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Self-Renewal Capacity and Economic Growth

Toni Saarivirta

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Abstract

This paper adopts the point of view that a crisis will face a person, organisation, region or country at some point in their life span or history. The question is how to prepare for the crises and recover from them afterwards? Some of us recover better than others and in a shorter time. The concept of self-renewal capacity will be introduced here as a tool to prepare for the future. Three economic theories: neoclassical and endogenous growth theories, and evolutionary economics based theory are used here as reference points in search of self-renewal capacity. The results show that endogenous growth theory gives more room for self-renewal capacity than does neoclassical growth theory, but, nonetheless, several questions, such as the dynamic of economies, remain unsolved. Evolutionary theory, however, fits most eminently when defining the concept. Self-renewal capacity starts clearly from an individual level learning processes and grows in time, to consider firms, organisations, institutes and regions. Exploitation, exploration, absorption, integration and leadership, together with social capital, are at the core of self-renewal capacity. Together with localised technological knowledge and collective knowledge, self-renewal capacity can combine bottom-up and top-down approaches.

Keywords

Self-Renewal Capacity, Growth Theories, Evolutionary Economics, Regional Development, Localised Technological Knowledge, Collective Knowledge

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Note on the author

Toni Saarivirta is a PhD who currently works as a senior researcher at the Department of Regional Studies, Research Unit for Urban and Regional development Studies (Sente) in the University of Tampere, Finland. Innovation studies form a large part of his work. Dr Saarivirta's work has been focusing on education and innovation, specifically the economic impacts of education and research for regions and regional innovation policies and strategies as well as innovation systems and policies, economic growth and the spatial mobility of university graduates. At the moment Dr Saarivirta is working on medical innovations. In years 2004-2005 he worked as a visiting research fellow at the Manchester Institute of Innovation Research at the University of Manchester in the UK.

SELF-RENEWAL CAPACITY AND ECONOMIC GROWTH

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Abstract

This paper adopts the point of view that a crisis will face a person, organisation, region or country at some point in their life span or history. The question is how to prepare for the crises and recover from them afterwards? Some of us recover better than others and in a shorter time. The concept of self-renewal capacity will be introduced here as a tool to prepare for the future. Three economic theories: neoclassical and endogenous growth theories, and evolutionary economics based theory are used here as reference points in search of self-renewal capacity. The results show that endogenous growth theory gives more room for self-renewal capacity than does neoclassical growth theory, but, nonetheless, several questions, such as the dynamic of economies, remain unsolved. Evolutionary theory, however, fits most eminently when defining the concept. Self-renewal capacity starts clearly from an individual level learning processes and grows in time, to consider firms, organisations, institutes and regions. Exploitation, exploration, absorption, integration and leadership, together with social capital, are at the core of self-renewal capacity. Together with localised technological knowledge and collective knowledge, self-renewal capacity can combine bottom-up and top-down approaches.

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1. Introduction

The basis of the search for a concept of ‘self-renewal capacity’ starts from the point of view that a person, organisation, region or country faces a crisis sooner or later. However, a crisis differently affects different actors: some survive better and are stronger after it, but some actors decline even more. This paper adopts the approach that crises simply cannot be avoided, but one can be prepared for them by developing ‘self-renewal capacity’, the concept to be defined later in this paper.

There is much literature on economic recessions and crises that emphasises the nature of strategies and development policies developed for future planning. Planning the future is generally based on history and the ideal of avoiding mistakes made in the past. However, strategies and policies developed in search of and the making of the better times do not often evolve coincidentally with the existing world.

This paper will put flesh onto the bones of the concept ‘self-renewal capacity’ by using three theoretical frameworks as platforms and reference points in search of it. The primary research question concerns how the three main economic theories of growth and economic development view the concept of self-renewal capacity. Is there room for the concept as such in the theories used in this paper? The three theories used here are ‘neoclassical growth theory’, ‘endogenous growth theory’ and ‘evolutionary economics’ based theory. By taking a closer look into these three theories, and their alternative ways of negotiating such internal variables as sources of economic development and growth, the discussion of ‘self-renewal capacity’ may begin.

This paper is a part of an ongoing project titled ‘Self-Renewal Capacity of Clusters: Three Level Analysis on Resilience and Innovation Policy (Sere)’ in the Research Unit for the Urban and Regional Development Studies at the University of Tampere. The aim of the paper is to look at the Sere-project’s approaches in a wider perspective, and to provide background and a deeper understanding of the economic development and growth to

support the project, even if the project's main approaches are not focused directly on economic growth.

2. Theory number one: neoclassical growth theory

It is not far wrong to say that the father of a modern neoclassical growth theory is Robert Solow. Solow's (1956) idea was to explain economic growth by taking into account also technological improvement, i.e. allowing it to determine growth outside the previous, so called post-Keynesian theory, where the interventions taken by public sector (increase of public demand) were seen as the main drivers for economic growth.

Starting from the classics, it has been under investigation for a long time to study why growth rates vary in different countries and what are the underlying factors in building economic development. The basic assumption is that the increase of factors of production is the easiest way to achieve greater economic growth. Traditional factors of production are:

- 1) natural resources
- 2) physical capital and
- 3) labour

Natural resources comprise land and other resources taken from Mother Nature. Farmers can increase their production by farming more land up to a certain point. The short definition for physical capital is machines, buildings and equipment. However, the wider definition embraces financial capital (money and stocks in a market), real capital (equipment controlled by state needed in production processes) and land and other resources (Fagerberg, 1994; Pekkarinen and Sutela, 1996; Woolcock, 2001). But the three factors of production mentioned above have for long been the cornerstones in defining the sources of economic growth.

