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Sustainable Innovation: A Competitive Advantage for Innovation Ecosystems

Kaisa Oksanen and Antti Hautamäki

“Yet in the end, sustainable development is not a fixed state of harmony, but rather a process of change in which the exploitation of resources, the direction of investments, the orientation of technological development, and institutional change are made consistent with future as well as present needs. We do not pretend that the process is easy or straightforward.”

World Commission on Environment and Development
In *Our Common Future* (1987)

In this article, we elaborate the emerging concept of sustainable innovation and analyze the relevance of innovation as a means to solve wicked problems and enhancing sustainable well-being. We also examine the changing conditions for innovation creation: building global knowledge hubs and local innovation ecosystems. As a result, the drivers of innovation and opportunities to utilize the untapped innovation potential of people outside traditional innovation contexts are expanded and diversified. Ultimately, the success of sustainable innovation constitutes its impact on the well-being of people and vice versa: sustainable well-being is an important source of innovation and growth. The article adds to the conceptual development of sustainable innovation and its motivation, which lies in combining competitiveness, the well-being of people, and inclusive solutions.

Introduction

Both national innovation systems and regional developers are struggling to meet the demands of the constantly changing global competitive environment. Countries, regions, and cities all over the world undergo major structural changes as the economy shifts from manufacturing towards services and as waves of socio-technical development shape the innovation landscape. To manage the structural change and to support innovations as efficiently as possible, local innovation environments need to be developed and strengthened. This article aims to stimulate discussion and provide new perspectives on innovation.

In this article, we posit solving wicked problems and generating sustainable well-being as prerequisites for innovation and as sources of competitive advantage for innovation and knowledge ecosystems. The changing drivers of innovation provide the sparks needed for new policies and processes worldwide to tap undiscovered innovation potential. Because innovation is often associated with problem solving, the special innovation challenges of today are related to wicked

problems: those challenges in life and society that are particularly complex, multi-faceted, and that require creative approaches. One common type of wicked problem relates to sustainable development. The World Commission on Environment and Development (WCED, 1987) defines sustainable development as: “development which meets the need of the present without compromising the ability of future generation to meet their needs”. Sustainable innovation, building on sustainable development, on corporate sustainability, and on systems thinking, can help us understand and solve complex and serious problems. Sustainable innovations emerge all over the world in eco-innovation business, in design, in peer-to-peer practices, in policy-making, and in sustainable lifestyles changes, but the concept needs systemic clarification. This article aims to elaborate the concept appropriately.

An Ecosystem Perspective on Innovation

Innovation tends to cluster in certain sectors or areas, which grow faster and often require structural changes (Fagerberg, 2006). Similarly regional development is shifting towards large clusters, cities, and metropolitan

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areas, and most of the value creation, R&D activities, and patenting take place in global level innovation hubs (Kao, 2007; Kim & Short, 2008). Creative hubs in the global economy produce considerable value for global value networks. They are well known and attract talent, firms, and investments (Florida & Gulden, 2005). They are capable of reinventing themselves in the changing environment. In them, we can find a dynamic innovation ecosystem where innovations emerge when different actors collaborate (Kao, 2009). Previously, we have argued that innovations require a special ecosystem that has top-level universities and research institutions, sufficient financing and a local market, skilled labour force, specialization, and cooperation among companies and global networking (Hautamäki & Oksanen, 2012; Oksanen & Hautamäki, 2014). Based on this view, there is a need to build up world-class innovation hubs that combine high quality of life and excellent business possibilities. This goal is achieved through intensive cooperation among local, regional, and national actors. The forces and resources must be gathered around local strengths and recombined into new industries. However, in reality, relatively few regions have exhibited this kind of renewal capability (Etzkowitz & Klofsten, 2005).

The term "innovation ecosystem" refers to a dynamic, interactive network that breeds innovation. In practice, the term can refer to local hubs, global networks, or technology platforms (Moore, 2006). It has roots in industry and business clusters (Estrin, 2009; Porter, 1998), in the conceptual evolution of innovation (e.g., Chesbrough, 2003; von Hippel, 2005), and in the Triple Helix approach to regional development and national innovation systems (Etzkowitz & Leydesdorff, 2000). In many studies, the emphasis has been on local and regional ecosystems and their development. The ecosystem approach emphasizes the position and roles of local and public actors in developing the innovation activity. For new firm creation, the hub-based innovation ecosystem led by a single firm has become the most prominent context given the numerous benefits associated with hub membership such as access to established markets, branding and reputational advantages, and access to intellectual property and technical know-how (Nambisan & Baron, 2012).

