instead of being profitable. They attribute this partly due to “ignorance and lack of knowledge” and partly due to the fact that most investors, contractors and consumers “look on short-term pay-back times and not on the longer term”. So, although this increased awareness has provided a strong boost for sustainable entrepreneurial undertakings, barriers still exist in other categories of system interactions.

4.2.1.5 Thinking differently

An important barrier mentioned by entrepreneurs resides in the cognitive institutions and occurs with companies in the building and energy sectors and with consumers: the need to think differently. Both types of entrepreneurs perceive this barrier.

Currently, the actions, behavior, practices and routines of companies, consumers and governments do not include attention to sustainability. It is not yet ‘normal’ to think in terms of sustainable energy and to incorporate the use of sustainable innovations in daily routines. More than half of the entrepreneurs specifically mention this mental barrier, and highlight that “people first need to grasp the concept of sustainability within their mind”. People in the sector have to think differently, not only about concepts or products, but about the sustainability of the whole supply chain in the sector. However, changing these cognitive institutions is hard. Adopting and using innovations involves uncertainty, which results in “perceived increased risks”. Many entrepreneurs mention that the actors around them fear innovation – they rather not change the way they are currently doing things and do not want to take on any more risks: “many actors have prejudices against sustainable innovations”, are “reluctant to try something new” and are “unwilling to implement sustainable innovations”. The idea remains with other actors in the sector that investing in sustainability costs money, that the sustainable innovations do not work (well) or that they increase complexity and increase risk.

Changing cognitive institutions is unavoidable for any actor in the system, however there are two actor groups for which it was specifically mentioned often that they need to think differently in a radical way. The first group consists of installers of sustainable innovations – seven entrepreneurs mention they are “very risk-aversive and a very difficult hurdle in the building sector”. Installers are not educated or informed and “do not know how to deal with the implementation of sustainable innovations”, yet entrepreneurs perceive them as a crucial link since “they are the ones interacting with consumers”. Installers are very hard to persuade since they perceive many complexities, difficulties, uncertainties and sometimes “don’t even believe claims of novel products”. The problem is that it is no usual practice for
installers to offer and provide sustainable innovations to consumers. The normal way of doing things is that the distribution channels and building suppliers do not include sustainable products – the consumer has to initiate this himself. As a result, the sustainable innovations are not recommended to consumers and are not implemented. The second group of actors that strongly needs to think differently about sustainable innovation, consists of investors. For entrepreneurs, there is “always a constant search for investors” 13. However, finding investors as a sustainable entrepreneur is perceived to be difficult, since most sustainable innovations require longer term views in order to become profitable and most investors “look at profitability on the short term” 9 and “are more reluctant when investing in sustainability” 1. Finding funding sometimes costs time, but eventually all 16 entrepreneurs succeeded with private investors, with government funding or by using own capital.

To summarize, sustainable innovations are perceived as a disruptive innovation for many actors in the building sector and to make all these people think differently and gain credibility for sustainable entrepreneurship is a daunting and long-term task.

4.2.1.6 Knowledge exchange
Technology, in the form of technological knowledge and development, was mentioned by 75% of the entrepreneurs as being an important enabling factor, but all of them emphasized that “there are other factors that eventually make the difference” 11 for successfully developing sustainable innovations 1,3,7,11-16. However, some differences are noticeable between system following and system building entrepreneurs. System following entrepreneurs agree that technology is in constant development, but mainly perceive technological developments as causing barriers that need to be overcome: “the technology is not yet ready and needs further development before we can proceed” 5. Yet by system building entrepreneurs technology was mentioned specifically as a driver for introducing their sustainable innovations. System building entrepreneurs that aim to create a new system context, look further into the future and therefore invest more in technology development. Half of the system building entrepreneurs 2,8-10, therefore says that continuous improvements in the technology underlying their innovations are “essential for staying competitive” 8 and “technological developments made our existence today possible” 9. Moreover, these system building entrepreneurs perceive positive influences coming from partners with whom they are exchanging technological knowledge: “the availability of technological knowledge providers forms the foundation of our existence” 8-10. For system building entrepreneurs, technological progress thus is seen as a driver for sustainable innovation.

4.2.2 Summary
This section has described the influences from the system context on the introduction and diffusion of sustainable innovations as perceived by two types of entrepreneurs. From these results, it has become clear that the most important drivers that have been mentioned by entrepreneurs for the introduction of sustainable innovations are the public awareness of sustainability and developments in technology. The most important barriers in the eyes of entrepreneurs are the lack of guidance and flawed subsidy schemes from the government, a lock-in of vested interests in the building and energy industries and the need of all actors to think differently about sustainability.

Differences have been found between the influences mentioned by the two types of entrepreneurs introducing sustainable innovations. System following entrepreneurs experience influences from the system context differently than system building entrepreneurs. System building entrepreneurs experience the lack of guidance from the government and the lock-in of vested interests in the sector as stronger barriers for sustainable innovation than system following entrepreneurs do. Also, system building entrepreneurs perceive governmental regulation as containing barriers, while system following entrepreneurs view regulation more as a driver for sustainable innovation. The need to think differently about sustainability is a barrier for the two types of entrepreneurs and the increased awareness of sustainability is a driver for both.

With regard to the actor behind the influences, table 3 shows that the drivers and barriers are located with specific actors. Where the important drivers for sustainable innovation in general lie with all the actors, the barriers for sustainable innovation are concentrated with the government and with industry
actors, and less with consumers and capital providers. From the same figure, it can be seen what the most important categories of system interactions are. The most important influences are the result of the institutions in the system; interaction influences are also important and technology plays only a minor role. Concerning the institutions, the regulative and cognitive institutions result in barriers, while the normative institutions are a driver for sustainable innovation.

Besides these mentioned influences, there can also be made some observations of influences that have not been mentioned. These lacking influences reside with certain actor groups and with certain categories of system interactions. First of all, when looking at the actor group of consumers, the only things of importance to entrepreneurs seem to be the normative and cognitive institutions within this actor group, since strong influences are perceived to be coming only from these two categories. Apparently, influences resulting from network failures or from the regulative institutions are not caused by consumers. Another important observation is that when complaining about regulations, entrepreneurs only look at the government and do not mention influences from others, such as industry players. The entrepreneurs are primarily blaming the government for the absence of supportive regulative institutions. Finally, it can be noted that technology and providers of technological knowledge do not seem to have a very important influence on the introduction and diffusion of sustainable innovations.