In neoclassical growth theory models the assumption is, that in the long run, with diminishing returns to capital, a country's per capita growth rate tends to be inversely related to its initial level of income per person (Barro, 1989). In other words, this would mean that countries should converge over time and thus, inequality between countries should reduce. However, empirical evidence does not support this assumption. According to Barro (1989), after the post-war period per capita growth rates in 100 countries are uncorrelated with the starting level of per capita product. If the empirical findings do not support the assumptions of neoclassical growth theories, what could be the reasons for that?

The first thing that crosses the mind is that the theory is poor or not well enough developed. In neoclassical growth theories, the main problems are the linear ways of thinking about how the world is being created. If input is about to increase, it has a direct impact on output. And the impact is also positive. The basic rule is more resources, more outcomes. However, it is not as simple as that. There exists abundant literature claiming that a process of production or such like cannot be moved from one place to another with total ease and flexibility. And this is also the explanation for why the convergence between countries, as neoclassical theories would suggest, does not happen. In every case, the observed phenomenon is related to its environment, such as people, infrastructure, political atmosphere etc. One of the classic examples is that there is bank in a small region and the bank is producing good results in its financial activities. Very often the focus of attention is on the director of the bank. In a small bank the director will tend to be extremely good at what he does, and he invests the bank's money wisely by considering people's needs. If the small bank is part of a bigger consortium, the director is usually moved to a bigger bank and to a bigger region. Very often, the director of a small bank does not succeed in a bigger

bank. Why is this? This is because of the director being moved from his context in a small region where he has no shared experience with the new people (customers) he is supposed to interact with in a bigger region. In a small bank the director knew if it was wise to lend money to a farmer whom he has known for a long time and who wanted to invest in farming machines, for example. In a bigger region, there is an absence of common history.

The second huge problem in neoclassical growth theories is that they take the relationships of factors for granted and do not allow for individual decisions. Every economic agent is supposed to seek profit maximisation and therefore all the actions taken by the actors are based on finding the best economic situation. However, this is not the case in every situation. One can study ancient languages for the pure pleasure it gives and not because of looking profit. Or people can work for charity etc. Not all actions are based on an economic way of thinking.

The third problem in neoclassical growth theories is the highlighted role of technological change as an exogenous factor. Especially in Solow's formulation, technological change is part of economic growth, but it is an exogenous factor and hence it is called a 'public good'. Public good means that it is available for everyone, in this case technology, and who ever can, may simply start to use it. Besides the exogenous nature of technological change, Solow and neoclassics have many assumptions, such as perfect markets, perfect knowledge in the markets, utility maximisation, no spillovers, and positive and reducing marginal revenue (Solow, 1956; Fagerberg, 1994; Nelson, 1998; Firth and Mellor, 2000). One could easily argue against a number of these assumptions, for example, perfect markets and perfect knowledge in the markets, but such assumptions are fundamental to this mode of analysis.

The fourth, and certainly not the least, problem in neoclassical growth theories is how they treat knowledge as a factor of production. One of the factors is the labour force, but knowledge, human or intellectual capital (depending on ones definition) is in some manner embedded into the labour factor. On the other hand, considering the labour force as such, the quantity (or quality) of knowledge among the labour force is in any case not diversified. This is huge problem, and will be discussed later, together with endogenous growth theory.

Solow's neoclassical growth theory has been able to empirically explain two thirds of economic growth. His model has been widely used for decades and it still is (Yamarik, 2006). However, more recently the focus on studying economic development and growth, both on a national and regional level, has been more on knowledge, knowledge spillovers and innovations.

3. Theory number two: endogenous growth theory

Because Solow's theory could not explain all of the economic growth, new theories were developed. One of these is the new theory of growth, also known as endogenous growth theory, developed by Paul Romer. Romer's (1986, 1989) main argument is that technological change is not 'mana from heaven' and its rate and direction can be directed. If this is the case, technology can then be made endogenous to growth, rather than being an exogenous factor as in Solow's model. In addition to this, human capital and investments in innovations can then be observed to be crucial in the process. The new growth theory sees knowledge as a public good (Romer, 1990; Harris, 2001; Juniper, 2002). Traditional goods are rivalrous and excludable; they are also privately produced and they can be bought on rivalrous markets. However, public good (in this case knowledge) is available for everyone. Once the technology for producing goods is presented, the technology then becomes available for others. Of course patents provide some protection to intellectual property, but over time, patents expire and this protected knowledge is available for others to use. In contrast, human capital is rivalrous and excludable. A person can only physically work in one place at one time. In general, new growth theory stands in

stark contrast to the law of diminishing returns. That is because the law of diminishing returns suggests that productivity decreases if we increase the inputs. However, over the last 100 years, productivity in developed countries has increased. The new growth theory attributes this to innovations and knowledge spillovers.