An innovation ecosystem is a network of relationships through which information and talent flow through systems of sustained value co-creation. The systems approach has been used to describe the multifaceted nature of innovation at various levels – national, regional, technological, and sectors – and to describe the pro-

cesses by which research capabilities build knowledge and then transfer the knowledge to support business development in the context of the Triple Helix of business, government, and academic interaction (Etzkowitz & Leydesdorff, 2000). The ecosystem metaphor also enriches the systems model with value and culture. The transformation of an ecosystem is characterized by a continual realignment of synergistic relationships of people, knowledge, and resources for both incremental and transformational value co-creation. Through relationships, value co-creation networks evolve from mutually beneficial relationships between people, companies, and investment organizations. A related definition of an innovation ecosystem is given by Estrin (2009): in her view, the innovation ecosystem is made up of communities of people with various types of expertise and skill sets.

Sustainable Innovation and Wicked Problems

Sustainable development has economic, environmental, and social dimensions (Harris et al., 2001). We call the emerging concept "sustainable innovation". Wicked problems (see Rittel & Webber, 1984) are complex issues where the solution requires extensive cooperation and many actors, but when managed successfully, the solutions provide a means to tap into a significant, long-term innovation potential. The role of innovation in solving great challenges such as climate change or water scarcity is indeed becoming increasingly important (Kao, 2007). Similarly the business models are changing together with innovation (Carlson & Wilmot, 2006). Pioneering entrepreneurs introduce new products and services, expand the range of global knowledge networks, and most importantly, challenge established business and innovation interests with new approaches (Auerswald, 2012). What is important for the solutions is the systemic nature of wicked problems. Therefore, sustainable innovations are holistic and avoid partial optimization. Solving wicked problems through innovation further enhances the need for new capabilities, because innovation is not grounded in convention, but it challenges the existing mindsets and ways of operating. Both innovation and wicked problems have to be dealt with in a context of uncertainty and risk, and both require collective actions (van Bueren et al., 2003).

In recent decades, wicked problems have been a hot topic with scholars and practitioners from different disciplines (Weber & Khademian, 2008). Given that public organizations, companies, non-governmental organizations, and citizens are all interested in creating solu-

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tions to wicked problems, more efficient identification of problems and more collaborative approaches to creating solutions are needed. Similarly, innovations are often produced through co-creation among diverse individuals and groups, not by institutions alone. Problem solvers often possess conflicting views of the problem, of solution methods, and of the legitimacy of possible solutions (Wexler, 2009). Thus, we argue that the best solutions are created when all stakeholders are able to find their role within the problem-solving network; this requires an inclusive approach to innovation. Ideation and discussions should take place in shared arenas, where organizations together with opinion leaders and other central figures guide the innovation processes and meaning creation (see Luoma-aho & Vos, 2010). Finally, we argue for inclusive innovation policy. It starts from the principle that all people should have the opportunity to develop their skills and look for creative solutions to the challenges they see as important.

Sustainable innovation takes sustainable well-being and sustainable development as the basic values, leaving economic growth with instrumental value. It also shifts the dominance and focus in the discussion from a national level to both local and global levels when the basic field of innovation activity is the innovation ecosystem and not the national innovation system.

Innovation is described as a lifecycle ranging from concept to practice (Crossan & Apaydin, 2010; Narayanan, 2001). There are four elements in the lifecycle of innovation: idea, invention, implementation, and impact. We call this approach the 4i model of innovation (Hautamäki & Oksanen, 2012). What keeps the 4i circle moving are the flow of ideas and the ongoing identification of wicked problems. In innovation practices, much emphasis is laid on the organizations' capability to gather ideas, to network, and to collaborate (McLean, 2005; Medina et al., 2005). However, ideation and networks do not produce innovation without motivation. Wicked problems are an important motivational source because, ultimately, innovation provides a solution to a problem worth solving. This point is often overlooked when discussing creativity or idea generation. Pure ideation rarely creates successful products; it takes a real, persistent problem, a genuine need that requires resolution.

Innovation creates new practices and leads to changes in the structures of organizations and in the actions of people. The impact stage is often ignored in innovation research, because innovation is considered ready when it is implemented. In addition, there is the general as-

sumption that innovations are always useful, valuable, and good in nature. These qualities are impossible to verify without considering the impacts of innovation. Innovation could be a success economically, but socially a disaster, because of its impact on social practices, as in the case of excessive marketing of infant formula in developing countries (Sethi, 1994). However, the goodness of innovation has not been widely studied. Some researchers have pointed out that it is possible that innovation is harmful or uneconomical from the point of view of an individual or a social system (Rogers, 2003; Rogers & Schoemaker, 1971), but the given nature of innovation needs further investigating (Simula, 2012). One driver for innovation has been sustainable development. Nidumolu, Prahalad, and Rangaswami (2009) have argued that there is no alternative to sustainable development, and the principle has challenged companies to develop products and services for new clean-tech markets, for better control over the lifecycles of products and services, for the use of recycled materials, for energy efficiency, and for improved quality of life. There are also more and more consumers who take sustainability as an important factor in their consumer intent and behaviour, which has increased sustainability marketing (Belz & Peattie, 2010).