These empirical findings of the influences mentioned by entrepreneurs clearly show that the system context has some strong influences on the introduction of innovations by the two types of entrepreneurs. All the influences mentioned by entrepreneurs confirm that the success of their innovations greatly depends on the presence and on the form of the interactions with other actors in the entire system, which matches the view of the innovation system literature where innovation is both an individual and a collective act (Nootenboom, 2008). The empirical findings confirm the theoretical insight that system interaction failures, particularly of the strong kind, can seriously hamper the successful introduction and diffusion of sustainable innovations (Klein Woolthuis, 2005). Moreover, the influences confirm the considerable importance of a supportive institutional context for the successful introduction and diffusion of sustainable innovations. The results show that the introduction of sustainable innovations is influenced by the institutional environment, which was interpreted as the regulative, normative and cognitive institutions shaping the interactions between actors in the system. These ‘rules of the game’ are experienced by entrepreneurs as profoundly influencing – positively as well as negatively – the introduction of sustainable innovations. These findings correspond to the idea of institutional entrepreneurship: entrepreneurs, who choose to introduce sustainable innovations and thereby choose to resist the current institutional environment, undergo pressures from these institutions for not complying with them (Oliver, 1991). However, the empirical results have also shown that the institutional environment can exert a positive influence on entrepreneurs, in case of the normative institutions. Moreover, the distinction between the two types of entrepreneurs showed that influences from the system context have different effects on entrepreneurs. These issues mentioned above raise the follow-up question whether and how the two types of entrepreneurs react to these system influences and if they are able to achieve favorable changes in the system context. This topic is addressed in the next section by presenting the empirical results on the strategies of entrepreneurs for influencing the system context.

4.3 Strategies to influence the system context
This section discusses the empirical results on the strategies that entrepreneurs have for influencing the system context to create the necessary changes in the system which are crucial for the successful introduction and diffusion of their sustainable innovations.

4.3.1 Strategies
The interviews have led to a list of 23 strategies (see appendix II) that are mentioned by entrepreneurs as being used to influence the system context. For all the strategies, the entrepreneurs have explained the underlying rationales for why these strategies are pursued, to whom they are directed, how it is carried out and – where applicable – their effectiveness. In order to analyze these results, the strategies are put in the same table as the influences, leading to the emergence of 5 distinct groups of strategies in table 4. These 5 strategies are being used by both the system following and system building entrepreneurs, but in different ways. Some strategies are done in the same way by both entrepreneurial types, while some
strategies are executed with a different approach. The details of the strategies for each of the two types of entrepreneurs will be discussed below.

Table 4: Strategies of entrepreneurs to influence system context

<table>
<thead>
<tr>
<th>Actor:</th>
<th>Government (national, local)</th>
<th>Industry (large firms, SMEs, competitors, suppliers)</th>
<th>Consumers (households, companies)</th>
<th>Capital providers (banks, private investors)</th>
<th>Knowledge providers (universities, research institutes)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Category of system interactions:</td>
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<td></td>
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<td></td>
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<td>Network interactions</td>
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<tr>
<td>Institutional interactions</td>
<td>Regulative</td>
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<tr>
<td></td>
<td>Normative</td>
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<tr>
<td></td>
<td>Cognitive</td>
<td></td>
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<td></td>
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<tr>
<td>Technology interactions</td>
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</tr>
</tbody>
</table>

4.3.1.1 Position & power
First of all, entrepreneurs have mentioned many key strategies directed at influencing the industry players in order to counteract the influences from the strong network failures (discussed in paragraph 4.2.1.3). A strong position and gaining power in the network interactions within the sector is mentioned by entrepreneurs to be crucial, and is created through a strategic approach that differs per type of entrepreneur. System following entrepreneurs connect with the vested interests in the sector, while system building entrepreneurs create a new network. The explanation for this follows below.

Partnering is by far mentioned most often by both types of entrepreneurs as the most important strategy. All 16 interviewed entrepreneurs mention the power of engaging in relationships with others: “making smart combinations makes that we are stronger together” 6, “we can offer a more complete and integral product package to the market” 11 and “we can combine our knowledge and add our values up together” 10. Partnering occurs mostly with partners whose power and market positioning are relatively well established and positioned: entrepreneurs like to be “relatively certain that there will not be any competition, where the powerful position of the other partner can only help the entrepreneur” 9. The partnerships are complementary in terms of market access, of knowledge, of technologies, of products etc. and therefore mostly vertical or diagonal in the supply chain. Most partnerships are not relationships based on price and performance, but are longer term, stronger relationships based on trust, or as one entrepreneurs says: “where we understand and respect each others problems” 8. Some entrepreneurs are really ‘agile’: they don’t employ many people themselves, but instead have many and strong relationships “to tap into the knowledge of others and stay flexible themselves” 10. The most mentioned reasons for partnering are: knowledge exchange (for technological knowledge exchange, but mainly for “tacit knowledge surrounding technologies” 3, e.g. about the market, about possible partners, about regulations, about politics, about entrepreneurship in general etc.), demand (partnering with users, retailers, sales organizations, dealer networks or advisory companies “to create more certainty of getting the innovation sold” 2), supply (“secure access to resources reduces uncertainty” 8) or for funding (“partnering with banks, venture capitalists or investors is a necessity” 13).
Suitable candidates for partnership can be found within, or outside of the vested interests. This is where a clear distinction has been found in the partnering strategies between system following and system building entrepreneurs. System following entrepreneurs say they just can’t go around the vested interests: “eventually we have to cooperate, in order to get market access and gain volumes” 11 or “we simply can’t do it without them” 1. System building entrepreneurs, on the other hand, mention that the vested interests are opposing the sustainable innovation, “some companies see nothing in sustainable innovations” 11. Partnerships in this case cannot be made with players from the vested interests in the building or energy sector and entrepreneurs choose to fight outside of the vested interests: “we specifically choose to collaborate with those organizations who genuinely want to support our sustainable innovation. In that respect, relations with vested interests are really our worst enemy” 11. The system building entrepreneurs put a lot of time and effort in trying to find the right people to partner and cooperate with. These people should truly believe in their innovation and be willing to buy the innovation, recommend, implement or demand the innovation, support the innovation, remove regulations, create added value/functionality etc. For entrepreneurs, it is a constant search to find exactly those people that are also willing to do something new, to take risk, that trust the entrepreneur and that are prepared to innovate together and “to stand stronger together” 6. Entrepreneurs find this difficult: “it is hard to find a willing person in every organisation you aim to cooperate with” 7. The process of finding these people can be long and time-consuming, and requires a lot of ‘networking’, getting to know people in the sector and exposure to become visible for many others in the network.