Education and its contribution to economic growth

For simplicity, instead of separating them this paper places human capital and knowledge together, and uses the concept of 'education'. Education, in this sense, will be formed from a number of years in formal schooling or from certain levels of education (e.g. primary, secondary or university level education). Education is then a proxy, which allows statistical analyses to be used. The early scholars in this respect, such as Jacob Mincer (1958), Theodore Schultz (1961), John Vaizey (1962) and Gary Becker (1964, 1975), have emphasised that investments in education show are realised in terms of higher salaries. However, this so called human capital theory pays too much attention to linearity, and therefore many aspects of the phenomena are missing. Years of schooling as a measurement is not an ideal way to approach human capital and knowledge, but still it has been the most used method when estimating the rates of return to schooling. There are number of empirical studies concerning the impact of education on economic growth. Lin (2003), for example, found in his study in Taiwan that the contribution of education (human capital) with economic growth between years 1965-2000 was 24.77%. Lin's study is based on an augmented Solow model estimation, using such factors of production as physical capital, labour force and human capital. The average contribution of physical capital to economic growth was 15.66%, labour force 22.3% and technical progress 37.27%. Lin (2004) has also studied the role of higher education on economic growth in Taiwan by using a similar augmented Solow model. This study is based on the same period and uses similar data in his latter study, Lin (2004) focuses on higher education, and in particular on different types (disciplines) of higher education. The results of Lin's study show that higher education overall has had a significant effect on Taiwan's economic growth given the fact that one additional percentage point of higher education stock increases real output as a whole by 0.19%. Lin's study also shows that engineering and natural sciences play a more crucial role in this process (one additional percentage point of engineering and natural sciences increases real output by 0.9%), while disciplines such as the humanities (-0.3%), business and social sciences (0.04%) and agricultural sciences (0.07%) have less impact on economic growth. The humanities' negative coefficient (which is not statistically significant at 10% level, but still remarkably high) actually would mean that it has a reverse effect on economic growth. This, on the other hand, taken in this way, would give interesting signals to the politicians who make higher education policy! But it has to be remembered that not all impacts of education can be measured in money and therefore be taken account in growth accounting as such.

Petrakis and Stamatakis (2002) studied the impact of human capital on economic growth in 24 countries. They divided countries into three categories, i.e. advanced countries (OECD), developed countries (OECD), and less developed countries (non-OECD countries). They also divided human capital into three different categories in terms of education (primary, secondary and higher education). Factors in their production function were physical capital, labour force, human capital and the average working time of employees. The study by Petrakis and Stamatakis suggests, that primary and secondary level education are more important for economic growth in less developed countries than in OECD countries. Economic growth in OECD economies depends mainly on higher education.

Asteriou and Agiomirgianakis (2001) studied economic growth in Greece between the years 1960-1994 with production function analysis. The factors in the function were GDP

per capita, human capital (in terms of enrolment rates to primary, secondary and higher education), and public expenditure on education relative to total public expenditure. They discovered that co-integration between GDP and education exists, and that primary and secondary level education are more important for economic growth than is higher education.

Self and Grabowski (2004) studied the impact of education on India's economic growth between the years 1966-1996. Their study was based on 'Granger causality' by testing the significance of education for per capita GDP. Only primary and secondary level educations were significant in their study.

Overall, many studies of the relationship between education and economic growth have concluded that there is a strong relation between these two. However, one of the most interesting findings of these studies is that primary and secondary level education seem to be more important for economic growth than higher education in developing countries. What could be the interpretation for this kind of result? One could say that the explanation concerns the manner in which human capital and knowledge is used. Human capital and knowledge by themselves do not do anything; the essential question concerns how they are used. More advanced countries can use human capital and knowledge more effectively than less developed countries; and that is because more advanced countries already have more people with human capital. Because the process is accumulative, it is important to establish the basic structures before adding more knowledge on top of the old knowledge.

4. Theory number three: evolutionary economics

Evolutionary economics is an approach that uses terminology originally familiar in biology. However, the interpretations are partly different from those in the natural sciences. The field of evolutionary economics is interested in looking at the longer time-lines of specific phenomena, such as the development and evolution of industry and technology, but also wider perspectives, such as the dynamics of an economy as a whole. Evolutionary economics is famous for its strong criticism of the neoclassical way of thinking, especially equilibrium and 'steady state' assumptions, and provides alternative insights from which to view economic development. (see for example Dosi and Nelson, 1994; Dosi, 1997; Metcalfe, 1998; Cantner and Hanusch, 2002; Nelson and Winter, 2002; Fagerberg, 2003; Metcalfe, 2004; Loasby, 2007) The criticism is discussed in more detail later in this section.

According to Nelson and Winter (2002), there are three fundamental questions concerning the economy that people have been interested in ever since the era of Adam Smith. The first question concerns how an economy can be directed (or even whether it can be directed)? If the market economy is free (as it is supposed to be), is there any way to lead or direct it in a certain direction? The second fundamental question has for long concerned the relation of prices, inputs and outputs: how does that relation explain the prices of labour costs and land? The third question, where evolutionary economics in particular steps in, concerns how to understand the dynamics of economic development?

