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Extended abstract submitted to the Transitional green entrepreneurs: Re-thinking ecopreneurship for the 21st century Symposium at Umeå University June 3rd - 5th, 2014

What is the role of start-ups and SMEs in the transition to green entrepreneurship?

BACKGROUND

Transition to green economy is widely seen as a necessary step to meet multiple challenges of our time. These challenges include climate change, deficiency of renewable and non-renewable resources and the recent economic recession. For example, the Organisation for Economic Co-operation and Development (OECD) identifies that strategies towards green economy have the potential to address economic and environmental challenges and open up new, sustainable sources for growth (OECD, 2011a). The development of cleantech business gives an indication of the potential of green growth. Despite the recession, global cleantech business grew almost 12% between years 2007–2010. By 2025, the annual growth rate is estimated to be 5.6% (BMU, 2012). However, cleantech is only a fraction of green economy. A holistic and systematic change towards green economy is a complex process, one that comes from various sectors and different types of technologies, but also from social changes and new ways of working, acting and networking (Geels and Kemp, 2007).

Eco-innovations can play a crucial role in achieving green growth, promoting sustainable development and maintaining the competitiveness of European countries (European Commission, 2011; OECD, 2011b). Eco-innovation has been defined to be “any form of innovation resulting in or aiming at significant and demonstrable progress towards the goal of sustainable development, through reducing impacts on the environment, enhancing resilience to environmental pressures, or achieving a more efficient and responsible use of natural resources.” (European Commission, 2011).

In general, innovations begin with the ideas or inventions. However, the broadness of the term means that innovations can emerge in many ways, with invention as one of the steps. Significant innovations represent or lead to societal and economic transitions (Andersen, 2008, 2009a, 2009b, 2011; Arundel and Kemp 2009; OECD 2009; Cheng and Shiu, 2012).

The relationship between policies and policy instruments and their role in the development of markets, technology, and economic growth has being studied widely (Kivimaa and Mickwitz, 2008; Fuad-Luke, 2009; Lovio, 2011; Papanaab et al., 2013). Less attention has been devoted to the actors

in innovation networks and their influence on other networks, policies and the eventual greening of the economy. Yet, there are clear signs that these interactions are becoming increasingly important.

Understanding the innovation networks requires focusing on the interaction and relationships between the elements and actors in the process, innovation ecosystem (Moore 1993). Famous examples of such ecosystems include Silicon Valley, Bangalore and the Japanese car industry. The innovation ecosystem incorporates not only established companies and entrepreneurs, but also universities and research institutions, capital investors and other financiers, skilled work force, active users and public and a multitude of services supporting the ecosystem activities. But the real dynamics are formed by the mobility of ideas and people and the overall culture of innovation, which encourages risk-taking. This whole creates potential for new entrepreneurship.

The Finnish innovation system in general has been considered successful, and according to World Economic Forum (2013), the country has one of the most innovative business environments in the world. In Finland, the share of R&D investment is about 3.8% of the country's GDP (OSF 2011). Innovation policy has been a key component in this successful development and, from e.g. the green economy perspective, the number of green patents in Finland has more than 4-folded between 1990 and 2010 (OECD 2013). However, the full potential of Finland in the field of eco-innovations, cleantech business or green growth has not been fulfilled yet. Especially SMEs have a substantial growth potential, and often start-ups and SMEs often have an agile approach when it comes to innovations and market needs. However, there are major research gaps with regard to radical sustainability-oriented (i.e. eco-) innovations, streamlined innovation methods, the role of SMEs in industry transformation and in sustainable supply chains, as well as a need for a stronger theoretical debate on eco-innovations of SMEs (Klewitz & Hansen 2014) .

In addition, the potential co-creation is large. By co-creation we mean "any act of collective creativity, i.e. creativity that is shared by two or more people" (Sanders and Stappers, 2008). Co-creation and its community, i.e. the network that is involved in the co-creation process, thus, becomes an important new type of ecosystem that can support innovations. Examples of co-creation and co-production, also known as crowd-sourcing, include such as Wikipedia and initiatives such as Transition Movements in the UK (Hopkins, 2011), eco-efficient/smart solutions using ICT in reducing the system's overall environmental burden by e.g. reducing energy consumption (see e.g. Peloton camp), and food and waste community initiatives (Ruokapiirit).

Transition to green economy, enhancement of competitiveness and promotion of innovations are not only Finnish challenges. For example, Europe's current top challenges are the economic crisis and the path to sustainable growth. The European Union (EU) framework programme for research and innovation, Horizon 2020, will pay special attention on SMEs, on acceleration of the commercialization and diffusion of innovations, and on speeding up time from idea to market significantly. In addition, Horizon 2020 addresses environmental challenges such as climate change and the depletion of resources.