An important strategy for system building entrepreneurs to find suitable partners outside the vested interests, is to create a new network around their sustainable innovation. All 8 system building entrepreneurs 2,6,8,11,13,15 explain that they aim to bring together a “new network consisting of a consortium of willing partners” 15 that together cover all necessary functions and steps for the successful introduction and diffusion of the sustainable innovation. They aim to create a network of “willing people in the right organizations that together span the whole supply chain” 11, in order to implement the sustainable innovation. Entrepreneurs are looking for other companies to connect with, in order to engage in strategic relationships to “approach the market together in a powerful block” 7 of cooperating companies. This is mostly done in an early stage of commercialization of the innovation, since entrepreneurs mention that “most of the important decisions and partnerships are created in the early stages of a project” 6 where partners show commitment to implement the sustainable innovations. This strategy of creating a new network of players that all support the innovation creates a group force which creates access the market, visibility for governments and leads to the successful introduction of the sustainable innovation. Through this strategy, system building entrepreneurs are able to leverage the necessary power and position to oppose vested interests in order to create a new sustainable system context.

4.3.1.2 Market access
Besides a strong and powerful position in the industry, all entrepreneurs acknowledge that good access to the market is crucial. However, as described in the influences, current players in the sector energy in the built environment dominate the market. Entrepreneurs experience that current players “control the distribution channels for addressing the market” 1, leaving no place for innovative entrepreneurs to interact with the market. Because of this form of weak network failure, the market potential of sustainable innovations can not be immediately recognized by consumers. Therefore, entrepreneurs mention an important group of strategies in the category of network failures which is directly aimed at interacting with consumers and focused on gaining market access.

75% of the entrepreneurs mention they have strategies that are directly aimed at creating their own market. Most of the smaller entrepreneurs focus almost all their time on direct sales to the market 1,3,5,9,12,24,15, since for them “direct sales is the most important strategy” 12. Three larger companies have a clear structure for direct sales and distribution channels in place 2,6,13. The approaches used for the market strategies are different for the two types of entrepreneurs: system following entrepreneurs mostly find consumers in or close to existing markets, while system building entrepreneurs create entirely new markets. System following entrepreneurs start by aiming on niche-markets, where “more knowledge and higher qualities are required and thus higher prices are justified” 6, or aim to connect their innovation to
already existing markets \(^{1,4,12}\), since this “reduces the efforts needed of creating your own market” \(^1\). Some already know the market before they introduce the innovation, but do not yet know who exactly their customers are: “it takes some networking and tapping into the network in order to find out who their actual customers are” \(^5\). The system following entrepreneur has to get to know the market first in order to find the right people to sell to. On the contrary, system building entrepreneurs have strategies to create an entirely new market on it’s own to sell their sustainable innovation to. These entrepreneurs use private persuasion to approach the market directly: “consumers do not yet know what innovation they want to buy in the future, you have to convince them to buy yours” \(^{13}\). Through this direct sales to customers, the system building entrepreneurs “directly create and design their own market for the product” \(^{13}\) without having to rely on existing actors or market structures. For this it is “crucial to follow all developments that can stimulate or change your market” \(^{13}\). In fact, more successful entrepreneurs have closely watched the emergence of the market they focus on and often have started from a perceived market opportunity: “we started because of a strong commercial need for sustainability” \(^{12}\).

### 4.3.1.3 Legitimizing

Besides getting a place in the network to counter the interactions between vested interests and to get market access, entrepreneurs also need to change the institutions if they want their sustainable innovations to succeed. Both types of interviewed entrepreneurs have mentioned some strong strategies calling at the normative institutions of all players in the sector, in order to legitimize their innovation.

The normative institutions of the system can not easily be changed. Most entrepreneurs don’t even try to influence the sector: “we have given up trying to convince others of the importance of sustainability” \(^{11}\). Entrepreneurs are unable to strengthen the feelings for sustainability with all actors in society by themselves, they simply have too little impact. The interviewed entrepreneurs argue that they “do not have enough time” \(^{10}\), resources or power and that it is “the task of other stakeholders to change the normative institutions” \(^8\). Creating legitimacy is therefore not done by changing the normative institutions, but by adapting and connecting to them. Entrepreneurs need to create ‘fit’ with the normative institutions in order to create legitimacy for their innovation. They can use the increased awareness of sustainability in the normative institutions of the entire society, to create legitimacy for their own innovation with certain actors on a smaller scale.

All 16 entrepreneurs mention the creation of legitimacy through emphasizing and showing how their innovation corresponds to the normative institutional context. They do this primarily through demonstration projects. For every entrepreneur, projects to demonstrate their innovation are extremely important and “worth gold in order to show that it can be done” \(^7\). Demonstration projects are valuable in order to show results, get actual measurements, provide evidence that the innovation works and is feasible, reduce risks and uncertainties, get references and gain persuasive power and legitimacy \(^{11-16}\). Furthermore, almost 90% of the interviewed entrepreneurs have strong marketing and media strategies in order to strengthen and legitimize their business position. Media exposure, media interviews, free publicity, awards, articles in professional magazines and other ways of “getting heard” \(^9\) and “making noise” \(^1\) are very important for potential customers to hear about your products: “promotion is the key to market success” \(^1\). In addition, media exposure also increases the legitimacy of the entrepreneurial company towards competitors: “much attention means that other players in the sector cannot crush or ignore me anymore” \(^9\). Finally, getting promotors such as celebrities, powerful or inspiring people to back the company gives an important impact. Using the power, legitimacy and influence of people from outside the company can provide “important backing to validate and authorize the innovation” \(^9\) and for making implementation projects happen due to their stronger power to convince others. Through all these mechanisms, entrepreneurs influence the government, industry actors, customers and other actors by calling at their awareness and by persuading them of the role, the importance and the usefulness of their innovation for sustainability. This approach of connecting with the normative institutions in order to create legitimacy is the same for system following and system building entrepreneurs.