It has been argued (e.g. Nelson and Winter, 2002) that evolutionary economics was a growing field among economists in the era before World War II. One of the pioneers of the approach was Joseph Schumpeter. This Austrian economist proposed in his early work that the driving forces in an economy are innovation and competition. Competition pushes economic agents (in a Schumpeterian world: firms) to give their best effort to survival and innovations will occur because of competition. If a business is going well, one cannot lie down and take it easy, because others are just behind and about to catch you sooner or later. On the other hand, this leads to a 'creative destruction' which cleans the air around business environment and markets; e.g. firms that cannot renew in an ever-increasing competition will vanish and be replaced by new firms. The idea in a Schumpeterian way of thinking goes like this: a new business activity begins. A firm comes to the market with a

new idea and starts to conduct its business. After a while, the firm will have competitors imitating the original business idea. One understands that the situation cannot continue like this forever, because there would be over-supply in a market. Prices start to fall and the business begins to lose its profitability. Natural market mechanisms then dismiss the firms that do not compete successfully. However, more important than the natural market mechanism is that, after the business field has stabilised, a new entrant or some of the existing firms present a totally new approach to the conduct of the business. This new approach can be a new product or process that changes the whole business environment. The firms that can adapt to the new situation will survive, but the others they will be eradicated from the field of business again. (Malerba and Orsenigo, 1995; Cantner and Hanusch, 2002; Nelson and Winter, 2002; Fagerberg, 2003; Metcalfe, 2004.) In a Schumpeterian world, new innovations keep the businesses and economies in a dynamic mode which is constantly out of equilibrium.

Neoclassical economic theory and the assumption of 'perfect market' and equilibrium

Evolutionary economics heavily criticises neoclassical economic theory. Perhaps the decisive mass of the critics opposes the neoclassical assumption of rationally behaving economic agents (Loasby, 2001, 2002; Nelson and Winter, 2002; Fagerberg, 2003). Neoclassical theory assumes that every agent tries to maximise their profits, and that this also guides their behaviour. Neoclassical theory also assumes that agents are homogenous and have perfect information on the market when taking decision.

The assumption of perfect information on the market and everyday living tends to be untenable. One could argue that most people realise that they do not have all the information needed for making the decision, and the decision will be made on the basis of current information and previous knowledge. This is also the point in time when you may choose wrongly, and after the moment has passed it cannot be recovered. Evolutionary economics is interested in these 'on the edge' situations and what will happen afterwards, and that on the other hand, having taken another choice, the history would have followed different routes.

Another criticism addresses the neoclassical assumption of equilibrium (Dosi and Nelson, 1994; Fagerberg, 1995; Nelson, 1995; Lambooy, 2002; Nelson and Winter, 2002; Freeman, 2003; Martin and Sunley, 2006). In a neoclassical world an economy is considered to be in balance. And if it is not, it is off-balance because of an external shock, and sooner or later it will again return to balance. Now, evolutionary economics sees that an economy is dynamic and moving all the time, and that therefore there is no balance at all. In evolutionary economics, there is no room for optimum, because if economic agents, for example, live in equilibrium, one has no incentive to make more effort. Why would such an agent do so, since they are already happy with the situation facing them. According to a Schumpeterian way of thinking, this simply cannot be the case. Competition drives people to put more effort into developing the things they are doing at the moment, because otherwise, they will be left behind. This also provides the dynamic for the whole economy to grow.

Path-dependency, variety, selection, adaptation and emergence

Evolutionary economics is interested in looking at long time-scale phenomena, such as the development of specific industries. Things do not happen suddenly, and it takes time to come to the present point of development. It is relevant to study and explain why something exists and how it became what it is today (Dosi and Nelson, 1994). Dosi (1997) suggests not believing that 'x' exists because it is a function of 'y'. Choices made in the past affect the situation at the present. This leads to a path-dependence since, when something was chosen, for example, a certain type of development policy for a region, other options

were dismissed. Wrong decisions may lead to 'lock-in' situations, and taking another path entails a long time-scale. And, as Lambooy and Boschma (2001), have stated, in terms of regional policy new development paths cannot be planned or even foreseen. Therefore, the options for policy-makers to significantly change the course of development are heavily limited.

When making a choice, the variety of existing possibilities is most important. If one has a large variety available, it gives multiple alternatives to choose from. After having chosen the best options from the existing variety, the total range of available variety is reduced. Therefore, new variety in the long run is needed to continue selection processes and so avoid 'lock-in' situations (David, 1994, 2007; Fagerberg, 2003). A consequence of the selection is adaptation (Metcalf, 1998). Adaptation is about the capacity to respond to changes in a selection environment in an appropriate way, but not everything will be adapted. This is due to the fact that, if all units of selection would adapt, it would kill variety and evolution. Thus, there is no reason to believe that all business units adapt identically to perceived market pressures. The last concept to be discussed under this paragraph, emergence, is an end result of the long run evolution of different options to be chosen. Cantner and Hanusch (2002) call emergence a mutation, wherein different mutations have already been enacted through selection processes. Emergent mutations either spread or vanish. When phenomena develop together, like policies and emergent economic transformation, it can be called co-evolution (e.g. Dosi, 1997; Boschma and Sotarauta, 2007).

In an evolutionary world, selection from the variety of options or opportunities is often influenced by the notion of fitness (Dosi and Nelson, 1994; Dosi, 1997; Cantner and Hanusch, 2002). This means that the history is always present when making the selection. Actors know, for instance, the previous technology, and, therefore, this makes it easier to continue on the same (earlier decided) route. A classical example of this is the development of the car industry (Dosi and Nelson, 1994; Dosi, 1997). At some point, there were three alternative ways to provide the energy for driving cars: gasoline-fuelled engines, steam engines, and batteries. Gasoline-fuelled became dominant, even if the other two options could have been chosen to be developed as well. However, the technology based on developing gasoline-fuelled engines seemed to be the most promising, and engineers decided to carry on with this path, the results of which we see in our everyday living.