Sustainable innovation has roots in sustainable development, and it is based on ethically, socially, economically, and environmentally sustainable principles. Similar principles can be seen in eco-innovation (Boons & Lüdeke-Freund, 2013; Hall & Clark, 2003; Rennings, 2000), in frugal innovation and engineering (Bhatti & Ventresca, 2012), in jugaad innovation (Radjou et al., 2012), and in the rise of the shared-value mindset (Porter & Kramer, 2011), but the wider concept of sustainable innovation needs to be thoroughly elaborated.

In business, innovation has been motivated by the need to create superior competitiveness in the marketplace. Traditionally, this has been accomplished through two basic strategies: cutting costs or creating products superior to those of competitors (i.e., cost leadership or differentiation strategies; see Porter, 1980). Sustainable innovation, however, offers a third competitive strategy: to create products or processes with market-desirable features, such as durability, locality, or material and energy efficiency. Innovations that contribute to a reduction of environmental burdens or to other specified ecological targets are often called eco-innovations, but the theoretical and methodological framework is diffuse (Rennings, 2000).

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Because consumers are demanding sustainable products and services and are willing to pay more for them, the market for sustainable innovation is growing. Sustainable innovation assists customers and citizens in managing their lifestyles by enabling them to live happier lives in ways that support sustainable development. Sustainable innovation provides the foundation for future business; it does not simply reflect ethical responsibility. The tasks that sustainable innovation is geared towards – the wicked problems – have global significance.

In summary, sustainable innovation has three defining characteristics: i) it contributes to sustainable well-being, ii) it is systemic, and iii) it is inclusive. Each characteristic is described in greater detail in the subsections that follow.

1. It contributes to sustainable well-being

Sustainable innovations are evaluated according to their impact on sustainable well-being. We elaborated the concepts of sustainable well-being and innovation when studying the competitive advantages of the Helsinki metropolitan region with the Demos Helsinki think tank (Alanen et al., 2010). Our argument is that the well-being of people creates competitive advantage for regions and cities, not vice versa.

The three basic elements of sustainable well-being are quality of life (including happiness), a sustainable economy and balanced relationship with the nature (sustainable development). These are modern aspects of the Aristotelian good life (see also Castells & Himanen, 2014). It is important to emphasize the difference between this new concept of sustainable well-being and traditional welfare. The welfare refers to objective well-being such as health and economic security, whereas sustainable well-being is related also to the subjective experience of well-being. The other difference is that well-being is an active concept and contains the capability to act in society (Sen, 1999). Traditional welfare means compensating for handicaps and it is a passive concept. In our analysis of the competitiveness of the Helsinki metropolitan region, we state that the sustainable well-being of citizens is the real competitive advantage of the region. In practice, the approach of sustainable well-being can actualize, for example, in the design of physical living environments, which shapes the complexity, sociability, and ecological footprint of everyday life. Another example is the planning of individual houses and commuting choices,

to which innovative policy incentives can play a particularly important role in both sustainable household choices and business development in the transition phase to a more sustainable socio-economic model, when green housing and traffic solutions do not have similar scale economies as the established solutions (Hämäläinen, 2013). Examples of such innovations include the hybrid car incentive scheme in the United Kingdom and the solar power feed-in tariff in Germany (Hämäläinen, 2013).

2. It is systemic

An innovation or its impact is difficult to predict, although favourable conditions can be created to encourage its emergence. Leaders at national, regional, and organizational levels are often challenged by this reality because establishing such conditions typically requires long-term, widespread, and systemic changes (e.g., Geels & Schot, 2007). Similarly, solving wicked problems in a sustainable way requires a systemic view.

