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ALIGNING PRIVATE AND PUBLIC DOMAINS FOR SUSTAINABLE DISRUPTIVE INNOVATION

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ABSTRACT

This paper addresses the constellation of various actors from private and public sectors represented by three companies, a municipality, a non-profit organization, a research lab and users to collaborate on bringing forward a sustainability driven disruptive innovation. The purpose of the paper is to investigate how the various actors' interests and contributions influence the management of the collaboration setup and what barriers and enablers boost or impede the outcome of the setup, i.e. deploying an innovation with sustainability promise. We argue that the alignment of diverse actors' interests and aims for the innovation in collaborative settings is crucial for the collaboration to lead to desirable outcomes. However, only alignment at an abstract level cannot ensure success even when actors bring competencies that balance the innovation requirements. Rather, creating cohesion and commitment of all actors simultaneously at a concrete level is necessary. The integration of new approaches to collaboration such as design methods may strengthen commitment despite actors coming from different organizational cultures and traditions.

Keywords: *Strategic niche management, sustainability driven innovation, transportation, collaboration*

1. INTRODUCTION

Climate changes and CO₂ emissions' amplitude have become central topics of political and policy agenda. Promoting innovation that challenges the current production and consumption trajectories toward sustainability is paramount (Hekkert & Negro, 2009; Petruzzelli et al., 2011). Changes of disruptive character are needed and innovations that disrupt the market and technological trajectory could affect these patterns as well as enable firms to maintain their competitiveness and leadership. Engaging in disruptive innovation with sustainability promise comes along with high uncertainty on both the technology and market sides because their values are not attractive for the mass consumers initially (Christensen and Bower, 1996; Yu and Hang, 2010). Particularly when innovation is rather new and socially disruptive requiring more than just customer acceptance i.e. new behaviors (Urban et al., 1996), firms face difficulties in finding the right strategies even when the technology side is straightforward (Christensen and Bower, 1996). In addition, many innovations do not stand alone, but depend on contextual changes for their own success (Adner and Kapoor, 2010) and require innovations from other actors as well (Adner, 2006). These patterns have been observed in many sustainability driven innovations i.e. transportation, energy, and agriculture (Geels, 2002).

Strategic niche management (SNM) has been suggested to facilitate the development and use of promising sustainable technologies through means of experimentation, in

order to learn about social desirability and application of the innovation (Kemp, Schot, & Hoogma, 1998). An emphasis of the SNM is the interaction among various actors from different domains as crucial to reduce uncertainty, and stimulate learning about the problems, needs, and possibilities of the innovation while fostering institutional adaptation toward change (Geels, 2002; Schot and Geels, 2008). When an innovation itself is dependent on a range of changes (Adner, 2006) i.e. new electric vehicles for instance, such constellations may be desirable and even necessary for many actors. By collaborating, actors from different public and private domains can build an innovation constituency, which may redirect evolving dynamics toward a desired path (Kemp et al., 2000). Collaboration among different actors is considered a core and beneficial to them, however, it may also increase coordination costs, induce complexity further and cause loss of control as found by Enkel et al., (2009). Aligning different interests and particularly when these actors come from different domains i.e. users, private companies (large and small), non-governmental actors, and others involved in the policy making, may be challenging from an innovation management perspective.

This paper therefore investigates collaboration between diverse actors from different public and private domains as a way to develop and deploy sustainability driven disruptive innovation and facilitate transitions towards sustainable futures. Using data from an ongoing collaborative development project, we look at the aims and interests of each participating actor for engaging in such a setup, and reflect on how these translate into enablers and barriers for innovative solutions toward sustainability. The paper draws from literature on strategic niche management, as it addresses management of core issues of achieving sustainability transitions through new and different innovations. The main research questions addressed are: how diversity of interests and contributions of various actors influence the management of collaboration setups and what enablers and barriers exist for a successful outcome of the collaboration setup. Learning about these is important for understanding how collaborations among diverse actors support or inhibit efforts toward sustainability.