Economic growth and systems of innovation

The so called 'Nelson and Winter models' see firms as main actors in an economy (Nelson and Winter, 1974; Dosi and Nelson, 1994). Firms represent competition at its best, and the gaining of more profit pushes firms into dynamic processes. Successful technological innovation generates profits for the firm making it, and leads to capital formation and growth of the firm. Usually, the growth of firms increases labour demand and, in the long run, it increases wages. Firms are, therefore, encouraged to either develop, or at least use, new technologies to trade-off labour intensity towards capital intensity. Metcalfe (1998) sees that, in the heart of economic evolution is a non-equilibrium account that explains why the world changes. Economies grow as a consequence of their structures changing. Economic growth is also a micro economic diversity translated into macro economic change, and it is endogenous by nature. Innovations create a basis for the variety on which evolutionary processes depend.

Since the 1980s there has been a growing body of literature on 'Innovation Systems' (e.g. Niosi et al., 1993; Metcalfe and Ramlogan, 2006). Within this concept, processes of innovation have been attempted both at the national and regional level. One of the very often used definitions of an innovation system is by Niosi et al (1993). According to them, an innovation system is:

“the system of interacting private and public firms (either large or small), universities and government agencies, aiming at the production of science and technology within national borders. Interaction among these units may be technical, commercial, legal, social, and financial, inasmuch as the goal of the interaction is the development, protection, financing, or regulation of new science and technology.”

On the other hand, Christopher Freeman’s 1987 definition was that national systems of innovations are:

“the network of institutions in the public and private sectors whose activities and interactions initiate, import, modify, and diffuse new technologies.”

Using one or another specific definitions, the overall concept of an innovation system has been widely used to explain differences in innovative performances in different countries. According to the concept, combinations of institutions involved, as well as their interactions, determine the processes of accumulation of capital and technology. Knowledge, especially tacit knowledge, plays an important role in innovation systems, as well as routine-based learning by doing. Due to that, innovation systems are national, since cultural differences determine our daily life, and, therefore, at least national views are needed (Lundvall, 1998; Metcalfe and Ramlogan, 2006).

Soon after general acceptance of the systems of innovation concept, several scholars started to apply it on a regional level, but nevertheless a specific definition is hard to address. Some may say that a regional innovation system is a national innovation system on a smaller scale, but, on the other hand, this is not so. A ‘top-down’ view of regional innovation systems leans more on a national innovation system, while the ‘bottom-up’ view considers regional differences starting from the localised communication patterns as well as localised and shared knowledge. The most common problem in using the concept of a regional innovation system is that a ‘region’ is a more difficult entity to define than a ‘nation’ or ‘state’. Labour mobility together with the transactions of financial assets, for example, within and outside the region, are a great deal more challenging to determine than compared to a national level. However, regional path-dependence and ‘lock-in’ processes are obvious and, therefore, regions in themselves are different from the overall sum of them as counted together. This is why regions should be analysed as single units when necessary. (Boschma and Lambooy, 1999; Boschma, 2005; Crescenzi, 2005; Howells, 2005; Iammarino, 2005; Boschma and Frenken, 2006)

5. Defining ‘self-renewal capacity’ and putting it into a map

Sotarauta (2005) and Ståhle (1998) have presented a concept called self-renewal capacity. According to Sotarauta (2005), self-renewal capacity represents a set of processes that can be intentionally designed on the one hand for the future, but on the other hand, adaptation is at the core. Self-renewal capacity can be seen as a set of capabilities aimed at renewing personal, organisational or even national resources. Such capacity is a resource formed of a) the amount of work a system can perform, b) the power of receiving ideas and knowledge overall, and c) the ability to perform or produce something to be used in preparing for the future and in facing future crises.

Ståhle (1998) sees self-renewal capacity as an organisation’s overall capacity to master changes in its strategies, operations and knowledge. This, on the other hand, is due to an organisation’s prowess in managing information, knowledge and innovations. Also Flier et al. (2003) see renewal itself as actions to align organisational competencies, even if their study is about strategic renewal processes. However, similarities can be found. When considering the big picture, e.g. the economic system in a region, the functions of self-

renewal can be sourced from several places and not just from one. However, one way of studying self-renewal capacity is to approach the concept by using case studies, and by that, seek to proceed from a micro level to a macro level.

A preliminary theoretical framework for **Sente**'s project 'Self-Renewal Capacity of Clusters' has been the model seen in Figure 1.