We face systemic change and systemic innovations in many challenges and wicked problems of the modern society: energy issues, transportation systems, health care systems, reforms in agriculture, and waste systems, to name but a few. Systemic innovations are related to changes in socio-technical systems and are often described as leaps or transitions. Systemic innovations are related not only to technological change but also to societal and cultural changes: changes in user contexts and symbolic meanings. In addition, systemic innovation often forms the core of national innovation strategies. The acceptance of the system is affected by the general values of society and the development of national and international trends, such as awareness of climate change and sustainable development. As a whole, systemic innovation includes changes in the market, consumer behaviour, politics, and culture (Geels, 2010; Geels & Schot, 2007). The systemic collaboration model developed in the Netherlands, referred to as "transition management", has been widely used to remove obstacles to sustainable transformation, for example, by guiding the transformation of transport and energy systems so that they become sustainable in an all-encompassing sense (Elzen et al., 2004). Another example, the smart grid, has potential to lead to interesting future practices; the smart grid emerges at the intersection of the Internet and energy management. It uses digital technology to manage the generation, transmission, and distribution of power from all types of sources along with consumer demand (Nidumolu et al., 2009).

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3. It is inclusive

In the first decade of the 21st century, innovation researchers emphasized networked, open, and diverse forms of innovation (e.g., Chesbrough, 2003; von Hippel, 2005). Similarly, in the past few years, the World Bank, the Organisation for Economic Co-operation and Development (OECD), and many other development agencies and national governments all over the world have promoted and launched inclusive innovation approaches and actions such as skill development and financial support for small enterprises. Inclusive innovation implies that all individuals should have the opportunity to use their potential to seek creative solutions to the challenges they deem important. A background for this argument is the notion that the most important resources of innovation are creative, skilled people, both in the workplace and in everyday life. Inclusive innovation could be summarized by the principle “innovation for all”. This means not only that all people must have some opportunities to innovate but also that innovation must serve and benefit all people.

Inclusive innovation supports collective wisdom and the crowdsourcing of problems (Surowiecki, 2004; Weinberger, 2011). This kind of development and other forms of mass collaboration have a deep impact on economies, businesses, and governments. In a deeper sense, sustainable and inclusive innovation promotes new forms of democracy, where citizens have the right and the opportunity to be creative and to contribute to improvements in services, products, and the structure of public organizations such as municipalities, schools, and hospitals (Benkler, 2006; von Hippel, 2005).

Conclusions

Innovation ecosystems are like natural ecosystems, consisting of specialized, diverse entities that “feed off, support and interact with each other” (Bahrami & Evans, 2000). They sit within much larger environments that include municipalities, governmental organizations, legislation, and regulation. This context presupposes a cross-functional cooperation between all partners and shareholders (Hautamäki, 2006). Especially important is the cooperation between firms, uni-

versities, venture capitalists, and other financiers, municipalities, and citizens.

In a global economy, human resources tend to cluster into attractive knowledge hubs. The major reason for clustering is that concentration of talents accelerates creativity and innovation (Florida, 2002; Saxenian, 2006). Richard Florida’s creative class theses have been criticised widely (e.g., Peck, 2010), but it is important to understand that definitions of creativity and innovativeness are very broad. In this article, we argue that, although knowledge hubs have many success factors, an increasingly important factor is the capability to solve wicked problems. We have also argued that producing human-centred solutions for wicked problems is impossible if the majority of people are out of reach of innovation activities. In innovation policy, there is a need to move from the national level to places where people work together, in other words, to local ecosystems, where sustainable innovation policy is localized and where people and their networks serve as the primary sources of innovation activities. Understanding people and the flow of ideas as a basis of innovation activities challenges traditional innovation policy, and requires a systemic approach and deep institutional cooperation and interaction (Chesbrough, 2003; Pentland, 2014; Seshadri & Shapira, 2003). This approach requires sustainable and inclusive innovation policy in which all innovation activities are considered in terms of how they contribute to quality of life and to solving wicked problems. More research on impact and sustainability of innovation is continuously needed; for example, the sustainable nature of social innovation is generally taken as a given, but in practice, it needs critical research to verify the usefulness and valuableness of any innovation. In addition, no universally accepted definitions of sustainable innovation or indicators to measure it exist – more research on sustainability considerations, both in the private and in the public sector, would be useful. In this article, we have outlined some modifiers for sustainable innovation. Most importantly, sustainable innovation outlines significant changes in mindsets: all the effects of innovation must be evaluated according to their contribution to sustainable well-being.

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Kaisa Oksanen, PhD, is a Senior Specialist at the Prime Minister's Office, Finland. Her key expertise is related to foresight, socio-technical change, and innovation ecosystems. Previously, she worked at VTT Technical Research Centre of Finland, working with foresight and bio-economy transition. Her background is in social and political sciences, and she has done research on systemic innovation, futures studies, science and innovation policy, service innovation, and sustainable well-being. She has also worked as a research coordinator and innovation researcher in the Agora Center at the University of Jyväskylä and in Finland's Futures Research Centre at the University of Turku.

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