2. STRATEGIC NICHE MANAGEMENT AND COLLABORATION OF ACTORS FOR SUSTAINABILITY DRIVEN DISRUPTIVE INNOVATION

For many new innovations and specifically those with sustainability promise, markets are not readily available because often these innovations differ drastically from the prevailing set of technologies (Schot and Geels, 2008). These innovations require different approach mechanisms both in terms of how they are developed, managed and deployed into the markets (Petruzzelli et al., 2011; Diaz-Garcia et al. 2015). Strategic niche management (SNM), is one approach that has been developed for managing particular types of innovations, such as socially desirable innovations serving long-term sustainability goals and radical novelties that face mismatches with regards to existing infrastructure, user practices, regulations etc. (Schot and Geels, 2008). We regard this approach complementing the disruptive innovation theory (Christensen, 1997), which treats innovation more exclusively to technology development and market dimension in isolation of other than the interactions between incumbent firms and new entrants. It also is in line with open innovation literature, which places collaboration with external actors as important for innovation (Chesbrough, 2006).

The progress in development of environmental technology must be supplemented by corresponding lifestyles i.e. changing mobility patterns and institutional changes that range from local networks to global organizations (Rennings, 1998; Elzen et al., 2004; Schot and Geels, 2008). SNM stipulates that transitioning innovation trajectory towards sustainability can be facilitated through co-evolution of technology, user practices, and regulatory structures in a process of interaction shaped by many actors (Schot and Geels, 2008). These all require alignment and collaborations by many actors for innovation to successfully create new markets or to be adapted to existing markets by modifying or changing user practices and behaviors. The emphasis of SNM is placed on what scholars call ‘endogenous steering’ or steering from within, where innovations can be enacted by several actors, including users and societal groups (ibid.) by bringing their expertise into the development process.

This steering may be enacted through domains of actors as posited by the framework such as niche, regime, and landscape level, which enhance the exchange of information, knowledge, and experience (Caniëls and Romijn, 2008). Here, niches are the spaces or structures for nurturing experimentation in real environments with new technology where learning is co-created, they are the micro-level where novelties emerge; regime is the socio-technical arena at the meso-level, where practices and rules have been established into cognitive routines along technological trajectories; and, landscape-level forming the macro-level which extends beyond the influence of niche and regime i.e. deep cultural patterns or macro-political development in which changes take place slowly (Rip and Kemp, 1998; Geels, 2002, 2005a). Niches are a crucial part because besides nurturing the development and design of innovation, they are seen as facilitation mechanisms allowing articulation and alignment of technology, demand, and broader societal issues, including sustainable development (Rip, 1992, 1995; Schot 1992, 1998). Particularly the alignment, which here can be interpreted as the coordination of actors that represent these dimensions, has been considered to provide direction for learning processes at multiple dimensions simultaneously (Schot and Geels, 2008). Aligning interests to a goal while altering expectations of different actors may be leveraging for the innovation to be developed and implemented in such way that it creates new paths towards effective social embedding. The enrollment of more diverse actors expands the resource base and the network (Geels, 2011), but may not support efficient coordination when actors come from different domains. Too much diversity may hinder development due to the uncertainty it creates impeding full commitment of actors, fragmenting resources, and emergence of stable set of rules (Schot and Geels, 2008). In this regard, there seems to be noticeable trade-offs in terms of the domain of involved actors and collaboration efforts for the innovation success in broader social embedding. For experimentation and learning to take place, this process ought to be interactive and diverse but at the same time convergent and aligned, where actors’ strategies, expectations and views, aims and interests go in the same direction (Hoogma, 2000). These interactions are fruitful when the participating actors develop a mutual view on their own direction as well as with the technology (Caniëls & Romijn, 2008).

3. METHOD

3.1 LEVPOOL PROJECT SETUP

ITRL, Integrated Transport Research Lab at KTH Royal Institute of Technology setup the LEV-pool-project as a constellation project between various actors from private and public domains represented by three large companies, a municipality and a non-profit organization. The users who signed up as caretakers of the product-service-system at the test site are also included as an actor. The project was set up with the overall aim of understanding how companies and municipalities can support people to replace work commuting in privately owned fossil fuel driven cars with more sustainable transportation practices. The project was set up in 2014 and included a one-year idea generation phase to get all actors on board and create initial internal alignment. Also, in this phase, before the actual intervention started, user needs were pre-studied to develop an initial understanding of how the solution should be designed to fulfill the special needs of users at work environment. This work was done with a service design approach to ensure development of user centered design solutions. In September 2015, the six-month period of field trial started. Seven caretakers were appointed to use seven Twizys (new small electric vehicles) for their work commuting trips using a sharing system service. The caretakers were responsible for bringing their respective Twizy to and from work every workday whereby the vehicles could be used by daytime users who booked their intended use in the booking system whereby they used it for work related transport and for private errands during office hours.