However, the system following entrepreneurs sometimes find that normative institutions are sometimes too opposing, because they interact with established players who do not always “see a need for sustainability” \(^9\). In this case, they try to evade them in order to legitimize their innovation elsewhere: “in
an environment more in favor of sustainability, introducing the innovation is easier. An important strategy of entrepreneurs to evade and avoid negative influences from the institutional environment, is to move to another country where the system context is more favorable. Some successful entrepreneurial companies are flexible and “can quickly move their resources to other countries in order to survive, in case the Dutch institutional context deteriorates.” Other system following entrepreneurs legitimate their innovation by focusing and emphasizing other advantages instead of sustainability advantages, such as cost savings, simple and quick installation, increased comfort levels etc.: “we strategically do not emphasize sustainability but focus on other advantages, because that is what convinces our consumers best.” Instead, system building entrepreneurs do not evade normative institutions, but consciously adhere to the current institutional context, because “by playing their sustainability awareness, we can clearly show consumers the importance of our innovations.” Although the emphasis of both approaches of the two types is on different aspects, the effect is the same since all these strategic approaches result in increased legitimacy for the innovation. So, despite the fact that entrepreneurs indicate they are unable to change the normative institutions themselves, they mention many different strategies calling at the normative institutions of other actors in order to show that their sustainable innovation ‘fits’ with the current norms and values and therefore is legitimate.

4.3.1.4 Private persuasion

Finally, the interviewed entrepreneurs mention specific strategies in order to remove the barriers in the category of cognitive institutions, particularly with respect to actors in the industry, with consumers and with capital providers. These strategies are important for both system following and system building entrepreneurs. They are used to change the ‘normal’ behavior, routines, practices etc. of other actors, in order to successfully guide the implementation and use of their sustainable innovation: “I need to educate consumers to break with traditional procedures.” An important characteristic of this strategy is to provide clear information to customers. Six entrepreneurs actively focus on providing this information, by creating transparent calculating methods which offer “clear insight into the product effects” or by providing “easy access and information about governmental regulations.” Through providing this information, entrepreneurs indicate that “uncertainty for consumers is reduced” which helps to solve the cognitive barrier. Moreover, four entrepreneurs actively educate their distributors or installers so “they know how to work with and sell their innovation.” Furthermore, by using an approach of direct marketing and interacting in private with consumers at public fairs, stands and in demonstrations, entrepreneurs are able to directly change the cognitive behavior and attitude of their potential customers. Also, investors are most of the time persuaded to invest in sustainable innovations through this strategy. Although the strategy of private persuasion is very individual and time-consuming, removing the cognitive barriers one by one is mentioned as being a vital strategy for the successful diffusion of sustainable innovations: “making your proposition clear for customers is the most important part.”

4.3.1.5 Lobbying & regulative change

As described in the influences (paragraph 4.2.1.1), entrepreneurs mention strong negative influences coming from the government in the categories of network interactions (no guidance) and regulative institutions (barriers in regulation and subsidies). However, the interviews revealed that entrepreneurs are not strongly pursuing any strategies directed at countering the negative influences from the government in these categories. Differences are noticeable with respect to the two types of entrepreneurs, which are explained in detail below.

Since system following entrepreneurs follow other actors and comply with current regulations, they perceive a less important need for strategies to influence the government. On the other hand, system building entrepreneurs perceive barriers from current regulations and from the lock-in of vested interests, and therefore need a strategy to counteract these barriers. Some of the system building entrepreneurs argue that political lobbying with the government might help with removing regulations or with breaking the power of vested interests. By talking to politicians, only 2 entrepreneurs have in fact been able “to voice the obstacles they perceive and stress the importance of their innovative company and the new industry as a whole.” To achieve this, entrepreneurs stress the importance of political savvy and playing political games in order to display the position of their company: “it all comes down to politics.”
and “our growth is due to clever political maneuvering” 8. But lobbying to change regulations is difficult for every entrepreneur: “it’s a daunting if not impossible task on local level, on national level and especially on European level” 2. Companies that can effectively lobby usually have power and the necessary resources and critical mass to influence the government, while all other entrepreneurs that have been interviewed are relatively small or young players introducing sustainable innovations that do not have enough power: “there is no way we can influence the government” 2.

One mechanism for system building entrepreneurs to create the much needed power and critical mass in order to be able to lobby with the government for favorable changes in the regulative institutions and to counter the influencing power of vested interests, is to act together. Four entrepreneurs indeed acknowledge that cooperation in the strategic form of ‘running in packs’ as proposed by Van de Ven (2005) could be very useful 2,6,9,10. These entrepreneurs acknowledge that coordination and cooperation between competitors might be useful in order “to better address, to guide and to break open a common market” 10 and to achieve market growth for the entire growing industry (“to increase the whole pie” 6). However, none of the entrepreneurs actually pursues a strategy of running in packs as described by Van de Ven (2005) – there is no entrepreneur that runs together with competitors. Entrepreneurs do not collaborate with other small, growing entrepreneurs in their field of business and do not try to influence the regulative institutions or network failures with the government. Since the entrepreneurs introduce innovations which create entirely new markets, all competitors are still fighting hard to gain market share (“to increase my own share of the pie” 6). Cooperation or even coordination would bring about business risks for the entrepreneur, especially at this early stage: “releasing and revealing vital and strategic information to the competition would greatly undermine my strategic position” 9. The interviewed entrepreneurs believe that the “individual profits of fighting alone to gain market share, currently outweigh the collective profits of partnering together with competitors to increase the market as a whole” 6. Increasing the market as a whole simply has no priority for entrepreneurs – no new entrant is willing to take the initiative to cooperate. Innovative entrepreneurs live to compete and believe they have a competitive advantage over their competitors: “I am passionate to fight for market share” 6.