AIMS AND RESEARCH QUESTIONS

Our study will bridge the existing gaps in eco-innovation and ecosystem research and to develop application to eco-innovations and their diffusions by studying experiences of Finnish co-creation communities, start-ups and SMEs, and by comparing them with international experiences.

This study supports the transition to green economy by examining the creation and diffusion of eco-innovations in business ecosystems, with special focus on growth entrepreneurship and emerging

ecosystems. Our main aim is to identify success factors for constructing and managing eco-innovation ecosystems in different circumstances (or stages of development) in order to improve the competitiveness of Finnish companies. In particular, the purpose is to examine the emergence of co-creation and to identify processes and tools that encourage co-creation.

Our main research questions are:

- How can innovation ecosystems support the creation of eco-innovations and competitiveness, i.e., transition to green economy? How should innovation policies be adjusted in order to take into account the changing innovation environment?
- How do inventions become successful eco-innovations in start-up communities?
- How do eco-innovation ecosystems bring new business opportunities? How to facilitate the creation of a fruitful ecosystem?
- How do eco-innovation ecosystems differ in Finland, Sweden and UK?

The project, financed by Tekes - the Finnish Funding Agency for Innovation, was launched in January 2014, and it will run till the end of 2015.

RESEARCH METHODOLOGY

Several methods are used in the implementation of the study. The theoretical analysis of eco-innovations and interpretations of innovation ecosystems as well as their relations to green economy is based on a literature study and expert knowledge. We use previous studies in order to examine the concept of eco-innovation and its interpretations, and to develop criteria for eco-innovations, which will be used in the screening of inventions of start-ups and searching for potential eco-innovations. Published studies in the field of innovation ecosystems form the theoretical background also for outlining the ecosystems under case studies in the co-creative municipalities. We also use literature and expert knowledge from Sweden and UK to make comparisons of ecosystems and to relate the study in international context.

The main research approach in the study is case studies. The cases under examination are based on data from Finnish growth enterprises i.e., start-up community and group of co-creation communities that are committed to ambiguous CO_2 emission reduction targets, so called HINKU targets. Within these, the cases are a joint purchase of lightning solution and design of innovative heating systems. Study material of start-ups is based on the data provided by the Aalto ACE (Aalto Center for Entrepreneurship) and it was selected due to the fact that it is an extensive database of inventions and start-ups in Finland including around 700 innovative business ideas.

A rationale for selecting case study as a main method is that it can be used to investigate a contemporary phenomenon in depth and within its real-life context, especially when the boundaries between phenomenon and context are not clearly evident (Yin, 2009, 18). Case studies are applicable here also because they address the exploratory “what” and “how” questions, and also cover the complex naturally occurring social conditions and processes (Hammersley & Gomm 2000; Laine et al. 2007; Yin 2003, 2009). In our study, case studies are used to facilitate and promote the creation of a new ecosystem that supports eco-innovation and green entrepreneurship. In the case study analysis, we examine the relationships of different stakeholders and networks in value creation, and the structure and dynamics of the ecosystem. In addition, they may indicate specific

features of an ecosystem where eco-innovations can emerge and succeed compared to the ecosystems of innovations without the green aspect. In order to detect these, we will develop and use a systematic framework that explores the salient features of each case.

In the implementation of action research, several tools are used. Two main tools, workshops as well as a relatively new IT-based application, AltoGame, will be used. Also face-to face contacts and interviews are used especially with actors in HINKU municipalities i.e. municipalities committed to ambiguous CO_2 emission reduction targets. AltoGame will be used to study and demonstrate the emerging innovation ecosystems and related conditions in all three cases. AltoGame form a set of social *learning games* for teams and individuals, which allows the group (i.e. the innovation ecosystem) to be more agile and interactive (www.altonova.fi). The anonymity and removal of real life hierarchies built in the game are essential elements in this. With the help of this tool, we will pilot a facilitated anonymous ecosystem creation process, and simultaneously study how this type of process supports building up new and wide ecosystem solutions creating new and more environmentally friendly business models. The AltoGame-method is also suitable for innovating new solutions and for sharing experiences and best practices. In the case study analysis, we analyze the linkages and relationships of stakeholders and conditions in the network that have been visualized by the AltoGame –tool. In our study, the facilitation process may lead e.g. to adopting a hybrid heating solution, which is totally oil-free. Hybrid solution is based on different renewal energy sources such as biomass (pellets, biogas), geothermal heat pumps, or solar energy. With hybrid solutions, better environmental performance may be reached as compared to single solution, but also more possibilities for companies, and better resilience of the system.