3.2 RESEARCH METHODOLOGY

To investigate the research questions, data have been collected using semi-structured interviews conducted with all the actors (n=14) involved in the research project described above. Out of this, interviews with users (n=7) have been conducted after they completed a six months trial period using the new solution. The actors interviewed represent their respective organizations as they come from high-level of decision-making positions. Data were sourced also by observing the actors' interaction through project meetings and online platforms and usage of service. The data from the interviews have then been categorized into actors from different domains to analyze each representative actor. These actors were categorized as client actors: one municipality and one corporation where the innovation was tested; the user actors: all the employees of the client actors participating in the trial; the supplier actors: two private large companies supplying the product and the service; the non-profit organization actor: a large influential organization in public opinion; and finally, the academic actor: a research center working with innovation in transportation. Then, for each actor group, aims and interests for participating in the project as well as their contribution to the project were analyzed as categories in order to see how each actors' interests related to their contribution within the project as well as when do these interests conflict or bring the project forward. Besides these, part of the interviews also investigated the experiences of each actor within the project, where positive and negative aspects of such involvement were categorized into barriers and enablers for the constellation and its goals.

4. RESULTS

4.1 ACTORS AIMS AND INTERESTS FOR PARTICIPATING IN THE PROJECT

4.1.1 THE CLIENT ACTORS

Both actors on the client side were interested in finding solutions to replace employees' cars for commuting trips and for trips during the day, related to work as well as private life. The actors were looking to encourage employees to change their transportation practices into more sustainable ones. Their reasons for this were both practical, such as shortage of parking spaces, as well as value related aspiring for transitions towards sustainable transportation practices and fossil fuel free lifestyles.

On a practical level, the client actors wished to obtain hands-on decision-making suggestions. The client actors were also interested in having a research partner involved to carry out the practical work, saving them time, as well as to take advantage of the thoroughness the research partner could devote to the analysis. To test the product-service-system in real life situations together with real users was considered valuable and in line with their organizations' values.

On a more abstract level, the client actors wished to influence attitudes of employees and their surroundings. At this level, their interest lied in communicating alternatives to cars. On a higher level, the client actors also wanted to, in line with their strategies of influencing society, become more fossil fuel independent, lead the way in sustainable transitions. Not only were they interested in influencing their employees but also the many people and society at large.

4.1.2 THE USER ACTORS

There were three main interest areas for the users who signed up in the project. Firstly, those with a genuine interest in new technology and particularly in vehicles predominantly joined the project because they were curious to test an electric vehicle. They also enjoyed testing something new and exciting. Secondly, some were mainly attracted to the project as a way to try more sustainable alternatives to their fossil fuel driven cars. They also wanted to explicitly show others in their surroundings the potential of electric vehicles and, in line with their own interests, make others reflect on sustainability issues in society. Thirdly, those with families including young children were mainly driven by the practicalities of adding a second vehicle to their families to make their everyday logistics easier and cost effective. They were at the same time interested in exploring sustainable transportation practices.

4.1.3 THE SUPPLIER ACTORS

The supplier actors were interested in exploring new ways of thinking in mobility and curious to find out about the sharing concept with electric vehicles. From their commercial point of view, testing a new concept in collaboration was a way to obtain 'proof of concept'. They saw testing and collaboration as necessary to be able to convince higher-level management within their organizations that the concept worked in reality, therefore push for commercialization. One of the supplier's aim was to look at how new vehicles can be used for car sharing. The other supplier aimed at obtaining real-user data in terms of the new business model for car sharing integrating lightweight electric vehicles. Another aim of both supplier actors was to connect with academia to expand their networks.

4.1.4 THE NON-PROFIT ORGANIZATION ACTOR

The involved non-profit organisation was interested in affecting opinions with the overall aim to reach climate goals of fossil fuel independent transportation in 2030 in Sweden. Affecting opinions were strived for at different levels: public's opinions through increasing awareness about electrical vehicles and sharing solutions; corporate level through learning about users; and the political level through demonstrating possible solutions.