Although a strategy of running in packs was not found, entrepreneurs do use approaches in the form of cooperation and coalition forming in order to gain power – although in a different way than was described by Van de Ven (2005). One cooperative strategy mentioned by entrepreneurs as being used to influence the government, are branch organizations. In 7 cases, entrepreneurs are grouped together with competitors in a certain market segment (certain product, certain technology) in a branch organization 2,3,6,8,10,13,15. This branch organization represents the companies of a whole sector and thus has more power to lobby for regulatory changes and to create legitimacy for the new industry in the system. These branch organizations take the lobbying activities out of the hand of the individual companies and entrepreneurs, since these are too small, have too little time or too few resources to lobby themselves. For instance, branch organizations can lobby for establishing a common certificate for the industry’s products, to establish common standards, establish a common message to consumers, to guarantee quality, to avert foreign competitors etc. Five entrepreneurs mention that if they want to change regulations, they do it through their branch organizations 2,3,6,8,10. However, for these entrepreneurs, branch organizations are not mentioned as a very effective strategy for influencing the government: “activities with branch organizations involve very long-term processes while it is unsure if you will profit from them” 2. This can be explained by the fact that branch organizations only occurred in later stages of the industry life cycle: in 4 cases in which entrepreneurs participated in a branch organization, the entrepreneurial company had more than 50 employees; and all the 7 cases of branch organizations occurred in a market segment where the power and positioning of the industry actors was relatively well established. Entrepreneurs explained that branch organizations come into existence “when competition for market shares is not so tough anymore, when the market shares have become settled down and when it is more clear which actors have the power in the market” 9. Only when this has happened are perceived competitive risks and uncertainties lowered and are actors in an industry willing to group together. As it has been put clearly by one entrepreneur: “it is much easier to form a branch organization when there are 4 large players left, than to start cooperation with 20 small entrepreneurs” 14. When it is not clear whether other actors will become competitors in the same market segment, entrepreneurs have no need to establish a branch organization. In these early stages, entrepreneurs still perceive the possibility to
create a temporary monopoly power and they rather aim to capture the whole market themselves and alone. This makes a branch organization not an effective strategy. Concluding, for the entrepreneurs interviewed in this research, where the sustainable innovations they introduce are quite radical and in an early stage of development, no successful strategies are performed to offset network failures or regulative institutions by influencing the government.

4.3.2 Summary
This paragraph has described which strategies entrepreneurs have mentioned that they use to influence the system context for the successful introduction and diffusion of their sustainable innovations. The analysis of the results on the strategies revealed differences in terms of the strategic approaches of the two types of entrepreneurs.

System following entrepreneurs mainly focus their strategies on establishing partnerships with vested interests in order to gain a powerful position in the industry and to get access to existing markets to sell their innovations to. On the other hand, system building entrepreneurs partner with willing people outside of the vested interests in order to create a new network and to create an new market for sustainable innovations through direct sales. Similarities were found in the mentioned strategies for influencing the institutional context: both types of entrepreneurs legitimize their innovation by creating fit with the normative institutions through demonstration projects and use private persuasion as an approach to remove cognitive barriers with actors on individual level. Finally, entrepreneurs do not have many effective strategies for influencing the government to create favorable environmental conditions: system building entrepreneurs have not enough power to lobby and grouping together to create critical mass is not done due to associated insurmountable risks and uncertainties for small and starting entrepreneurs.

As can be seen from the overview in figure 3, the strategies are directed at specific actors and at specific categories of system interactions. Concerning actors, most strategies are aimed at influencing the industry actors and consumers. Only the strategy of legitimization is directed at all actors in the sector, while no strategies are clearly directed at the government. Concerning categories, entrepreneurs aim to influence the network interactions and network failures in the sector and the normative and cognitive institutions. No strategies are directed at technology or at the regulative institutions.

These findings raise the question whether the range of mentioned strategies corresponds to the influences mentioned by entrepreneurs and what the combined interactions are between the influences and the strategies of both types of entrepreneurs. In order to answer these questions, the next paragraph first provides a combined and interactive analysis of the results, by integrating the mentioned influences with the mentioned strategies of entrepreneurs.

4.4 Interactions between entrepreneurs and the system context
In this paragraph the influences from the system context are integrated with the strategies of entrepreneurs for influencing the system context, to arrive at an integrated picture of the interactions between the two types of entrepreneurs and the system context. First, the general interaction patterns between entrepreneurs and the system context are described, then follows an explanation of the specific interactions for each type of entrepreneur.

4.4.1 Interaction patterns
When the tables depicting the influences (table 3) and the strategies (table 4) are combined, some overlaps and some gaps become apparent. First of all, overlaps exist where influences from the system context are countered by strategies of entrepreneurs. On three issues, strong interactions occur between the influences on entrepreneurs and their strategies for addressing exactly this influence in return:

- First, there is a strong interaction visible between entrepreneurs and the system context in the field of network interactions with industry actors. The strong negative influences from the lock-in of vested interests between industry actors, are directly countered by using a range of strategies for gaining power and a clear position within this network of industry actors. Entrepreneurs that are hindered by current players actively focus on getting a place in the network of actors through partnering either
with vested interests (system following entrepreneurs) or with willing new partners (system building entrepreneurs). This interaction with the system is vital for both types of entrepreneurs in order to become established in the industry and to clearly position their business in the network relations.

- Second, interactions occur with the normative institutions. Increased awareness with governments, industry actors and consumers is indeed used by all entrepreneurs to legitimize their sustainable innovations. A multiplicity of actors in the system interact and reinforce each other in the case of the normative institutions, in order to shape the direction of sustainability. Where the government and other societal organizations increase the awareness, entrepreneurs can use this increased awareness to contribute physically to achieving sustainability. Through this virtuous cycle of many actors working together to adapt the normative institutions, the introduction and diffusion of sustainable innovations coincides with changes in the system context. This interaction between system influences and strategies functions well and shows the great importance of increased awareness for the legitimization of sustainable innovations.

- The third important locus of interactions resides with the cognitive institutions. The barrier consisting of the need to think differently – which is located with industry actors, consumers and capital providers – is directly removed through the strategy of private persuasion. This negative influence is thereby directly addressed by both types of entrepreneurs. This interaction pattern where entrepreneurs directly remove this barrier, is very important for achieving system change necessary to introduce and diffuse sustainable innovations – especially since it is impossible for the government to individually change or remove all the cognitive barriers on a large scale. The government therefore truly needs a range of entrepreneurs to use the strategy of private persuasion in order to infiltrate the thinking of system actors to achieve changes in the behavior, routines and habits of actors in the whole system in favor of sustainable innovations. This interaction pattern where entrepreneurs slowly shape the cognitive institutions of individual actors to support sustainable innovations, is vital for achieving the transition towards sustainability in the system as a whole.

Besides these three interaction patterns between influences and strategies, there is one case in which entrepreneurs have strong strategies to influence the system context, while they do not mention any positive or negative influences. This is in the area of market access, referring to the network interactions with consumers. Although entrepreneurs do mention that the increased awareness provides a market boost, they still need to get access to this market. Entrepreneurs do not perceive this as a big problem in the system, but they do spend a lot of time and efforts directly influencing the market. Every entrepreneur recognizes that in order to be successful, entrepreneurs always have to watch the market closely and put time in addressing the market. System following entrepreneurs do this mostly by finding consumers in or close to existing markets and system building entrepreneurs by creating entirely new markets. So despite the fact no clear influences have been mentioned from the market, market strategies remain undeniably important for both types of entrepreneurs for successfully introducing and diffusing innovations.