The Model of Self-Renewal Capacity

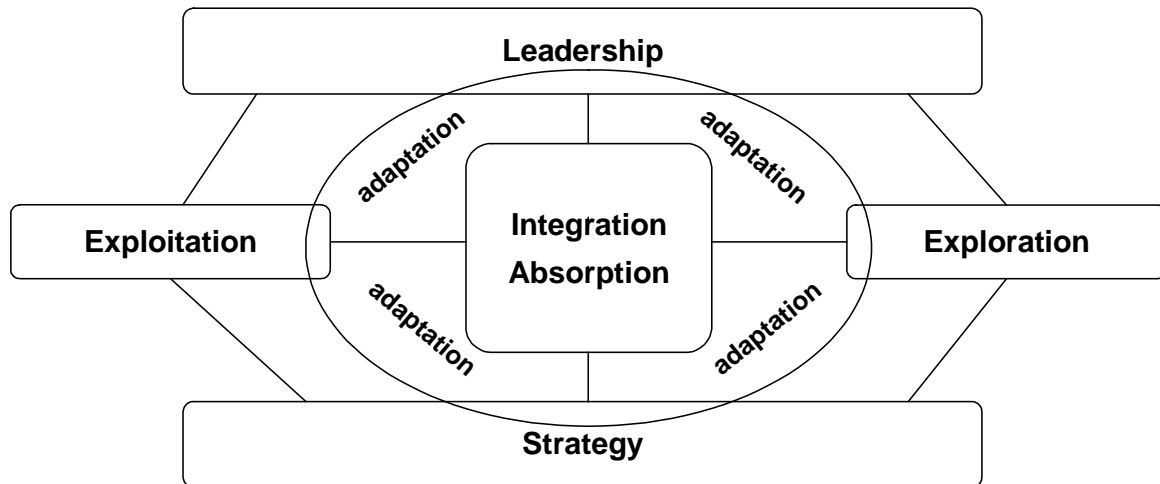


Figure 1. A model for self-renewal capacity. Source: Sotarauta, (2007a), Saarivirta (2008a)

The assumption in the model is that adaptation is at the heart of the self-renewal. Adaptation consists of **integration** and **absorption**. Self-renewal requires above all an ability to **exploit existing knowledge** and to **explore new findings**. In addition, **leadership** and **strategy** are needed to keep the process and its orientation under control (Stähle, 1998; Kostiaainen, 2007; Sotarauta, 2005; Saarivirta, 2007a, 2007b).

Behind the philosophy of the model lies an assumption concerning the variety of choices. The variety of choices means that the more opportunities there are to choose from, the more there are also opportunities for future development paths. If the environment for variety remains heterogeneous, the possibility of being confronted by lock-ins reduces. People, firms and regions often need to deal with new situations, and market environment can change rapidly as well (e.g. Boschma and Sotarauta, 2007). The recession of the early 1990s in Finland, and the years following it, is a good example of this. When the environment changes rapidly, usually the variety of choice becomes smaller too. After the 1990s recession in Finland, all of the regions did not adapt to the new situation. That led many regions to a massive unemployment. One of the great survivors is a Finnish city called Tampere, for example. Tampere has been a traditional, heavily industrialised city that managed to find new paths when the old paths were about to lead into a dead-end. In the transformation process from the old 'chimney industry', the ICT sector has provided new paths that have been utilised well. Thanks to the two universities located in the region there was a wide knowledge base in the city, , which has been crucial in current development. The two universities of Tampere have played in important role overall in improving the knowledge base of the region. Self-renewal is connected in this paper to endogenous dynamics where the statuesque is in a state of constant transformation. In this sense, self-

renewal can be associated with the Schumpeterian point of view where innovations and competition can be seen as the driving forces in competitiveness. According to the so called evolutionary theory, not all the actions taken by the people are rationally based. Routines play a crucial role in everyday activities (e.g. Lundvall, 1998; Metcalfe & Ramlogan, 2006). A person tends to learn a specific model of action that then continues for as long as it continues to be effective. Routines are changed when the old routines no longer work. In this regard, a continual search for new models of action and changing of routines would be crucial for self-renewal. When reflecting on the direction of the model for self-renewal capacity, whether it is at top-down or bottom-up lead, it can be argued that it starts from the individual grass-roots level to cover firms, organisations and regions. Therefore it can be seen as a learning process that also takes place in communities of practice in which the actors can create dynamics to change the dominant routines.

Sotarauta (2005) has specified five functions for self-renewal capacity to be based on:

- 1) exploitation
- 2) exploration
- 3) absorption
- 4) integration and
- 5) leadership

Exploitation and exploration

Exploitation means the utilisation of existing information, knowledge, processes, products etc. If something has already been created and is about to be needed, there is no need to invent it again, because one can adapt. Perhaps someone may even use the concept 'imitating' instead of exploitation, especially when producing very similar products to those of competitors.

However, beyond a certain point, the practice of exploitation is no longer sufficient, and something new has to be created. This is the stage where exploration steps in. Exploration is a (research) journey to somewhere where one could find something radically new, or the journey may not be a specially successful one. If the journey is not useful, it will be a waste of time and money. But, on the other hand, if it is useful, and will lead to sources of creating revolutionary ideas, then it is definitely not a waste of time and money. Following exploration, new ideas and knowledge etc., will be exploited. As a matter of fact, exploration is followed by exploitation, and vice versa. Due to this, it is not actually clear which one comes first (this is like a chicken-and-egg dilemma), but ultimately, they both are needed. It seems obvious that exploration is not very common among enterprises, regions etc. overall. This could be because of the financial risks or that people are happy with their present state. Now, this is the occasion in which great danger lies. When a crisis occurs and one has not prepared for it, outcomes may be very bad.

A crisis can also launch a set of processes that, in a long run, lead to an exploration. Unfortunately, when a crisis occurs R&D funding is usually the first thing to be cut, while on the other hand this could be the best opportunity to invest in R&D so as to get a head in future markets with regard to competitors, but only if few (or no others) are willing to do this.