4.1.5 THE ACADEMIC ACTOR

The academic actor saw the project as integral to its portfolio through which it aims to demonstrate advantages for new kinds of transport solution, adding to the overarching goal to develop sustainable transport solutions. A major aim was to understand the challenges involved with one specific transport solution and create awareness of transport issues in relation to sustainable development. Another interest was to focus on the users' behavior by aiming at decreasing the amount of cars used for commuting. As well, the academic actor was interested in expanding the network of actors involved in the research center.

	New mobility solutions/ concepts	User knowledge /Change behaviour	Knowledge on car sharing	Knowledge on EVs	Collaboration with University	Network expansion	Test concept in real environments	Strategy or branding
Client 1	X	X					X	X
Client 2	X	X					X	X
Users	X			X			X	X
Supplier 1	X	X	X	X	X	X	X	X
Supplier 2	X	X	X	X	X	X	X	X
Non-profit organization	X	X	X		X	X	X	X
Academic Partner	X	X	X	X		X	X	X

Table 1. Actors' Aims and Interests for Developing the Innovation in Collaboration

4.2 ACTORS CONTRIBUTION TO THE PROJECT

4.2.1 THE CLIENT ACTORS

Foremost, the client actors contributed with their employees as users of the product-service-system. The employees of both organizations were used to test and evaluate new things considering many different perspectives. Also, an important part of their cultures was the fact that they were used to deal with change, the unknown and the unexpected, so called wicked problems.

4.2.2 THE USER ACTORS

The seven caretakers used the product-service-system, including the Twizys and booking service, for a six-months period. Every workday they drove their respective Twizy to and from work. They also regularly used the system in their spare time to go shopping, to drive their children and for getting to various sport activities as well as going to visit friends and relatives. On some of these occasions the Twizy replaced their car whereas on others the Twizy replaced their bike. The caretakers occasionally

used the Twizy during work hours for work related trips to get to meetings and to go for lunch or run errands during lunch hours.

4.2.3 THE SUPPLIER ACTORS

Both supplier actors contributed to the project with their expertise and technical know-how in terms of car sharing and the vehicles. Since they were the suppliers of the platform and the vehicles in the project, they saw their contribution with regards to technical support and logistics, system setup, product information and knowledge, as well as their experiences within this area as valuable for the project.

4.2.4 THE NON-PROFIT ORGANIZATION ACTOR

The non-profit organisation contributed mainly by engaging in communication activities, both internal communication with project group members and in external communication activities with research participants and their surroundings.

4.2.5 THE ACADEMIC ACTOR

The academic partner's main contribution was to realize and manage the project as well as bring competence in mobility issues and project management. In addition, the network it supplied was perceived as strengthening the project, particularly due to its reputation in developing sustainable system solutions. Furthermore, the academic actor included the research team that planned, conducted and implemented the research.

	Product Innovation Knowledge	Service Innovation Knowledge	General knowledge on EVs	Communication (internal and external)	Platform for Testing the Innovation	Project Management /Project Realization	Network Expansion	Technical Support
Client 1					X	X		
Client 2					X	X		
Users					X			X
Supplier 1	X		X					X
Supplier 2		X						
Non-profit organization				X				
Academic partner			X	X		X	X	

Table 2. Actors' Contribution in the Collaboration

4.3 ENABLERS AND BARRIERS

4.3.1 THE CLIENT ACTORS

The access to the project enabled the organization, as well as its employees, to try a different solution to mobility. This enabled the organizations test if the solution suited their needs. The client actors appreciated the setup of the project where the research partner ensured time and devotion was spent on analyzing the findings. For the client partners this was both a practical solution to test something new and a trustworthy evaluation of the product-service-system. The trial setup of six months was also an enabler for the organization as they were unsure how well the product-service-system

actually would work for them. The trial setup was also an important enabler for the participating users, i.e. the employees of the two organizations, to try out new transportation practice and test new technology.

Furthermore, it was clear that a barrier to test an innovative product-service-system lied in the possibility to attract users of the vehicles. Not only was it difficult to attract different types of users, rather than only the early adopters, it was also difficult to simply get people to try an unfamiliar transportation practice including an unknown booking system for sharing a new type of vehicle.