As opposed to the above-mentioned areas where entrepreneurs have clear strategies to influence the system context, some influences from the system context remain unaddressed. In two areas, strong influences from the system context are not countered by any strategies of entrepreneurs. First, negative influences from the government are not addressed by entrepreneurs. The empirical results show that although entrepreneurs perceive many negative influences from the government, they do not lobbying to change this. Nothing is done about the complaints of entrepreneurs about the lack of guidance from the government and the flawed regulations and subsidy schemes. Through a strategy of running in packs entrepreneurs would be able to together create new institutions, but no entrepreneur dares to do this because they are busier getting a place in the network interactions. Since negative influences do exist, it can be concluded that an important interaction pattern between the government and entrepreneurs is needed, but missing. A second influence that is not addressed with any strategies, concerns technology. Technological developments and progress is perceived as a rather external influence for system following entrepreneurs and as a driver for system building entrepreneurs, but all entrepreneurs tend to focus their time and attention mostly on other strategies.
Finally, in four areas no influences and no strategies were mentioned at all by entrepreneurs. First, no interactions take place in the field of the regulative institutions with industry actors or with consumers. Given that entrepreneurs also do not direct any strategies at the government for this, entrepreneurs do not interact with any actor with respect to regulative institutions. This could be seen as a serious problem for successfully introducing sustainable innovations. Second, interactions with technology only occur with specific knowledge providers, not with any other actors. In the interactions with governments, industry actors and consumers, technology is not playing an important role but the focus is on other issues. Third, no interactions take place at all concerning the cognitive institutions of the government. When entrepreneurs talk about interactions with the government, they are negative for almost every category, except for the cognitive institutions. This could be explained by reasoning that when a government has formulated the ambition of an energy transition, they need to think ahead and therefore the government needs to be the first actor in the system to change it’s behavior, practices, routines and other aspects of the cognitive institutions. Fourth and finally, no interactions are taking place in the field of network interactions with capital providers and knowledge providers. This indicates that with these actors there exist no network failures but only institutional failures.

Summarizing, this analysis of the research results has led to the identification of 3 vital areas of interactions between entrepreneurs and the system context, 1 area where entrepreneurs directly influence the system and 2 areas where interactions are needed but largely missing. In addition to these general interaction patterns, the analysis of the results has shown clear differences between the two types of entrepreneurs in their approaches towards system interaction, which are discussed in the next paragraph.

### 4.4.2 Typology of entrepreneur-system interactions

For both types of entrepreneurs, this empirical research has found clear differences between them in terms of their interactions with the system context, including which influences they perceive and which strategies they use. An overview of these differences is presented in Table 5 and will be described below.

**Table 5: System interactions of system following versus system building entrepreneurs.**

<table>
<thead>
<tr>
<th>Characteristics</th>
<th>System following entrepreneurs</th>
<th>System building entrepreneurs</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Network interactions</strong></td>
<td>No long-term vision, innovations have short pay-back times and lead to immediate (cost) advantages.</td>
<td>Often known as ‘headrunners’, have a long-term vision of the future and usually longer pay-back times of their innovations.</td>
</tr>
<tr>
<td><strong>Institutions</strong></td>
<td>They create a new network of willing players outside of the vested interests. Lack of guidance from the government is a problem, so is cooperation with many stakeholders. Therefore, they need political savvy, lobby activities and branch organizations.</td>
<td>They go ahead of the government: do not depend on subsidies, find that most regulations are barriers and voluntarily set new standards.</td>
</tr>
<tr>
<td><strong>Regulative</strong></td>
<td>They connect with vested interests and with existing markets. Guidance from the government gives an impulse for their innovations. Lobbying, branch organizations and political savvy are therefore not necessary.</td>
<td>Sustainable norms and values are emphasized to legitimize their sustainable innovation.</td>
</tr>
<tr>
<td><strong>Normative</strong></td>
<td>Regulation &amp; subsidy schemes provide an impulse for sustainable innovations. They comply with regulations and are dependent on subsidies.</td>
<td>They focus on sustainability, but they evade opposing actors and emphasize other advantages of the innovation.</td>
</tr>
<tr>
<td><strong>Cognitive</strong></td>
<td>They go ahead of the government: do not depend on subsidies, find that most regulations are barriers and voluntarily set new standards.</td>
<td>Sustainable norms and values are emphasized to legitimize their sustainable innovation.</td>
</tr>
<tr>
<td><strong>Technology</strong></td>
<td>Some technological barriers need to be overcome.</td>
<td>Technology is primarily an impulse. They have more knowledge relationships.</td>
</tr>
</tbody>
</table>
As described before, system following entrepreneurs are entrepreneurs for which the introduction and diffusion of sustainable innovations does not coincide with large changes in the system context – they do not initiate systemic changes. The results have shown that system following entrepreneurs introduce sustainable innovations by partially depending on other actors: on the government when they issue new regulations or subsidy schemes, on the initiatives of large industry actors that slowly move towards sustainability or on developments in the market. This type of entrepreneurs was shown to connect with existing actors in the system and to depend or build upon other actors in order to create changes in the institutional environment. These entrepreneurs usually lack a long-term vision, they view regulations from the government mostly as a driver for sustainability and gain legitimacy through complying with regulations. They connect with the current institutional context and they mostly cooperate in existing markets and with existing players. This type of entrepreneurs focuses on sustainable innovations that are not too radical and that lead to immediate cost-savings. Although this type of entrepreneur can clearly foster changes in the system context and unmistakably make a contribution to the transition towards sustainability in the sector, system following entrepreneurs are not the instigator of systemic changes.