Absorption

Absorptive capacity, by definition, means the ability to recognise the value of new, external information, assimilate it and apply it to commercial ends (Cohen & Levinthal, 1990). Cohen's and Levinthal's original definition focuses on the firm level, but can be applied to other fields, such as regions and in different systems in general, as well (Antonelli, 1998; Coombs & Metcalfe, 2000; Howells, 2005). The basic idea is that a firm is never alone in

the location (region etc.) in which it operates. Different kinds of information and knowledge flows are coursing all the time, but successful firms know how to absorb the essentials from the environment, and by that, increase its absorptive capacity. Absorptive capacity is also strongly based on a firm's prior knowledge. That is because knowledge has an accumulative nature, in which new knowledge is added to the old without losing it.

Integration

Integration can be seen as connecting oneself to networks. Networks bind on several layers consisting of actors, organisations, enterprises, public sector, private sector etc. Integration and its relation to self-renewal capacity, conceptualised in this way, has a direct link to social capital. In taking a very quick look into social capital, Robert Putnam cannot be ignored. According to Putnam (2001, 2000, 1995), but also OECD (2001), social capital, on the one hand, is a value which arises from the reciprocity of networks and the norms within them. Networks and norms, on the other hand, have value for the people who operate in the networks and under the common norms. Social capital can be in a formal or non-formal shape. Social capital in a formal shape is, for example, organisations or organised associations. Non-formal social capital is, for example, pub evenings on Friday nights or card game evenings on Thursday nights. Social capital can also be lean or high density. In Putnam's examples, the density of social capital is very high among manual workers who see each other every day in a factory. Correspondingly, social capital is then lean for example when two people who do not know each other well, meet at the supermarket, they simply acknowledge each other by gesture and carry on with what they are doing without having a conversation.

When considering the sources of social capital, three main sources can be recognised. The first is family. Within a family, norms and ties (bonds) are the strongest. In a family, children are raised under parent's norms and their way of living (how to comprehend the world as it is) and this, naturally, reflects directly into the children. Based on the social relationships in the family, external social contacts to other people outside the family are created. The next source of social capital is relationships outside the family. These connections can be called 'bridges'. Places where bridges can be created are, for example, schools, workplaces and other forums where people meet. The last source of social capital is relationships between groups and organisations. These kinds of connections can be called 'links'. One could see links as language skills in a society (Coleman, 1988; Painter & Levine, 1999; OECD, 2001; Woolcock, 2001; Raivola, 2003).

It seems obvious that tighter and more reliable connections between actors in a network provide more fruitful platforms for the development of self-renewal capacity. This also has links to strategy processes in a region, for example, but it is not necessary to go deeply into this at this stage.

Leadership

Even if self-renewal processes can be extremely personal (but collective, for example, at a regional level) self-renewal capacity needs a proper leadership. As Sotarauta (2005) states, without leadership, self-renewal capacity may remain static and turn out to be a hollow shell. Leadership is then a collective power that drives forward exploitation, exploration, integration and absorption. It is a function more of directing the ship than controlling it. However, proper leadership is not an easy task to perform. Sotarauta, Hukkinen, Bruun and Linnamaa (2002) have analysed the basic tasks of leadership into following five categories:

- 1) strategic and visionary leadership
- 2) network leadership

- 3) resource management
- 4) knowledge management and
- 5) institutional management

Strategic and visionary leadership is about the ability to define strategies and visions for development together with actors. It is also about the ability to bring visions of different scenarios of futures together and transform them into focused strategies and actions. Network leadership is about the ability to involve people and empower them to act as a network for joint, but also separate goals. According to Sotarauta (2007b), one of the most important influence factors in networks seems to be indirect influencing. Active actors, e.g. regional developers in the public sector, can guide the direction via their own behaviour. Directing the network is difficult, since the actors in the network are there because of their own will. Therefore there is not 'a boss who tells what you must do'. In this case, indirect influence is as a matter of fact the only way to change the direction of development.

Resource management is about the ability to utilise existing resources and to find new ones in the promotion of development. Resource management also requires the ability to direct resources according to existing strategies. Knowledge management is about the ability to create an environment that supports knowledge management in different organisations, i.e. it is an ability to openly grasp initiatives by informal decision-making channels and render them concrete in formal structures of decision making. The last basic task of leadership is institutional management. By institutional management is meant the ability to create and maintain a flexible, but at the same time enduring institutional set-up that supports networking and the fluidity of development processes.

6. Localised technological knowledge and collective knowledge

It seems crystal clear that there exists an essential gap when mapping self-renewal capacity only by using theories of economic development as reference points. Institutional theories must be taken into account when developing the theoretical framework more precisely (e.g. Hodgson, 2006). Concepts such as technological knowledge and its generation by collective processes, as developed by Christiano Antonelli (2005, 2006), seem to provide good approaches for future mapping of self-renewal capacity.

Antonelli (2005, 2006) sees that collective knowledge in localised processes is a main driver together with exploiting external knowledge (after exploration) in creating new technological knowledge. Internal and external knowledge are complementary inputs, but external knowledge gives new insights into generating new knowledge. Technological knowledge, by definition, is an outcome of localised interactions by a variety of heterogeneous agents that are able to learn and to establish network relations rooted in a limited technical and product space. In these spaces, each agent has accumulated competence by means of a process of learning by doing. Following the Schumpeterian tradition, where firms are seen at the core of introducing new innovations, market failures or mismatches are incentives for firms to develop new technological knowledge, and by that end, new technological innovations.

In generating new technological knowledge, the variety of agents is important as well as their absorptive capacity. Among the agents, proximity makes the flows of knowledge easier to grasp and therefore the exploitation of knowledge more effective. However, according to Antonelli (2005, 2006), very often knowledge in a region is dispersed and fragmented, scattered among a myriad of learning agents. As a result, coordination of the agents is needed, since no single agent can be alert to every movement of knowledge, especially external knowledge, in the system in which they operate.