4.3.2 THE USER ACTORS

At a rather intangible level, the users appreciated being part of a future-oriented project with sustainability ambitions as using electric vehicles were considered environmentally beneficial. This emotional side was a clear positive experience for all of them and an enabler to deal with the less convenient parts of both the product and system. Overall users had a positive experience of the system, but there were a number of functional and technical problems with the Twizy and the booking system was sometimes perceived as too rigid. However, the users overcame the product respectively service related barriers and dealt with the inconveniences. At a system level, the involved logistics required a considerate amount of planning, especially for those with families of young children. Particularly, they had to plan and negotiate their responsibilities when going on business trips or being absent for other reasons. The more intangible side of the barriers included their felt disappointments as there were not as many daytime users participating as expected.

4.3.3 THE SUPPLIER ACTORS

One of the main enablers perceived by both supplier actors was the access to multi-dimensional knowledge. Other positive aspects of the collaboration were networking and involvement with academic research and the ability to initiate new business relationships. In addition to the commercial perspective, one of the actors saw the collaboration with academia particularly as a way to be recognized by their customers as reliable by showing engagement in trying out sustainable innovations. The other actor emphasized and valued the shared resources put into the project from different actors to test out a concept in multiple dimensions i.e. the business model, user behaviour, learning about car sharing and electric vehicles in general, and the diffusion of the concept.

In terms of barriers, both these actors emphasized that the time consumed by the project was much more than expected with difficulties in following the project progress. One of the actors thought that the focus of the project was too oriented towards user-friendliness development rather than ensuring actual system usage, which for them was of higher interest. The other actor was concerned with the project's internal communication aspects, which they saw as a barrier since following its progress was difficult and data access was limited. Other barriers perceived by these actors were that one of them saw engagement in collaborative projects as far ahead from their strategy, whereas the other indicated that they were unable to commercialize the innovation being developed and tested in the short run. In addition, both actors saw the utilization of vehicles as crucial but also as a barrier for them if utilization rates were low during the test period.

4.3.4 THE NON-PROFIT ORGANIZATION ACTOR

An important enabler for the non-profit organisation to be able to spread information about sustainable mobility solutions was the research project in itself. For learning throughout the project, an open project environment was considered an enabler and also a key benefit. This enabled even the smaller organisations with limited resources to co-operate on equal terms with the other project partners, where all contributed with valuable perspectives. The research environment, where the researchers had possibilities to deeply engage in project matters and include all partners in this process, was considered an important enabler for success.

However, a barrier for project success was considered to be the cultural differences of the various actors' respective organisations. As the actors included all sectors, from corporations; public sector including municipalities; non-profit organisations; to academia, it was not found surprising that there were challenges in aligning the team and its commitments.

4.3.5 THE ACADEMIC ACTOR

Networking through the project was a relevant factor for the academic partner. The way the actor conducted the project, which was experimental and demonstration work, was an enabler for more complex research about change. On a higher level, the actor considered being 'culture developer' was an enabler making changes in real life.

On the other hand, the required project hours were critical and when one or more actors laggard, this was a barrier to accomplish the project. The divergence of the project also became a barrier in terms of difficulties in managing it. In addition, the setup of the project, where things were being changed in real life, became a challenge. Last, the test sites' distances to the academic actor's location were perceived as another barrier.

5. DISCUSSION

In this multi-dimensional project, actors from all sectors: private and public sectors, third sector as well as academia, all brought valuable contributions to the project. Each of them, representing a different perspective on the same innovation, in this case a new mobility solution, was influenced by actions from all domains in order to push the change toward sustainability.

The results show that there are three common aims despite the different perspectives: first to explore new mobility concepts toward sustainability, second to test these in real environments, and third to use collaboration as a strategy for marketing purposes. The actors involved were all interested to learn more about how such innovation could work in real contexts, but each expressed an interest to learn about the specifics relevant for them. For instance, as seen from the results, the client actor was interested in the innovation to change employee behavior for sustainability reasons, whereas the supplier actors wanted to know product and service utilization rates for commercial purposes.

The findings indicate that the group was not fully convergent with regards to aims and interests although aligned on a higher level i.e. the goal toward sustainability. On the more practical side, the actors were interested in finding suitable solutions adapted to their own specific needs. This may have implications regarding a coherent functioning of the group when realizing those aims. Aligning the different interests is difficult when challenges emerge because actors' focus on their own interest may hinder their commitment on pushing the innovation forward.