On the contrary, the results described that system building entrepreneurs actively create changes in the system context. The successful introduction and diffusion of their innovations requires changes in the network interactions between actors and changes in the institutions, which they aim to create themselves. Although system building entrepreneurs do not have it as their core purpose to directly influence and change the system context, they do change the system indirectly through the advancement of their own innovations. System building entrepreneurs have shown to be able to create new interaction patterns by finding innovative partners that believe in their innovation, they voluntarily set new regulative standards, create new markets through direct sales and they explicitly create new norms, values, behavior and habits with actors around them. Through all these activities, system building entrepreneurs create a new system, with new network interactions and new institutions, that fights and aims to compete with the old system. The results showed that system building entrepreneurs therefore perceive stronger barriers from the old system: they complain more about the lack of guidance form the government, they perceive current regulations as a barrier for them and more often have a strategy of internationalization to evade an unfavorable system context. Radical technological advances are often a driver for system building entrepreneurs and initial pay-back times of sustainable innovations are usually longer. For these reasons, system building entrepreneurs need political savvy or, in a later stage, branch organizations in order to persuade the government to support their system-building actions. It is this type of entrepreneurs that truly contributes to setting in motion processes where the introduction and diffusion of sustainable innovations coincides with actively creating changes in the system context.

The proposition of this distinction between system following and system building entrepreneurs has followed from the empirical findings in this research, but is not definite. For instance, additional research will need to determine whether both types of entrepreneurs are equally effective and successful and whether the differences remain evident in other situations. However, by making a distinction between these two types; researchers, policy-makers and entrepreneurs are provided with a guideline to better understand and explain the different ways in which entrepreneurs interact with the system context for the successful introduction and diffusion of sustainable innovations. This could prove to be an important first step for further understanding, describing and eventually stimulating fertile interaction patterns between all types of innovative entrepreneurs and changes in the system context.
5 Conclusion and discussion

This section will describe and discuss the findings of this research. In the first paragraph, a summary of the results and analysis is presented to answer the 4 sub-questions and the main research question. The second paragraph describes the implications of these findings for current theories. Finally, the last paragraph will shortly describe some limitations of this research and identify opportunities for further research.

5.1 Conclusions

This research has investigated the question what the strategies are of entrepreneurs to change the system context for the successful introduction and diffusion of sustainable innovations. For this, face-to-face interviews have been held with 16 entrepreneurs introducing sustainable innovations in the sector energy in the built environment in the Netherlands. The results from these interviews have been analyzed and have led to answers on the sub-questions and the main research question.

The results showed that 2 types of entrepreneurs can be distinguished, that have different approaches for interacting with the system context: system following entrepreneurs, that aim to connect with existing actors in the system and depend on other actors for creating changes in the institutional environment, and system building entrepreneurs, for whom introducing and diffusing sustainable innovations coincides with creating a new system through actively changing network interactions and institutions. Both types of entrepreneurs have pro-active sustainable strategies and are able to reconcile the creation of economically profitable business with a focus on sustainability, but they experience different influences from the system context and have different strategies to change the system context (sub-question 1).

The influences from the system context mentioned by entrepreneurs (sub-question 2) can be divided in drivers and barriers. The most important drivers from the system context are the public awareness of sustainability and developments in technology, and the most important barriers are the lack of guidance and flawed subsidy schemes from the government, a lock-in of vested interests in the building and energy industries and the need of all actors to think differently about sustainability. System building entrepreneurs experience the lack of guidance from the government, the current regulations and the lock-in of vested interests in the sector as strong barriers for sustainable innovation, while system following entrepreneurs view the government, regulations and initiatives from current players as drivers for sustainable innovation.

Concerning the strategies of entrepreneurs to influence the system context (sub-question 3), the results showed that entrepreneurs do not influence the government or lobby for regulative changes, but instead legitimize their innovation by creating fit with the norms and values of society and by using an approach of private persuasion to change individual behaviors and practices. The differences between the two types of entrepreneurs are that system following entrepreneurs mainly focus their strategies on establishing partnerships with vested interests in order to gain a powerful position in the industry and to get access to existing markets, while system building entrepreneurs partner with willing people outside of the vested interests in order to create a new network and a new market for their sustainable innovations.

Altogether, the findings of this research provide an answer to the main research question by clearly showing which strategies entrepreneurs use to change the system context for the successful introduction and diffusion of sustainable innovations. Moreover, the proposition of a new typology of entrepreneurs (sub-question 4) offers insight in the two different approaches that entrepreneurs have for interacting with the system context: system following have strategies to move the current system towards sustainability, while system building entrepreneurs create an entirely new sustainable system. With these results, this research hopes to contribute to the further understanding of the interactions between entrepreneurs and their system context in order to more effectively stimulate and support innovating entrepreneurs to contribute to the transition towards sustainability.
5.2 Implications for theory

The empirical findings of the interactions between entrepreneurs and the system context as described in the previous paragraph, have some important implications for theory. This section describes where the empirical findings confirm existing theories and where current literature needs refinement.

The empirical findings of this research confirm the importance of the system context for innovation as described in the innovation systems approach (Edquist & Lundvall, 1993; Hekkert et al., 2007). This research confirms the important role of entrepreneurs and shows that they need to intensely cooperate in a network of many actors and under the influence of the institutional environment. Interactions in networks and interactive feedback loops to create new networks, to legitimize, to change the institutional environment and to create markets, are shown to be crucial components of entrepreneurship in order to shape the build-up of a supportive system context – which are also central functions in the innovation systems approach (Hekkert et al., 2007). The results showed that especially system building entrepreneurs have various strategies to contribute to the build-up of a new innovations system. In this respect, the empirical findings of this research help to better explain the dynamics on the level of entrepreneurs within an innovation system in order to strengthen this theoretical strand.

In addition, the empirical findings of this research confirm the proposition of the literature on sustainable entrepreneurship that entrepreneurs are able to reconcile economic growth with advancements in sustainability (Lepoutre, 2008; Dijkema 2006; Gerlach, 2003; Cohen & Winn, 2007). For this theoretical strand, insights from this research can prove to be valuable in order to better explain the specific barriers, drivers and characteristics of a supportive system context for sustainable entrepreneurship and to explain how entrepreneurs developing innovations that integrate the three aspects of sustainability could more effectively contribute to the transition towards sustainability.

Compared to the institutional entrepreneurship literature, this research provides a more positive story concerning the ability of actors to change the institutional context. Although the empirical findings on the influences as perceived by entrepreneurs validate the notion that the institutional context creates pressures towards stasis, they also show that actors do not necessarily need ‘a great extent of organizational power and legitimacy’ to be able to survive the negative institutional influences or change the system context (DiMaggio, 1988; Oliver, 1991; Klein Woolthuis, 2005). This research has shown that small actors without power, are still able to change part of the institutions. As described in the results, small entrepreneurs might be unable to change regulative institutions, but entrepreneurs do have an important role for legitimizing their innovation through influencing normative institutions and are crucial actors for changing the cognitive institutions. This was found to be the case for both types of entrepreneurs. This research thus contributes to theory on institutional entrepreneurship by shedding light on the ways in which small innovative entrepreneurs without power are able to achieve changes in specific parts of the institutional context.