Collective processes, and thus collective knowledge, makes the mapping of self-renewal capacity more concrete, since learning and sharing information are, no doubt, at the core of

the concept of self-renewal capacity. Collective knowledge is a shared activity, because of the continual efforts of acquisition and implementation that it requires (Antonelli, 2005).

7. Discussion

It seems natural that, endogenous growth theory offers more room for self-renewal capacity than does the neoclassical growth theory. The world for neoclassics is linear and factors of production are threaded as stocks, not flows. Individual capabilities and decision making are neglected and, according to neoclassics, disequilibrium between countries' economic performance will disappear in the long run (convergence hypothesis). However, as described earlier in the paper, this does not seem to be the case. It will lead us to a consideration of where sources of growth rely to a very great extent on skills, human capital and all kinds of self-developing. Technological improvement is not 'mana from heaven', but arises as a consequence of human actions and the use of knowledge. Macro level theories do not seem to provide precise answers at this point concerning how self-renewal capacity can be developed.

Localised technological knowledge and collective knowledge can be used here as missing concepts in filling the space left over from the neoclassical and endogenous growth theories when applied top-down. Concepts of binding self-renewal capacity are more adequate to networks, organisations and institutes. But, after all, it looks more likely that the starting point of self-renewal capacity relies heavily on learning and individual level processes, and, from there it can be developed to contain larger components such as firms, organisations, institutes and regions. So in this sense, a bottom-up approach is needed.

However, an evolutionary theory view based on self-renewal capacity seems to be the most adequate one, and it is also the most comprehensive one. The world is full of uncertainties where one thing leads to another, and the whole future is uncertain as well. Summing up all the theorising presented in this paper, the notion of competition is the driving force in economic development. Competition pushes single actors and entities to give their best performance in order to survive. To put it strongly, it is necessary to self-renew or die. The other question concerns whether the building of self-renewal capacity can be a part of everyday life and become an internally built-in mechanism? It is certain that this kind of capacity building is case-oriented and cannot be the same everywhere, and it has cultural as well as market environmental differences. For example, monopolistic situations do not provide fruitful origins for building self-renewal capacity, because there are no incentives to self-renew. Overall however, once now that the long path of evolution has emerged, self-renewal capacity can be considered seriously as a factor of production.

All the five functions of self-renewal capacity (exploitation, exploration, absorption, integration and leadership) addressed by Sotarauta (2005) seem to be crucial when considering the reference points in developing capacity. Exploitation of existing resources, as well as radical searching for new modes of action, is well understood. Knowledge has an accumulative nature and, thus, new knowledge builds on previous knowledge. Absorption is needed, since, for example, a single person cannot change the whole system even if they would like to do so. Integration is important because a human being is a social actor and does not function in a vacuum. In addition to this, the importance of *social capital* is relevant. This is because persons have to develop themselves in relation to others. If people are untrustworthy and not willing to cooperate in with a good will in a firm, organisation, regional etc., self-renewal capacity is difficult, or even impossible, to develop. At the organisational and regional level, good leadership is needed to guide the system as a whole and to utilise it in a most effective way.

The empirical part of the study is yet to come, based on the holistic model of self-renewal capacity. Empirical work has already been conducted in different cities of Finland such as Helsinki, Oulu and Hämeenlinna. The preliminary results (e.g. Saarivirta, 2008b)

show that especially exploration plays an important role in future business. However, as the recent history of Finland evidences, self-renewal is crucial when, for example, an economic recession occurs. A concrete illustration of this would be the early 1990s economic crisis in Finland. The Soviet Union, the eastern neighbour of Finland, had collapsed and this impacted heavily on Finland's exports so that they declined dramatically. The Soviet Union used to be the biggest partner of trade for Finland in the preceding times. Also the Bank of Finland had deregulated, and Finnish financial markets had expanded domestic credit creation (Honkapohja and Koskela, 1999; Kiander, 2004a, 2004b;). Many bankruptcies were seen, as well as high unemployment. By the end of the 1990s the Finnish economy had recovered, mostly due to structural changes in the economy. Heavy industry started to move towards higher technology, especially information and communication technology, and exports started to find new routes to compensate for the old ones. The economic crisis forced the country to change its routines and seek for alternative ways of functioning, and the move was towards a state called the 'knowledge economy'. Today, Finland is doing relatively well, and in fact it has been ranked several times by the World Economic Forum as the world's most competitive nation.

8. Conclusions

In the search for self-renewal capacity, by using three theories of economic development: the neoclassical, the endogenous and the evolutionary, it can be said that evolutionary theory is the most prominent one. Obviously, endogenous growth theory offers more space for self-renewal capacity than the neoclassical theory, but nonetheless the unexpected nature of economic development at a regional and country level remains a mystery. As a consequence of this, an evolutionary based approach will be the one to be used and developed more in future studies.

As a summary, it can be said that self-renewal capacity starts from an individual level of learning processes and grows in time to encompass firms, organisations, institutes and regions. Localised technological knowledge and collective learning are at the core of building self-renewal capacity through individual learning processes. Concepts such as these can also be seen as a junction of combining individual level (bottom-up) and wider level (top-down) approaches. When facing future crises, those who have the wider capacity for self-renewal may recover better.

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