However, when looking into their contributions, two interesting findings can be observed relating to the importance of alignment of actors from different domains. First, each actor brings diverse competences and when combined these provide strong support for implementing the innovation. The actors see this as an enabler for innovation, as access to such diverse knowledge means possibilities to deal with various challenges. This is in line with the postulations from the SNM approach implying that diversity positively affects learning and network expansion (Schot and Geels, 2008). On the other hand, the diversity of contributions indicates that these actors also expect the project focus to be aligned with their specific interests. This is reflected when considering the barriers of which the actors point at the different views on project activities inhibiting individual actors to focus on their interests, e.g. the actors' cultural differences. Second, actors perceive their contribution as straightforward, and yet all of them considered that there were unclear responsibilities or lacking roles, which they saw creating a vague vision for the project. This indicates an implication for collaborative projects involving different actors from different domains. Even though the diverse competencies brought into the collaboration to balance the innovation requirements, were all clearly committed, it did not ensure cohesion of the collaboration. A study by Caniels & Romijn (2008) also suggests that the lack of cohesion may inhibit proper functioning of the network in such setups. Further investigations into structures of collaboration projects and combinations of actors' competences would be fruitful to determine effectiveness of constellations for implementation of innovation.

In addition, managing the divergence of the actors' contribution implies a barrier for the actors since they all come from different organizational cultures with different perspectives on what the focus of the project should be. This may hinder development by consuming resources such as time, which seems to be another major barrier experienced by all the actors. Enkel et al. (2009) showed in a study of 107 European large enterprises and SMEs that higher coordination costs (48%) as well as loss of control and higher complexity (both 41%) were often associated with engagement in collaboration with external actors. On the other hand, by bringing different competencies to the innovation, actors feel that they are able to test a concept without being tied up. They see it as a win-win strategy because all of them benefit from each other's expertise and since none of the actors are able to affect the transition to more sustainable innovation individually, collaboration of this structure is fruitful. When collaboration is on equal terms, also the smaller and less powerful actors can feel they gain from it.

6. CONCLUSION

In this project we have seen that not only is collaboration difficult, but it is also hard to change ways of doing things. For several of the actors, working in this

collaborative way was clearly challenging and the innovation as such is challenging through the demand of changes in users lifestyles. The different actors had to step out of their comfort zones and get over the hurdles of understanding each other. This took more time and effort than expected and required considerable amount of planning.

As seen in this project, when desiring sustainability transitions, it can be relatively easy to align actors from various domains at an abstract level but it is clearly more challenging to find mutual interests on the concrete level. The abstract goal of a sustainable society can work as a vision, but in order for transitions to actually take place, there also needs to be alignments on concrete and practical level, such as how to develop and innovate, which are more dependent on cultures and traditions. We see a potential in using design methods as a way to bridge between various actors to facilitate communication amongst these affecting their interactions. This will be further investigated in coming stages of the project.

The actors chosen, either by the project management or by volunteering to participate, were all open to change and desired transitions toward a more sustainable future. For them it was in their tradition, corporate culture or personal lifestyle to constantly evolve, try new things and change tracks. Traditions of openness for the new will have to be fostered if new sustainable practices, challenging current unsustainable ones, are to emerge. This research project has pushed actors in different domains to try new sustainable mobility solutions hence knowledge about their respective traditions of openness for the new has been created.

Finally, it could be concluded that this project has also shown the strength of collaborating actors affecting various transition levels (niche, regime and landscape). The users and clients were central for real life concept trial and the suppliers' competences and contribution were crucial for both developing the concept and executing the project. In the long run, there is an ambition that this learning could also affect at landscape level. The project shows that collaborations of actors with different skills and contributions is essential for developing, testing and establishing sustainable driven innovations.

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REFERENCES

- Adner, R. (2006), Match Your Innovation Strategy to Your Innovation Ecosystem, Harvard business review.
- Adner, R. & Kapoor, R. (2010), Value creation in innovation ecosystems: how the structure affects firm performance in new technology generations, Strategic Management Journal, (31), pp.306–333.
- Caniëls, M.C.J. & Romijn, H.A. (2008), Actor networks in Strategic Niche Management: Insights from social network theory, Futures, 40(7), pp.613–629.