The view obtained in this research from the interviewed entrepreneurs on their role within the system, aligns well with the concept of path creation as introduced by Garud & Karnoe (2001, 2003). The empirical findings confirm the distributed nature of agency over a multiplicity of actors, with their distributed competencies and the great importance of interactive learning cycles between them. Moreover, the findings show that actors become embedded within their own path they are shaping in the system. System building entrepreneurs have shown to really be able to set in motion processes of developing innovations in the form of new social practices, products and services and to shape a path towards renewal of the sector. The system building entrepreneurs interviewed in this research demonstrated characteristics of the bricolage process, where collaborating actors gradually build up a new system with at it’s heart the sustainable innovation surrounded by the built-up of accompanying tools, practices, rules and knowledge. This research has elaborated this view by showing the particular importance of entrepreneurs for developing accompanying cognitive institutions, creating markets and creating new networks – whereas other actors in the system might be more responsible for developing supportive regulative and normative institutions. The interactions within the system as mentioned by entrepreneurs, show that micro-learning processes between actors are crucial in order to successfully introduce and diffuse innovations and in order to co-produce the supportive system context surrounding these
innovations. It confirms the importance of taking small steps to allow for interactions and continuous feedbacks to build up a new network of actors. Concluding, this research has explained the methods to create new paths by showing how system building entrepreneurs are able to initiate a process of bricolage, in which the successful introduction of sustainable innovations coincides with the gradual build-up of the surrounding system context.

Theories on collective entrepreneurial action need to be nuanced according to the results of this research. The empirical findings have shown that none of the entrepreneurs in practice uses the exact strategy of advocacy coalitions (Sabatier, 1988) or running in packs (Van de Ven, 2005), but instead have variations on these strategies. Entrepreneurs do in fact have fruitful strategies for cooperation and coalition forming, although they use them in a different way than described in current literature. The creation of partnerships and collaboration is not horizontal as theory suggests, but mostly vertical: partnering is done for complementary reasons such as securing market access, offering a more integrated product package, obtaining financial resources or knowledge exchange, and not in order to influence the government or change regulative institutions. This is because in the early stages of growth in which the innovative entrepreneurs reside, cooperation and coordination between many small entrepreneurs brings many risks and uncertainties and it was shown that entrepreneurs rather fight on their own. Furthermore, the proposed typology of entrepreneurs has shown that two different strategic approaches exist for collective action: system following entrepreneurs group together with the vested interests in the sector, while system building entrepreneurs create a new network of willing players. Supported by the empirical results from the interviews with entrepreneurs, it is deemed reasonable here to conclude that the collective entrepreneurial strategies in current theory do not adequately describe the strategies used by entrepreneurs in practice for influencing the system context. This does not mean that the theory of running in packs is incorrect, but instead, this research has elaborated this theory by showing that entrepreneurs that run in packs create new networks through complementary relationships. By describing the reasons and methods that entrepreneurs use for cooperation, this research has provided a more detailed understanding of how entrepreneurs run in packs in practice. With this insight from empirical findings, this research hopes to contribute the literature on collective entrepreneurial action by increasing the understanding of the strategies entrepreneurs use to operate collectively.

Summarizing, this research adds insights to the theoretical strands on innovation systems, sustainable entrepreneurs, institutional entrepreneurship and path creation, while current theories on strategies for collective entrepreneurial action need refinement.

5.3 Recommendations for further research
This section will shortly describe some limitations of this research and identify several opportunities for further research in the same area. Since this research approach was rather explorative, the findings of this research need additional and more extensive empirical research in order to test the conclusions about the influences, strategies and types of entrepreneurs that have been found. The data gathering method of interviews could have resulted in invalid data, due to the construct validity of the concepts and questions asked, the clear understanding or socially wishful answers by the interviewees or the interpretation by researcher. Moreover, with regard to the methods for data analysis, the results could have been described by using different theoretical viewpoints and a different framework to analyze the data, which could have led to different insights on the interactions between entrepreneurs and the system context. Additional research is required to test the findings of this research, for instance through a survey in a larger population of entrepreneurs. In particular the topic of collaborative entrepreneurial action and the question whether and in which cases a strategy of running in packs might occur needs further investigation. The proposed typology of entrepreneurs demands further research in order to validate the distinction and to determine whether both types are indeed equally effective for introducing sustainable innovations and contributing to the transitions towards sustainability. Moreover, additional research is needed in order to determine whether these results are valid in other sectors with other system contexts. The results from this sector need to be compared and integrated with the results from other sectors, such as a similar research in the healthcare sector (Janssen, 2009). Finally, an important alley for further research would be to investigate the dynamic relation between entrepreneurs and the system context over time, in order to distinguish between different interaction patterns in different stages of the industry.
life cycle. Although this research has answered the questions that were proposed in the introduction, the results of this research inevitably raise more issues to be investigated.

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Appendices

I. List of influences from the system context mentioned by entrepreneurs
1. Public awareness of sustainability
2. Regulation
3. Subsidies
4. Guidance of the government
5. Networking & contacts
6. Politics
7. Competitors
8. Cost-focused market
9. Technology
10. Funding & investors
11. Financial crisis
12. Vested interests
13. Installers
14. Incentive of energy companies
15. Fear for innovation
16. Many stakeholders
17. Providers to consumers
18. Media attention
19. Suppliers
20. More assertive consumers
21. Climate for entrepreneurship
22. Energy price

II. List of strategies to influence the system context mentioned by entrepreneurs
1. Demonstration projects
2. Direct sales
3. Private persuasion
4. Information supply
5. Finding customers
6. The right people
7. Promoters & ambassadors
8. Emphasize other advantages
9. Partnering & alliances
10. Agility
11. Coalitions and consortia
12. Running in packs
13. Branch organizations
14. Political lobbying
15. Connect with existing market
16. Niche markets
17. Connect with vested interests
18. Intellectual Property Rights
19. Increase public awareness of sustainability
20. Internationalization
21. Training & education
22. Marketing & media
23. Internalize external dependencies