RESULTS

This research contributes to the national public objective of promoting the transition towards carbon-neutral society, green economy and environmentally leaner technology. For policymakers and businesses the study provides understanding on how eco-innovation ecosystems can be build up, and helps to recognize possible special characteristics and preconditions that such an ecosystem has. The study also allows understanding of possibilities of ecosystems arising in the sectors of green economy to be applied to other sectors of the society as well. The study will allow developing and testing a roadmap for the creation of agile eco-innovation ecosystems for the future. The results of the study will help the design and implementation of innovation policies in a rapidly changing innovation environment, but also the Finnish companies to find new business opportunities. As our research is in early phase, we have not yet produced novel results. However, based on our earlier research and literature, some preliminary results can be identified.

Eco-innovations have been defined by many, e.g. by the European Commission (2011). It sees that they are innovations resulting or aiming at significant and demonstrable progress towards the goal of sustainable development, through reducing impacts on the environment, enhancing resilience to environmental pressures, or achieving a more efficient and responsible use of natural resources. Different definitions have in common the idea that eco-innovation should benefit the environment, reduce the harmful impacts or to answer to ecologically specified sustainability targets (Triguero et

al. 2013; Cuerva et al. 2014). Closely related terms include such as cleantech, greentech and environmental technologies, but in fact eco-innovation definition is broad enough to cover innovations in goods, services, manufacturing processes and business models. Eco-innovations are significantly driven by market demand. Regulation is a complementary institutional factor especially for the diffusion of eco-innovation. (Wagner & Llerena 2011). This is partly because innovation has rarely been an explicit goal of environmental policies (Kivimaa 2008).

One tool to promote eco-innovations is public procurement. Finland adopted in 2013 a resolution concerning the promotion of new and sustainable environmental and energy solutions in public procurement. The aim is to lower energy and material consumption, to reduce harmful environmental impacts during the entire life cycle of products, services and buildings and to create incentives for the development and adoption of new cleantech solutions. Public procurement processes are highly regulated, and often it is difficult both to the procurers and suppliers to produce any new innovative solutions. Especially SMEs often lack know-how concerning the procurement process and good examples. In this project we work together with both supplying companies and municipalities and aim to create discussion allowing parties together find new solutions also for making public procurement more ecologically sound and still economically wise at the same time. Bringing different parties of ecosystem to open discussion is important, because in normal public procurement processes, providing and procuring new innovative solutions may not be easy. One interesting viewpoint is also to evaluate does the current public procurement process in fact even prevent new innovative solutions from SMEs to be taken into use.

Different roles of supply-side, demand-side and regulatory factors encourage the adoption of different types of eco-innovation (Triguero et al. 2013). In addition, collaborative networks with research institutes, agencies and universities are essential to drive all types of eco-innovation. Eco-innovation ecosystem is wide consisting of different types of public and private stakeholders (Fig. 1). Due to the limited resources, especially in SMEs, it is crucial to find the right collaboration partners. One key question to be further elaborated in our study is who are the main actors and stakeholders in the successful eco-innovation ecosystems, and what their relationships (formal and informal).