- Chesbrough, H. (2006), *Open Innovation: A New Paradigm for Understanding Industrial Innovation*, In *Open Innovation: Researching a New Paradigm*, eds. H. Chesbrough, W. Vanhaverbeke and J. West. Oxford: Oxford University Press, pp. 1-12.
- Christensen, C.M., Bower, J. L., (1996), Customer power, strategic investment, and the failure of leading firms, *Strategic Management Journal*, 17(3): 197–218.
- Díaz-García, C., González-Moreno, Á. & Sáez-Martínez, F.J. (2015), Eco-innovation: insights from a literature review, *Innovation*, 17(1), pp.6–23.
- Enkel, E., Gassmann, O. & Chesbrough, H. (2009), Open R&D and open innovation: exploring the phenomenon, *R&D Management*, 39(4), pp.311–316.
- Elzen, B., Geels, F.W., Green, K. (Eds.) (2004), *System Innovation and the Transition to Sustainability: Theory, Evidence and Policy*, Edward Elgar, Cheltenham.
- Geels, F.W. (2002), Technological transitions as evolutionary reconfiguration processes: a multi-level perspective and a case-study, *Research Policy*, 31(8-9), pp.1257–1274.
- Geels, F.W. (2005a), The dynamics of transitions in socio-technical systems: a multi-level analysis of the transition pathway from horse-drawn carriages to automobiles (1860–1930), *Technology Analysis & Strategic Management* 17, 445–476.
- Geels, F.W. (2011), The multi-level perspective on sustainability transitions: Responses to seven criticisms, *Environmental Innovation and Societal Transitions*, 1(1), pp.24–40.
- Hekkert, M.P. & Negro, S.O. (2009), Functions of innovation systems as a framework to understand sustainable technological change: Empirical evidence for earlier claims., *Technological Forecasting and Social Change*, 76(4), pp.584–594.
- Kemp, R., Schot, J. & Hoogma, R. (1998), Regime shifts to sustainability through processes of niche formation: The approach of strategic niche management, *Technology Analysis & Strategic Management*, 10(2), pp.175–195.
- Kemp, R., Truffer, B. & Harms, S. (2000), *Strategic Niche Management for Sustainable Mobility, Social Costs and Sustainable Mobility*.
- Petruzzelli, A. M., Dangelico, R. M., Rotolo, D., Albino, V. (2011), Organizational factors and technological features in the development of green innovations: Evidence from patent analysis, *Innovation*, 13:3, 291-310.
- Rennings, K. (1998), Towards a Theory and Policy of Eco-Innovation - Neoclassical and (Co-) Evolutionary Perspectives, *ZEW Discussion Paper 98-24*, pp.1–21.
- Rip, A., Kemp, R. (1998), Technological change. In: Rayner, S., Malone, E.L. (Eds.), *Human Choice and Climate Change*, vol. 2. Battelle Press, Columbus, OH, pp. 327–399.
- Rip, A. (1992), A quasi-evolutionary model of technological development and a cognitive approach to technology policy, *Rivista di Studi Epistemologici e Sociali Sulla Scienza e la Tecnologia* 2: 69–103.
- Rip, A. (1995), Introduction of new technology: making use of recent insights from sociology and economics of technology, *Technology Analysis & Strategic Management* 7, no. 4: 417–31.
- Schot, J. (1992), The policy relevance of the quasi-evolutionary model: the case of stimulating clean technologies. In *Technological change and company strategies: economic and sociological perspectives*, eds. R. Coombs, P. Saviotti and V. Walsh, 185–200, London: Academic Press.

- Schot, J. (1998), The usefulness of evolutionary models for explaining innovation, The case of the Netherlands in the nineteenth century, *History and Technology* 14: 173–200.
- Schot, J. & Geels, F.W. (2008), Strategic niche management and sustainable innovation journeys: theory, findings, research agenda, and policy, *Technology Analysis & Strategic Management*, 20(5), pp.537–554.
- Urban, G.L., Weinberg, B.D., Hauser, J.R., (1996), Premarket forecasting of really new products, *Journal of Marketing*, 60 (1), pp. 47–60.
- Yu, D. & Hang, C.C. (2010), A Reflective Review of Disruptive Innovation Theory, *International Journal of Management Reviews*, 12(4), pp. 435–452.