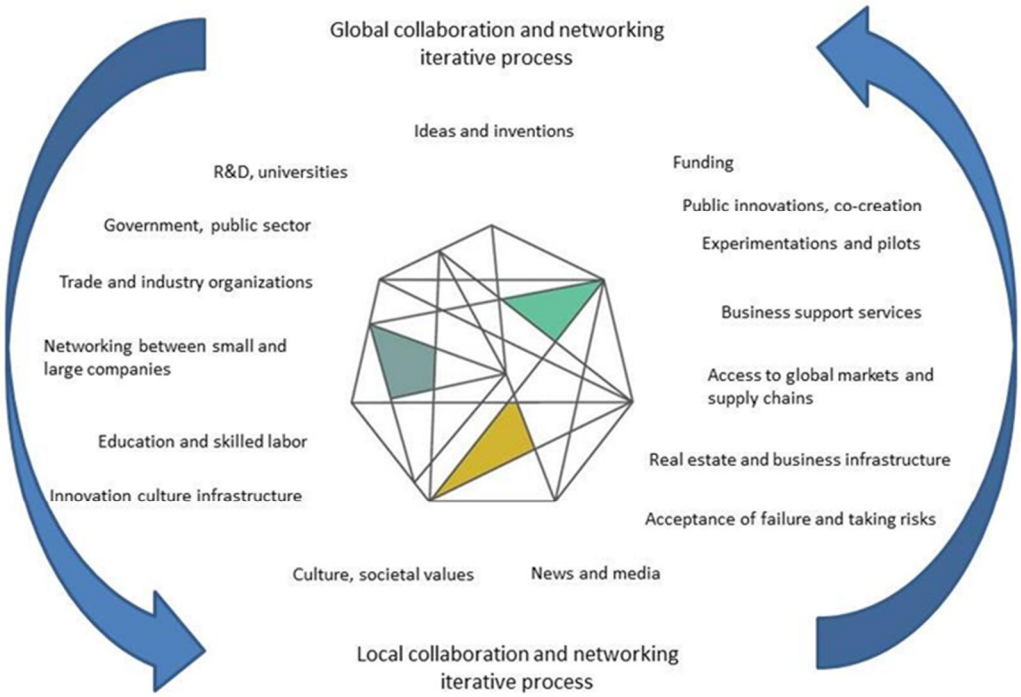

Figure 1. Innovation ecosystem framework. Source: Adapted from Hautamäki 2010 and Hwang and Horowitt, 2012.

Sustainability as well as green economy are rather difficult concepts. Reaching green economy in society produces multiple sustainability benefits (Table 1). When actively promoting eco-innovations (e.g. in our case ACE, where the aim is to use eco-innovation criteria as one selection criteria in advancing inventions to innovations and market access). However, when considering innovations, the true sustainability impacts are sometimes questionable or difficult to identify, even though methods have been created to calculate the environmental effects thus giving indicators for sustainability (Bocken et al. 2012; Consalez-Garcia et al. 2012). One method to calculate environmental costs and benefits is life cycle assessment (LCA). As it gives quantitative results, it is a useful method, but its application is crucial (e.g. what parameters are chosen). In addition, full LCA is very resource intensive and difficult to perform without expert knowledge. Due to the labour intensity of quantitative methods, qualitative methods have also been developed. One possible qualitative method for product analysis is design for environment method. The combination of several methods is probably the best method for environmental analysis of a product (Consalez-Garcia et al. 2012). Additionally, because in green economy, also other sustainability aspects than environmental aspects need to be considered, the need for using multiple methods for eco-innovation performance assessment is even bigger. Moreover, case-studies have shown that improved environmental performance at the micro-level does not necessarily mean an environmental improvement at the macro-level (van der Voet 2012). In addition to methodological issues, this is one aspect that needs further consideration when creating criteria for eco-innovations for inventions and start-ups.

Table 1: Green economy benefits (compiled on the basis of GGKP 2013).

Environmental benefits
Climate change mitigation
Improvement of resource efficiency
Reduction in fossil fuel dependency
Reduction of atmospheric and water emissions
Reduction in loss of biodiversity
Economic benefits
Improvement in economic growth, productivity and competitiveness
Accelerated innovation
Social benefits
Reduction of environmentally induced health problems and risks
Increased resilience to natural disasters, commodity price volatility, and economic crises
Job creation and poverty reduction
Improved regional equality
Improved access to environmental services and amenities (e.g. modern energy, water, sanitation and health care)

Currently, we are overusing our natural resources and exceeding the planetary boundaries in many ways (Rockström et al. 2009), and thus the achievement of green economy is a long-term challenge. Change in socio-technological system can occur through various types of processes, including reproduction, transformation and transition (Geels & Kemp 2007). In reproduction processes (also referred to as incremental changes), the system is improved but maintains its basic structure. In transformation processes, the development trajectories are re-directed through changes in regime rules, but the main actors remain unchanged. In transition processes there is a shift to a new socio-technical system and development trajectory, and the main drive comes from outside actors that develop radically new innovations. Similar typology also applies for eco-innovations. Incremental innovations improve the eco-efficiency of production processes and may also bring some environmental benefits to the consumption impacts, but radical innovations create massive environmental benefits to the production process and more widely to the whole system (Wagner and Llerena 2011). Transition to green economy requires actions and significant technological, behavioral and system changes in society's all levels, including citizens, companies, public sector and decision makers. However, often more radical innovations come from SMEs (Wagner and Llerena 2011). Therefore it is interesting to study more the eco-innovations in SMEs and the potential of collaboration (i.e. SMEs, large companies and municipalities) in public procurement and other processes that have a potential to increase demand for eco-innovations. In addition, it is fruitful to elaborate the criteria to be set for the inventions and start-ups. If the criteria are set too low, do we create only incremental innovations?

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